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THE

# FIRST LINES

OF THE

# THEORY AND PRACTICE

OF

# SURGERY;

INCLUDING

## THE PRINCIPAL OPERATIONS.

BY


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SENIOR SURGEON TO UNIVERSITY COLLEGE HOSPITAL, AND PROFESSOR OF SURGERY IN THE SAME COLLEGE, ETC.


**Seventh Edition.**




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# PREFACE

TO THE

# SEVENTH EDITION.

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This work was originally designed as an elementary treatise on Surgery; and, in all the editions which it has passed through, the same primary object has never been departed from. The principal wish of the Author has been to offer such views of scientific and practical surgery, as the student and young practitioner may refer to with advantage. Above all things, he is desirous, that the publication may serve as a text-book for the Lectures, annually delivered by him to the Surgical Class of University College; and, if the gentlemen, who compose that class, shall be in any way benefited by the undertaking, or derive from it a clearer comprehension of the doctrines, which they do him the honour of listening to, the pleasure that he will experience in thus promoting their advancement, will be his highest reward.

The reader, who compares this edition with the last, will discover numerous corrections; and, in almost every page, new matter. All this seemed requisite to adapt the work to the present state of surgery.

7. Woburn Place, Russell Square,
November 26. 1839.

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THE

# FIRST LINES

OF THE

# PRACTICE OF SURGERY.

## SECTION I.

### Elementary and General Subjects.

### INFLAMMATION.

As soon as due proficiency has been made by the student in anatomy, chemistry, the elements of natural philosophy, physiology, and other branches of knowledge, constituting essential portions of the foundation of medical science, he is qualified to commence with advantage the study of disease; the comprehension of which is to be derived, partly from the most authentic descriptions of it, but chiefly from the personal observation of its extremely diversified forms, as they present themselves in the field of experience.

No texture, possessing vessels and nerves, is beyond the reach of the attack of inflammation, and consequently nearly every part of the body is subject to it. In those animals which have no visible nerves, Dr. Macartney believes that the phenomena of inflammation are not exhibited. The nerves are regarded by him, and, I think, correctly, as essentially engaged in the process. Many diseases owe their commencement to it; all mechanical injuries are followed by it; and numerous disorders, not associated with it in their beginning, become complicated and materially influenced by it in their more advanced stages. It is indeed so closely connected with disease in general, either as a cause, an effect, an accidental complication, or even as a means of cure, that there is much truth in the observation, that, when once a student has acquired a knowledge of inflammation and its consequences, and has joined with this information some good ideas of the nature of a few organic diseases, he may be said to command a bird's-eye view of the whole field of pathology.

Inflammation is not always to be regarded as a disease, but frequently as a salutary process, absolutely necessary for the repair or removal of the effects of various injuries and morbid alterations affecting the textures of the animal body. Thus the disease, called hydrocele, is radically

cured by exciting inflammation within the tunica vaginalis; and, in wounds of the bowels, a fatal effusion of the intestinal matter can only be prevented by the compact and close state of all the parts within the peritoneum, followed up and cemented by the adhesive inflammation.* Abscesses of the liver discharge themselves sometimes externally, sometimes inwardly into the colon, and occasionally they make their way into the bronchi. In the first case, inflammation glues together the two contiguous portions of the peritoneum, and by means of ulceration, a passage is then safely formed for the matter through such adherent parts of the membrane, and next through the more external textures. Thus, the cavity of the abdomen is preserved from an effusion of pus, which would immediately excite a fatal attack of peritonitis. In the second case, by means of similar adhesions and ulceration, the contents of the abscess are safely conveyed into the intestine. In the third, the two contiguous peritoneal surfaces first, and then the two adjacent pleural surfaces, are rendered adherent by inflammation; and lastly, the ulcerative process opens a way for the pus through these adherent membranes, the diaphragm, the cellular tissue, and through the sides of the bronchi, whence the abscess is discharged by coughing.†

When any part of the animal body is red, swelled, and painful, its temperature being at the same time raised, its natural secretions altered or suspended, and its functions disturbed, such state of it always receives the name of *inflammation*. It is not, however, every form of inflammation that is characterised by a combination of redness, pain, heat, and swelling: in some cases, there is little or no redness; in some, scarcely any swelling; in others, only a trivial uneasiness, tingling, or stiffness, scarcely amounting to pain.

Inflammation is said to be *acute* when attended with redness, heat, swelling, and pain, and when the quickness of its course is such, that it either subsides in a few days, or brings on, in the same space of time, suppuration, ulceration, mortification, or, when seated in important organs, even the patient's dissolution.

*Chronic* inflammation is of a slower and less painful kind, frequently beginning almost imperceptibly, and then lingering in parts for an indefinite period. It may be attended with little heat or pain. Gradual and insidious as its progress may be, it frequently leads in the end to structural changes and functional derangements of the most serious and irremediable kind. Acute inflammation may terminate in it; and many of the slowly formed thickenings and indurations, of various tissues, appear to be effects of it; but the doctrine is far from being tenable, which ascribes to it the origin of those multiform tumours presenting themselves

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* In opposition to the commonly received doctrine of inflammation being often a salutary process, essential to the repair of accidental and morbid lesions of textures of the body ("the necessary condition, or means by which," as Dr. Carswell remarks, "most injuries, and all solutions of continuity are repaired"), Dr. Macartney's investigations lead him to conclude, "that the powers of reparation and of reproduction are in proportion to the indisposition, or incapacity for inflammation;" and that "inflammation is so far from being necessary to the reparation of parts, that, in proportion as it exists, the latter is impeded, retarded, or prevented." "On Inflammation," p. 6. 8vo. Lond. 1838. Many of Dr. Macartney's arguments, in support of this view, are derived from what happens in some of the lower animals, which possess no visible nerves, or whose nervous systems are exceedingly simple.

† See Dr. M. Hall's "Principles of Medicine," p. 28.

in the body as adventitious formations, or growths, superadded to the primitive textures, and even sometimes annihilating them.

Inflammation is said to be *healthy*, when uncombined with any determinate disease in the part or constitution, capable of exercising an unfavourable influence upon it, and particularly when established for the accomplishment of some salutary purpose in the animal economy. Such inflammation is also sometimes termed *common* or *simple*, and, if it be near the surface of the body, forming a circumscribed swelling, attended with heat, pain, throbbing, and redness, it often receives the name of *phlegmon* or *phlegmonous inflammation*. This is sometimes defined to be inflammation of the cellular tissue; but, if we are disposed to adopt this view, we must say, that it is *healthy* inflammation of that texture; for the cellular tissue is also the principal seat of some other kinds of inflammation, as for instance those of carbuncle, malignant pustule, boils, phlegmonous erysipelas, &c. Phlegmon is defined by Dr. Macartney to be usually the consequence of some injury, or evident irritation, and produced in constitutions, or parts of the body, which have been previously carrying on healthy functions. One of its most distinguishing features is the deposition of fibrine in and around the inflamed part.

*Unhealthy inflammation* comprises those forms of it whose appearances, progress, and termination, are under the influence of some definite or indefinite disease in the part or the system at large: its varieties are, therefore, as numberless as diseases themselves.

*Specific inflammations*, which always belong to the unhealthy class, are so called when their appearances, effects, course, and termination, are marked by striking differences from all ordinary cases; such as a connection with, or a dependence upon, a particular diathesis; the operation of an animal poison; the power of generating a contagious or infectious principle, and of being thus propagated from one person to another. Some specific inflammations, and their effects upon the system at large, produce a permanent impression on the constitution, whereby the individual is rendered insusceptible of a second attack of them. Particular kinds of inflammation appear to be considered as specific, partly on account of the peculiarity of their nature, and partly because they require treatment very different from that applied to the ordinary forms of inflammatory complaints. For one or another of these reasons, the inflammation of syphilis, scrofula, small-pox, cow-pox, scarlet fever, and of a multitude of cutaneous diseases, is specific: perhaps, indeed, the number of inflammations entitled to this denomination is much greater than usually calculated, and Rayer may be right in ascribing the peculiarities of cutaneous diseases in general to the specific quality of the inflammation, excited by various causes on the surface of the body.

Inflammation is said to be *primary* or *idiopathic*, when it is the original affection; *secondary*, or *symptomatic*, when the consequence of another disorder. The sympathies existing between different parts of the body, as that between the skin and mucous membranes, are usually cited in explanation of the origin of certain inflammations, which consequently receive the name of *sympathetic*. Thus some cutaneous diseases are frequently associated with chronic inflammation of the mucous membrane of the digestive or respiratory organs; while, in other instances, the latter affection, or even ulceration of the mucous membrane of the bowels, follows inflammation, injury, or disease of the cutaneous texture. This fact is often exemplified in erysipelas and extensive scalds and burns. The effects of *phlebitis* in bringing on inflammation and suppuration in

various textures and organs, remote from the original disease or injury, must not be confounded with *sympathetic inflammations.*

Amongst the most remarkable effects of inflammation are, the adhesion of parts to one another; the filling up of the interstices of the cellular texture with fibrine; the deposit of the same substance upon free surfaces, in the form of one or several layers, having somewhat of the appearance of a membrane, and hence frequently called a *pseudo-membrane;* or around collections of purulent matter, or around a foreign body lodged in the substance of parts, in which circumstance it is transformed into a cyst, calculated to prevent such foreign body from irritating the neighbouring textures; or it is deposited between the surfaces of a recent wound, which have been brought together, where it constitutes their first bond of union. Now, all these curious effects and changes, resulting from the exudation of fibrine or coagulating lymph*, and its occasionally becoming vascular and organised, as is frequently exemplified on inflamed serous membranes and in wounds, led John Hunter to name the kind of inflammation producing them the *adhesive.*

When the tendency of inflammation is to cause the production of a peculiar fluid, termed pus, the epithet *suppurative* is employed to denote this character of it. The expressions *ulcerative* and *gangrenous* signify its disposition to occasion ulceration and mortification.

Whether inflammation is to be *adhesive, suppurative, ulcerative,* or *gangrenous,* is chiefly determined by the kind of texture affected; the original quality of the inflammation itself; the nature of the exciting cause; or the previous state of the part, or constitution. In serous membranes, adhesive inflammation is more readily excited than suppurative; and this is also the case in the cellular tissue in general, so far as common inflammation is concerned.† On the other hand, a mucous membrane is more prone to suppurative than adhesive inflammation, the latter not taking place, unless the exciting cause act with violence, be of long duration, or of a peculiar description. In inflammation of serous membranes, and at a very early period, as Dr. Carswell has explained, the secreted fluid contains albumen; afterwards, and as the inflammation increases, fibrine is added, and generally an admixture of the colouring matter of the blood; and lastly pus. The same order of succession is also observed to take place in the fluid products of inflamed mucous membranes. The mucous secretion, however, is, almost from the commencement of the inflammmation, replaced by a serous fluid, which is often very abundant; this is succeeded by the presence of albumen and fibrine, and lastly of pus. The different degrees of fluidity, viscidity, and coagulability of the secretions generally of inflamed tissues, are derived from the presence of serum, albumen, and fibrine, in various proportions. As illustrations of the influence of the original quality of the inflammation, I may observe, that such as attends boils and witlows is remarkable for its tendency to sup-

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* The term *fibrine* is now frequently substituted for that of *coagulating lymph;* but as the latter contains albumen, there is, strictly speaking, a difference between them.

† Without the qualification here introduced, this doctrine, as taught by John Hunter, would not be correct; for "the cellular tissue is not only more frequently the seat of mortification, but it is also more extensively and rapidly destroyed by it than any other tissue of the body." See Dr. Carswell's "Illustrations of the Elementary Forms of Disease," Fasciculus 7; one of the most interesting works on Pathology ever published.

puration; while that which is exhibited in carbuncles, malignant pustules, phlegmonous erysipelas, and after the bites of venomous reptiles, is notorious for its disposition to produce extensive gangrene of the cellular tissue. Then some other kinds of inflammation, however severe, rarely or never bring on either abscesses, ulceration, or gangrene, as we find to be the case with gout, rheumatism, and the inflammation taking place in the disease called *mumps*. The effect of the violence and peculiar quality of inflammation, in giving to it the adhesive form in a part or texture not naturally disposed to it, is well exemplified on the mucous membrane of the larynx and trachea in croup, where the interior of these organs becomes the source of a copious and suffocating effusion of coagulating lymph. The difference, made by the previously healthy or morbid state of parts, on the effects of inflammation, is illustrated in the perilous consequences of an attack of it on limbs already affected with anasarca, or dropsical effusion. The same case likewise generally exemplifies the pernicious influence of an impaired constitution.

Parts remote from the source of the circulation, or having a circulation particularly subject to considerable interruptions and retardations, or to disturbance from inflammation, are more disposed to ulceration and mortification than other parts and textures not under such disadvantages. Hence the frequency of ulcers and sloughing in the lower extremities, of the mortification of tendons, surrounded by abscess, and of the general inability of a cicatrix, a callus, warts, wens, and many other adventitious formations, to bear inflammation, without being likely to ulcerate or mortify. Mucous membranes, and the skin, which are textures of high vascularity, often ulcerate or slough, because peculiarly liable to inflammation.

Generally speaking, *inflamed fibrous tissues*, as they are termed, including tendon, ligament, fascia, aponeurosis, and periosteum, rarely suppurate or ulcerate. Or, perhaps, it may be more correct to say, they do not do so from rheumatic or gouty inflammation; for, in scrofulous disease of the bones and joints, the ligaments and synovial membranes are commonly more or less destroyed by the ulcerative process. Mortification occurs more frequently in the skin, cellular tissue, mucous membranes, and lungs, than in any other tissues or organs, as the immediate effect of inflammation. Serous and fibrous textures never mortify, unless the cellular tissue, from whose vessels their nutrition is derived, has previously been diseased. This, it is to be presumed, often happens when abscesses are formed round tendons. In like manner, also, the death of cartilage and bone is effected by previous disease of the perichondrium, periosteum, and medullary membrane.*

The *redness* of inflamed parts seems to be principally owing to the dilatation of small arteries, and possibly also of small veins, both which orders of vessels become of sufficient size to admit the red globules; and they are not only increased in diameter, but fully injected with blood, or in the state termed by Andral *hyperæmia*. Whether the blood in the minute veins of an inflamed part assumes the scarlet colour of arterial blood, is a doctrine rather difficult to prove, because the exact line of demarcation between the capillary arteries and the smallest veins does not admit of demonstration. The redness has been partly ascribed to the generation of new vessels; but this doctrine is not tenable as a general

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* Carswell, op. cit. Fasciculus 7.

one, because redness is producible in a few seconds by friction, heat, and other causes of irritation,—a space of time too short to be consistent with such a view. Many textures, naturally colourless, may also be reddened with fine anatomical injection,—a proof, that the distension of those vessels which already exist, will account for a great deal of the redness. Undoubtedly, inflammation renders vessels plainly visible in certain textures, which cannot be made to manifest vascularity by means of any sort of injection. However, this fact only proves, that it is the nature of inflammation to dilate the minute vessels, and to make them capable of receiving the red globules of the blood. Redness, though a common effect of inflammation, is far from being one of its essential characters; for, notwithstanding the size of the minute arteries may be altered, their dilatation is not invariably such as will enable them to receive the red globules. This is exemplified in inflammation of the arachnoid coat of the brain, and in slight inflammation of the delicate production of the conjunctiva spread over the cornea.

The intensity of the redness varies in different examples: thus, some dense fibrous tissues, like tendons and ligaments, exhibit, when inflamed, but inferior degrees of redness; while textures of higher vascularity display a bright and florid red colour, as is often seen in cynanche maligna, the pharynx and tonsils presenting almost a fiery redness. The species of inflammation also modifies the colour of the inflamed part. The redness of phlegmon is not of the same shade as that of erysipelas, and the colour of a carbuncle is deeper, than that of the other inflammations here adverted to.

In genuine erysipelas, "there is so little impediment to the passage of the arterial blood into the veins, that it gives the skin a bright red or scarlet colour. Several other inflammations of the skin, as scarlatina, rose-rash, herpes, &c., are distinguished by their bright colour; and, indeed, most inflammations of the skin, which do not involve the cellular substance underneath, assume more or less the colour of arterial blood. In other instances, where inflammation is attended with much tumefaction or hardness, the colour is more or less purple, or that of venous blood: because, under such circumstances, the circulation is impeded; and consequently the blood longer detained, and thereby rendered venous, although still moving in the arteries. The purple colour is very remarkable in many scrofulous inflammations and tumours, in which the circulation is languid." * Dr. Macartney also notices the fact of brown-coloured inflammations being generally followed by a detachment of the cuticle and rete mucosum.

Another effect of inflammation is, to deprive certain textures of their natural transparency, a change noticed with remarkable frequency in diseases of the eye. If a portion of inflamed arachnoid coat of the brain be examined while extended over that organ, the *loss of transparency* is particularly evident, where the membrane lies over the interspaces of the convolutions.

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* See Macartney "On Inflammation," p. 17. "That there may be no deception with regard to the degree and nature of the red colour and vascularity of parts after death, it is of great importance that they be examined immediately they are exposed to view, as, under the influence of the air, those which are almost pale become reddened, or, if slightly red, become much redder, in the course of a few hours." Thus also venous and vascular congestion may put on the appearance of inflammation. See Carswell's "Elementary Forms of Disease."

A common change, resulting from inflammation, is the *thickening of parts;* thus, a piece of inflamed pleura or peritoneum, is always found to be so altered. Indeed, "an *increase of bulk*, thickness, swelling, or tumour, always accompanies acute inflammation."

Several of the above facts are finely illustrated in a preparation, preserved in the museum of the Royal College of Surgeons. John Hunter froze the ear of a rabbit, and thawed it again: a considerable inflammation of it ensued. The animal was now killed, the vessels of the head injected, and both ears removed and dried. The ear that was not inflamed, retains a clear transparent appearance, and its arteries are of the natural size; but the ear that suffered inflammation is opaque, and considerably thickened, with its arteries much enlarged. Dr. Macartney produced inflammation of a rabbit's ear by scalding it, and the only difference in the result was, that there was more dilatation of the branches, and less thickening of the auricular artery, than after Hunter's experiment.

The *swelling* and *tension* of inflamed parts arise partly from the dilatation and turgescence of the blood-vessels, partly from the extravasation of fibrine, serum, and sometimes even of blood from the rupture of the over-distended vessels; partly from the thickening of tissues; and partly from the interruption of absorption. The degree of swelling depends in a great measure on the violence of the inflammation, and the kind of tissue affected. In some inflammations of the eye, and in all superficial inflammations of mucous and serous tissues, there is little or no swelling; but, in inflammation of the testicle, phlegmonous inflammation in general, phlegmonous erysipelas, and the state of the eye termed *chemosis*, the swelling may be prodigious.

The interstitial effusion of limpid albumen, or serum, constitutes œdema, and one of the early effects of inflammation. "It frequently remains in the form of a pale and colourless swelling, after the vascular repletion and the consequent redness have disappeared. In one case, inflammation of the larynx, it is frequently the cause of death, obstructing the upper orifice of the larynx, and suspending respiration." *

One important physical character of acute inflammation, correctly explained by Professor Carswell, is a *diminution of consistence*, or rather of *cohesion*, of the organic elements of the inflamed part. "This change commences in the first stage of inflammation, and may proceed to such a degree in the second, as to render even the bones soft and fragile, and convert all the tissues into a mere pulp. It appears to affect the uniting cellular element, more than any other, of tissues and organs; and to do so in proportion to the degree of inflammation by which it has been preceded."

An opposite condition, that of *induration*, is a frequent consequence or accompaniment of *chronic inflammation*. "It differs from the solidification of acute inflammation in this, that there is at the same time increased cohesion of the anatomical elements of the affected part." †

According to Mr. Hunter's experiments, the *temperature of inflamed parts*, as indicated by the thermometer, is much lower than what might be expected from the consideration of the patient's own feelings and representations. By artificial means, he excited inflammation in the chest of a dog, and in the abdomen, rectum, and vagina of an ass, without being

* See Dr. M. Hall's "Principles of Medicine," p. 9.

† See Carswell's "Elementary Forms of Disease," Fasciculus 1.

able to detect with a thermometer any material rise in the temperature of those parts. In one patient, however, on whom he operated for a hydrocele, the rise was more remarkable; for the temperature within the tunica vaginalis, which was only 92° directly after the operation, rose on the following day to 98¾. Later investigations prove, that the heat of inflamed parts is sometimes as high as 107°.

It is not easily decided "how far the increased heat of inflamed parts depends on the higher degree of sensibility, or on the state of circulation and impeded secretion; since we find, that the temperature is most augmented, when inflammation affects those tissues which are the seat of active circulation and secretion. The inflammation of bones, tendons, and ligaments, which receive in a natural state few blood-vessels, and which furnish no secretions, is attended with very little increase of temperature; while the skin and mucous membranes have their heat greatly exalted during inflammation. It should nevertheless be considered, that these surfaces are most richly supplied with nerves, as well as blood-vessels." My friend Dr. Macartney, however, from whose writings I have borrowed the foregoing passage, is disposed to ascribe the increased heat of inflamed parts more to their state of local or organic sensibility, than to the condition of their arteries, as regards circulation or secretion. On the other hand, Dr. M. Hall inclines to the doctrine, that it is owing to the augmented quantity of blood in the part. The *varieties of pain* from inflammation depend partly on the character of the inflammation, and partly on the texture of the inflamed parts.

The *pain* is throbbing in phlegmon, but of a tingling, burning kind in erysipelas; it is acute in parts largely provided with nerves, and this more with reference to their number than their size. In parts of a dense, unyielding texture, the pain is likewise extremely severe, though they may not abound in nerves. This fact is exemplified in the generality of fibrous textures. In bones, the pain is aching, and in ligaments it is of a similar kind. In inflammation of parts bound down, or surrounded by a dense, unyielding fascia, the pain is always great. Inflammations of serous membranes are well known to be more acutely painful than those of mucous ones.

Amongst the *effects* of inflammation are those *produced in the secretions* of the inflamed part. When inflammation of mucous or serous surfaces is slight, the secretions may be increased; but, if it attain a somewhat greater degree, they are not only more copious, but altered in their quality, becoming of a thicker consistence, and assuming the appearance of pus. "Thus the serum of blisters, when the skin is much irritated, is found to be coagulated; and the cutaneous secretions of the eyelids, ears, and other parts of the skin, are changed into a glutinous adhesive fluid. When parts are excessively inflamed, whether they are situated externally or internally, secretion of every kind is stopped. Even the secretion of pus ceases, when an abscess, an ulcer, or an issue, is suffering a severe degree of inflammation." *

According to John Hunter, inflammation is not merely an action of the smaller vessels of the part itself, but of the larger ones leading to it. In a whitlow, the pain and swelling may be confined to the end of the finger; yet, the digital arteries may be plainly felt to throb through their whole course with unusual force; and, in severe cases, even the radial and

* Macartney, op. cit. p. 21.

ulnar arteries participate in the same disturbance. These facts are sometimes regarded as proofs of the arteries contracting with increased force in inflammation; yet John Hunter, who first particularly adverted to them, never ventured to draw such conclusion himself; but only that the arterial system was dilating itself, and allowing a greater quantity of blood to pass.

In all examples of common inflammation, its degree is greatest in the direction towards the surface of the body. It seems as if it had a tendency to spread outwards, and to avoid the deep-seated parts. Thus, when the irritation of a bad tooth excites inflammation of the gums, there is generally but little pain and swelling on the side of them towards the tongue, but a great deal towards the cheek or lips. Mr. Hunter regarded this disposition of inflammation to extend towards the surface, and not the interior of the body, as an established law or principle in the animal economy, the usefulness of which in promoting the cure of many diseases must be sufficiently obvious.

Every inflammation of much extent or violence, or affecting parts of high importance, is attended with a general disturbance of the whole constitution, called the *sympathetic* or *symptomatic inflammatory fever*, of which the symptoms run as follows: — Pulse frequent, strong, and full: many of the secretions changed, diminished, or suppressed: hence, dryness and heat of the skin, a parched state of the mouth and fauces, and oppressive thirst; urine scanty and high-coloured; and constipation.* Nervous system disordered; appetite lost; patient anxious, restless, and sleepless; headach; sometimes twitches of the muscles; wandering and confusion of the intellects; or actual delirium. This fever furnishes an illustration of what Mr. Hunter used to call *an universal sympathy of the body* with the disturbed condition of a part of it. The symptoms are always modified by the extent and violence of the inflammation and its situation in common tissues, or organs of the first-rate importance to life. When the latter are affected, the pulse is observed to be quicker and weaker than when only skin, cellular or muscular tissue, or other ordinary textures, are inflamed.

The symptoms are also modified by the nature of the constitution itself; and hence, in naturally irritable subjects, they rise to a greater height, and often assume a more alarming character, than in individuals of better stamina. Females being generally more irritable and nervous than men, are liable to experience from local injuries greater constitutional disturbance than the latter, unless these happen to be of intemperate habits. Fat, corpulent persons, not in the custom of taking proper exercise, bear local injuries and inflammation, as well as disease in general, very badly; and hence in them the sympathetic inflammatory fever often prevails with extraordinary severity. But there is a particularly irritable temperament, frequently accompanying a countenance in which the cheeks exhibit a peculiar ruddiness, terminating very abruptly at the circumference, and presenting the ramifications or streaks of minute vessels, more plainly than in the fine complexion of youth, health, and a

* In the *first stage* of inflammation, "the temperature is variously and greatly increased; the function of secretion is also for a time augmented: in glandular organs, however, only at the commencement; in serous tissues, for a much longer period, and to a much greater degree." In the second stage, the blood ceases to circulate, coagulates, and assumes a dark colour; the temperature sinks; and secretion, absorption, and nutrition, are finally interrupted. See Carswell's "Elementary Forms of Disease," p. 1.

sound constitution. Individuals, with the ruddy kind of cheek here described, do not undergo disease favourably — in them inflammation is not disposed to be mild, nor the constitutional disturbance to be free from severity.

Speaking of certain inflammations, and not of the healthy or phlegmonous kind, the nature of the exciting cause has a powerful influence on the character of the constitutional symptoms. This is manifest in cases of poisoned wounds, whether received in dissection, or caused by the bites of venomous animals. Here we have the most dangerous forms of constitutional disturbance, though not always entirely corresponding to the extent of the local inflammation, since the poison itself, when the bites of snakes are concerned, has a chief influence in determining the severity of the effects upon the whole economy.

Besides the *common* local and constitutional *symptoms of inflammation*, there are *particular* ones depending upon disturbance of the functions of the organs affected. Thus inflammation of the brain is attended with delirium, vertigo, coma, convulsions, or paralysis. Inflammation of the eye, with interruption or disorder of vision. Inflammation of the urethra, or bladder, with pain and difficulty in making water. Inflammation of the fauces, pharynx, or œsophagus, with pain or inconvenience in swallowing. Many diseases are not restricted to the production of changes of texture, or to derangement of functions: they seem often to bring about, and even more or less to consist in, changes of the fluids, as well as the solids. We know that the effects of inflammation extend to the blood itself; for, when taken from the veins of a person labouring under an attack of inflammation, sufficiently severe to disturb the constitution, it coagulates in the basin more firmly, and, according to John Hunter, more slowly, than usual; and a stratum of fibrine, of a yellowish buff or slightly greenish colour, or very similar in appearance to size or glue, is left upon the surface of the crassamentum, which often floats in an extraordinary quantity of serum. The yellow substance is termed the *inflammatory crust*, or *buffy coat*. Such *blood* is also called *sizy*, or *cupped*, &c.; the surface of the crassamentum being concave at the centre, but frequently contracted and puckered up at the edges. The inflammatory crust varies in thickness from a line to an inch or two, and consists of pure fibrine, deprived of the colouring matter, and mixed with a proportion of serum, which is found to contain nearly twice as much albumen as the serum in a healthy state of the system. Great analogy, therefore, prevails, both in appearance and in chemical composition, between the buffy coat of the blood, and the coagulating lymph or fibrine that constitutes false membranes. When the buffy coat is thick and compact, there is a proportional diminution in the firmness of the crassamentum. The cupped appearance, however, and the firmness both of the buffy coat and the entire coagulum, are usually proportionate to the strength of the patient and the severity of the inflammation, and greater in the inflammation of certain textures, such as serous membranes and fibrous tissues, than others; being then even more buffy than in inflammation of vital organs. The buffy coat is not confined to venous blood, but formed also on arterial blood. Thus, when in urgent inflammatory diseases, on account of the youth of the patient, and the small size of his veins, it is considered necessary to open the temporal artery, the blood exhibits a sizy appearance.*

* Dr. Davy is led by his experiments to think, that the coagulation of blood in inflammation commences sooner, and is completed more quickly, than in health. Yet any

The buffy coat merits particular attention, because it is to a certain extent a criterion of the existence of inflammation, and a vindication of the employment of means calculated to subdue it. Inflammation frequently occurs in deep situations, completely out of the reach of manual and ocular examination; and then the case may be obscure and doubtful, while the life of the patient may entirely depend on the decision for or against the use of the lancet. The doctrine of the buffy coat being a criterion of the existence of inflammation, is to be received, however, with limitation; for, though the buffy coat generally occurs in blood taken away from patients labouring under inflammation, it sometimes presents itself when no inflammation exists. Blood taken from individuals labouring under plethora, or such as are accustomed to be bled at particular periods as a measure of precaution, is mostly buffy and cupped. Certain nervous disorders, unconnected with inflammation, are attended with sizy blood. In pregnancy, and in individuals who keep watch in the cold nocturnal air, the blood exhibits the same appearance. Again, the buffy coat is sometimes absent, when inflammation is unequivocally present.* Sometimes what is first drawn is not buffy, but what follows is so. In proportion as the vessels are unloaded, the blood acquires more disposition to coagulate: thus, the blood, drawn in cases of acute internal inflammation, often does not afford so firm a clot as that of subsequent bleedings, although the inflammation may be lessened.† Some practitioners even dwell more on the excavated concave surface of the blood than the buffy coat, as evidence of the existence of inflammation. In establishing the diagnosis, then, we are to consider the buffy coat as not altogether sufficient of itself to remove every kind of doubt or obscurity regarding the existence of inflammation, and are particularly to take into the account the *concomitant symptoms*, the *degree of fever* present, the *state of the pulse*, the *situation* and *kind of pain experienced*, and especially the nature of the *functional disturbance*.

In obscure cases, we may take away a few ounces of blood at first for examination, and by way of experiment. Sometimes great light is thrown on the case by some of the *common symptoms* of inflammation being accompanied by *particular* ones, or such as are often termed *proper*, *essential*, and *pathognomonic symptoms*. Thus, severe pain in the loins might arise either from rheumatism, or from an inflammation of the kidney: but, if vomiting and retraction of the testicle were to be amongst

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circumstances, occasioning an *unusually rapid coagulation*, will prevent the formation of the buffy coat, such as a small opening in the vein, and the very slow escape of the blood from the vessel: this will sometimes account for the first quantity not being buffy, though what follows may have this appearance. The receipt of the blood in a flat cold plate, or letting the blood fall from a height into the basin, will also hinder the production of the buffy coat. During the first stage of inflammation, "the vital properties of the blood undergo a manifest increase. A greater quantity of fibrine is formed, the plastic property of which is increased; for, besides its rapid organisation, under favourable circumstances, it retains, when separated from the other constituents of the blood, its fluidity for a longer period, and contracts more firmly, than in the natural state." See Carswell's "Elementary Forms of Disease," Fasciculus 1.

* In some inflammations of mucous membranes, such as bronchitis, the blood frequently exhibits no buffiness, nor cupped appearance. When the blood is also greatly impoverished, and the constitution seriously reduced, the blood, during inflammation, instead of being buffy, will often present a dark red, jelly-like, and decomposed appearance; as is often exemplified when inflammation proceeds rapidly to mortification, or is attended with typhoid fever.

† See Macartney "On Inflammation," p. 145.

the other symptoms, with fever, &c., the inference would be, that the case was one of nephritis.

The *causes of inflammation* are divided into *predisposing*, *exciting*, and *proximate*. The human body is naturally susceptible of inflammation; and, if this were not the case, a recovery from many injuries and diseases would be impossible. In this point of view, inflammation is to be regarded as a salutary operation, the changes, which it brings about being absolutely necessary for the restoration of the parts to the healthy and perfect state again. Now, although there is in the animal economy a natural susceptibility of inflammation, seemingly intended for beneficial purposes, some constitutions are more prone to inflammation than others, and sometimes acquire such a disposition to it as receives the technical appellation of a *phlogistic* or *inflammatory diathesis*. This unfortunate kind of constitution may be innate or born with a person; but it is much more frequently produced by circumstances, which rank as *predisposing causes*. One of the most powerful and common of these is *plethora*, or a *full habit*, arising from taking immoderate quantities of food, or, in plain terms, from eating and drinking beyond what nature requires, and can well dispose of. This practice of living above par, and frequently at the same time in a state of indolence, leads to a prodigious fulness of the vessels, and a fibrinous state of the blood, which not only create a predisposition to inflammation, but to the process being more severe and difficult to repress whenever it does occur.

The extraordinary quantities of porter and other fermented beverages, taken by certain classes of workmen in this metropolis, such as coal-heavers, draymen, and others, make these strong-looking men notoriously bad subjects for disease. I have attended great numbers of them, and my experience justifies me in saying, that they frequently die of slight injuries and diseases, from which less robust, but more temperate persons would rapidly recover. When individuals are known to have followed these habits, they are not in a favourable state to bear operations; for which they ought in general to be prepared by previous bleeding or purging, low diet, and proper regimen. Unfortunately for them, circumstances often give no time for preparation: they meet, perhaps, with bad compound fractures, and their limbs must be amputated without delay.

A sedentary, studious life, joined with habitual indulgence at table, invariably creates a strong predisposition to inflammation, and sometimes either communicates a gouty *diathesis*, or, if such already exist from *hereditary* causes, brings it into action, becoming then the *exciting cause*. Among the predisposing causes, indeed, we should ever remember such peculiarities of constitution, because they explain why some individuals suffer from *gouty* inflammation; some from *scrofulous*, and others from *rheumatic;* though all of them may be living, perhaps, in nearly the same manner.

I believe, with Dr. Macartney, that a *local determination of blood*, as it is termed, is rather a *predisposing*, than a *direct* cause of inflammation. When too much blood is sent to one part of the body, too little visits some other; the balance, therefore, may be disturbed by external cold repelling the blood from one part, and causing its flow in undue quantity elsewhere. Thus, cold applied to the skin of the abdomen, produces a determination of blood to the peritoneum and alimentary canal. A determination of blood to the head may be occasioned by circumstances which have not a similar effect on other parts, as passion, mental application, the exertion of the sight, and intoxication. A forced state of

the circulation in the head gives a predisposition to inflammation of the membranes of the brain, the external parts of the nose, and the eyes.*

The *exciting causes* of inflammation are frequently mechanical injuries, fractures, bruises, wounds, &c.; stimulating applications, the contact of fire or heated substances, friction, and pressure on parts; the irritation of extraneous substances lodged in the textures or cavities of the body, as thorns, splinters of wood, bullets, fragments of bone, calculi, &c. One of the most common exciting causes is *cold*. In some instances, this seems to act *directly* on the part; as in inflammation brought on by it in the mucous membrane of the nose, larynx, trachea, and lungs. In other examples, cold acts *indirectly*, so as not to bring on inflammation of the part to which it has been applied, but of some distant organ. Thus, exposure of the feet to wet and cold will occasion in one person an inflammation of the throat, in another an inflammation of the chest, and in a third an inflammation of the bowels. Exposure to wet and cold, rubeola, &c., excite *internal* inflammation through the medium of the nervous and vascular systems.†

If a part, that has been exposed to intense cold, be suddenly warmed, the reaction is such as will bring on rapid and severe inflammation. In this way chilblains are excited, and large portions of the body destroyed by the quick advance of the inflammatory process to mortification. The cold may here be considered as the *predisposing cause*, and the sudden exposure to a warmer temperature the *exciting*.

Fevers sometimes operate as *exciting causes* of inflammation, which comes on towards their close, and frequently produces abscesses, formerly named *critical*, from their being supposed to have a share in bringing the disease to a crisis. Constitutional causes likewise operate in producing boils, some kinds of whitlow, the tendency of erysipelas to gangrene in certain epidemics; the carbuncle of plague, the malignant pustule, and the gangrenous inflammations of the cheeks ‡ and pudenda of infants. §

By the *proximate cause of inflammation*, is signified that state of the part upon which the phenomena peculiar to inflammation immediately depend; that secret process — that first essential action in the part, which constitutes the very beginning of inflammation, attends all its course, and is inseparably connected with its existence. The proximate causes of Galen and Boerhaave — viz., particular states of the fluids, viscosity and lentor of the blood, and the passage of the red globules into vessels not designed to receive or transmit them — even if they were facts, as indeed the latter one is, would not amount at all events to proximate causes, but only to predisposing and exciting ones. Whatever changes the blood may undergo in inflammation, they are now more justly regarded as effects, or at most as a predisposing cause, and not the proximate cause of inflammation. If the state of the whole mass of the blood were the cause, why should inflammation be confined to any particular part? Yet one fact here deserves to be particularly remembered, namely, that in plethora the blood is found to be buffy, which state unquestionably forms a predisposing cause of inflammation, but nothing more.

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* Macartney "On Inflammation," p. 79.

† Dr. M. Hall's "Principles of Medicine," p. 6. 8vo. Lond. 1837.

‡ Pearson's "Principles of Surgery," and Dr. M. Hall in "Edin. Med. and Surg. Journ." vol. xv. p. 547.

§ Mr. Kinder Wood in "Med. Chir. Trans." vol. vi. p. 84.

A larger quantity of blood is determined to an inflamed part than is sent to it in its natural state. If an incision be made in it, the blood gushes out more profusely, than from a cut in a similar part free from inflammation. If there be severe inflammation of the hand, and we open a vein at the bend of the elbow, the blood flows out much more rapidly than it would do from a vein of the other arm. This demonstrates a greater velocity of circulation, a more forcible current of blood towards the inflamed part, and also of the returning blood. Such facts cannot be explained by any reference to the action of the heart, an organ which drives the blood equally into the whole arterial system. They must depend either upon an increase in the diameter of the arteries of the part, or upon some power of the vessels themselves to transmit blood into the seat of the disorder with increased impetuosity and in larger quantity.

The capillary vessels are those by which the chief phenomena of inflammation are produced; such as the increased redness and heat of the part; the effusion of fibrine and serum; the formation of pus, when it happens; the swelling; the deposit of new or additional matter in the part; the pouring out of fluids from its surface or into its texture, &c.

The researches of Mr. Hunter proved, that the arterial branches acquire a greater power of contractility in proportion as they become smaller, and that the arterial trunks are less contractile and more elastic. That the minute ramifications of arteries are endowed with a high degree of contractility, is proved by a variety of circumstances. The minute arteries, like muscular tissues, retain the power of contracting after breathing has ceased: hence the empty state of the arterial system after death. When death is rapidly occasioned by lightning, or any violent narcotic poison, the action of the arterial and muscular systems being suddenly destroyed, the arteries are found filled with blood, as well as the veins. It is by the capillary vessels that the functions of *nutrition* and *secretion* are performed, and it is absolutely necessary for the uniform and uninterrupted continuance of these varied and highly important functions, that the vessels should have the power of controlling the motions of the fluids circulating within them.*

Some pathologists espouse the doctrine, that the changes which the vital fluid undergoes in its passage through the capillaries, whether these changes be for nutrition or secretion, have an important influence on its movement through them. However this may be, I would rather be content with the inference, that the capillaries possess a distributive power over the blood, so as at least to regulate the local circulation, independently of the heart, according to the necessities of each part.

The relative momentum of the blood in different parts of the body, or the quantity of the blood and its velocity, are perpetually varying, from the influence of the external stimuli or internal causes; facts, affording a

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* Bichat, who did not attribute to the arteries any muscular power, assigned to them another property, which he named *insensible contractility*. Dr. Macartney, who believes in the positive and active extension and dilatation of arteries, and other tissues similarly endowed, acknowledges, that, at present, we have no term applicable to the movements, or spontaneous changes of form in non-muscular structure. "It has been called by some," he observes, "*tone*, or *tonicity*, which, if applied both to the dilatation, or excited state, and to the contraction, as the movement leading naturally to fixedness and quiescence, will be as suitable a term, perhaps, as any other that could be devised." In this sense he speaks of the *tone*, or *tonic action*, of arteries.

decisive proof of the vital contractility of different portions of the arterial system. In *blushing*, the minute vessels of the cheek assume an increased activity, and admit more blood into them; while under the influence of depressing passions, such as fear, they are suddenly emptied, and the countenance becomes pale.

That in inflammation the diameter of the small vessels is after a time increased, so that red blood finds its way into many which naturally admit only a colourless fluid, and therefore cannot be seen at ordinary periods, is an undoubted fact. But, does the *increased action* in inflammation, of which we hear so much, signify any thing more than the action by which the diameter of the vessels becomes altered, a greater quantity of blood is transmitted to the seat of inflammation, fibrine is effused, redness, heat, and swelling are occasioned, fluids of various kinds poured out, and new products formed? Does it imply that the vessels are alternately contracting and expanding themselves in an extraordinary degree for the purpose of maintaining an accelerated flow of blood through the parts affected? Certainly not — with the naked eye we plainly see vessels dilated, but undergoing no alternate motion of dilatation and contraction. If, as Dr. Macartney rightly observes, the increased contraction were unremitting, it is the very state, to effect which is the object of many of the remedies employed; and, if it were alternated momentarily with the dilatation of the vessels, it would have more effect in driving the blood backward upon the great trunks, than onward through the minute termination of the arteries, unless the current were supported behind by valves *; neither, if we can credit microscopical examinations, is the blood constantly pervading the smaller with increased celerity. On the contrary, the experiments † of Dr. John Thompson, Dr. Wilson Philip, Dr. Hastings, and Gendrin, all tend to prove that a quickened circulation of the blood in an inflamed part is so far from being an essential feature in the process, that when inflammation is established, when a certain stage of it has arrived, the motion of the globules in the minute vessels is retarded, or even stopped. Hence, Dr. Wilson Philip was led to adopt the hypothesis, that inflammation actually consists in a *debilitated state of the capillary vessels, followed by an increased action of the larger arteries.*

It is curious to notice the very opposite conclusions to which different parties are brought by the same facts: while the generality of medical writers, ancient as well as modern, admit the *doctrine of obstruction in the minute vessels* ‡ of an inflamed part, some of them refer it, with Boerhaave, to *viscidity* of the blood and *error loci* of the globules; some, with Cullen, to *spasm* of those vessels; and others, with Dr. Wilson Philip, to their *debility.*

With respect to increased alternate contractions and dilatations of the arteries in inflammation, Mr. Hunter never meant any such hypothesis

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* Macartney "On Inflammation," p. 126.

† With reference to such of these experiments as were made on cold-blooded animals, it is Dr. Macartney's belief, that, "in neither of the two classes of vertebrate animals with cold blood, is it possible to produce the genuine effects of inflammation." This doctrine, however, is disputed, and even vegetables are alleged to be liable to a state corresponding with inflammation. See "British and Foreign Med. Review," vol. vii. p. 429., and vol. viii. p. 188.

‡ "It is probably by the partial obstruction to the circulation in the capillaries, that the minute arteries become enlarged, according to the well-known law, that muscular organs augment with obstacles to their functions." See Dr. M. Hall's "Principles of Medicine," p. 17.

to enter into his doctrines; for he distinctly says that "*in inflammation the muscular coat of the arteries does not contract.*"

Dr. Hastings takes the same view of inflammation as Dr. W. Philip, and represents it as consisting "*in a weakened action of the capillaries, by which the equilibrium between the larger and smaller vessels is destroyed, and the latter become distended.*"

A simple enlargement of vessels, and a mere irregularity in the distribution of the blood, will not constitute inflammation. We find that such changes occur in the spermatic arteries of animals which copulate only at particular periods of the year. We remark a similar change in the carotids of the stag, during the growth of its horns. Yet, in such examples, there is no inflammation, no pain, no redness. A simple increased determination of blood to parts may render their vessels preternaturally full and turgid — may produce what is technically named *congestion;* it may even be a predisposing cause of inflammation, but *it is not inflammation itself.*

The following is a summary of the principal changes occurring in the inflammatory process.

*First stage,* sometimes called *active congestion* * : — 1. Increased sensibility of the part. The nerves are essentially concerned, I think, in the first action of inflammation; but there is good foundation for the doctrine, that three elementary parts of the body have a constant share in the process — namely, the nerves, the blood-vessels, and the blood itself. Animals, which have no visible nerves, and those in which the nervous system is very simple, exhibit, according to Professor Macartney, none of the phenomena of inflammation. All the local causes of inflammation seem to him to act by making such impressions on the sensibility of parts, as dispose the arteries to assume the inflammatory state.† 2. Increased action of the vessels — quickened circulation — increased influx of blood — dilatation of the small vessels and capillaries — admission of red blood into vessels previously colourless — turgescence — swelling — and then, a slow embarrassed circulation in the immediate seat of the inflammation.

If the inflammation continues, its *second stage* begins — it is no longer merely *active congestion.* The contractility of the vessels is paralysed by their over distension — the blood stagnates, and undergoes changes in its composition — the coats of the blood-vessels suffer injury — many of these vessels are ruptured — the action of others is changed; hence, the formation of new products — extravasation and effusion of blood — fibrine and serous fluid — thickening, and other alterations of tissues.

The phenomena of inflammation, then, as Dr. Carswell justly observes, cannot be explained by a reference to the exclusive doctrines of *increased,* or *diminished action,* of the vessels. "It is obviously a compound of both, and not merely of the vessels of the inflamed part, but *primarily*

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* The term *congestion* would not be deemed by Dr. Macartney the best, because his views lead him to regard congestion as belonging to the venous system, and actually accompanied by a diminution in the size of the arteries. Op. cit. p. 139.

† Op. cit. p. 111.; also p. 133., where Dr. Macartney endeavours to refute the objection to this view, derived from the fact of paralytic parts being liable to inflammation. "The paralysis," he remarks, "consists in the interruption of the communication between the central parts of the nervous system and those remotely situated, and not in the destruction of organic sensibility."

and *essentially of the function of innervation* also, of the vital properties of the blood, and, consequently, of organic composition." *

One view entertained of this subject is, that the *first* effect of a stimulus, calculated to produce inflammation, is on the general organic properties of the part, and especially on its power of deriving from the blood the materials of its assimilating or secreting processes; and that the influence it exerts on the calibre of the vessels, and on the motion of the blood through them, is altogether *secondary* to this. It is argued, that the effect of a stimulus, which increases for a time the physiological or normal actions of any part, is to accelerate the capillary circulation, whilst the calibre of the vessels is diminished. The latter alteration, it is thought, can scarcely be due to the direct application of the stimulus; but rather to the influence of the ganglionic nerves, which are unquestionably largely concerned in the subsequent processes. To the same influence the simultaneous dilatation of the arterial trunks leading to the part is referred.†

The following considerations have been advanced against the doctrine of the nerves being essentially concerned. "Is it true, that the impressions, which produce inflammation, necessarily act through the nervous system? We think not. To prove this, it must first be shown, that the normal changes, which constitute the organic functions, all of which are due to the influence of external agents on the organism, depend upon its influence. If a normal stimulus can produce a healthy change or action without the intervention of the nervous agency, it is perfectly evident, that an abnormal stimulus may produce a morbid change independently of it. The remark of Mr. Palmer upon this question strikes us as peculiarly judicious. 'The office of the nerves in inflammation appears to hold precisely the same relation to this action that it does to the other organic functions. It is regulative, but not essential.'" See British and Foreign Med. Review, No. 15. p. 188. I briefly notice this mode of reasoning, without adopting it.

In *chronic inflammation*, the vessels do not always exhibit the redness and turgescence noticed in the acute forms of the disorder. Yet, sometimes, a good deal of redness is attendant even on chronic inflammation of certain tissues; but, more frequently, "various shades of purple, brown, or black;" while the pain, the heat, the throbbing, the febrile disturbance, usually accompanying acute inflammation, are not noticed. Besides, the tumefaction resulting from the deposit of morbid products, when inflammation is much prolonged, or often repeated, it causes an enlargement of parts by exciting an exuberant action of the nutritive vessels, and a consequent excessive nourishment, termed *hypertrophy*.

On the other hand, inflammation, by disturbing and interrupting the functions of circulation and nutrition in parts, sometimes has the effect of bringing on *atrophy*, or a wasted condition of them. These opposite results of inflammation are sometimes observed in parts composed of different structures: an exuberant nourishment of one tissue being generally attended with a deficient nourishment of other tissues of the same organ. By inflammation, the function of nutrition in parts may also be perverted, and then there may be *transformations of texture* — as into bone, cartilage, fibrous membrane, ligament, &c. *Acute inflammation* sometimes lessens the cohesion of tissues, and reduces them to a pulpy

* See Professor Carswell's "Elementary Forms of Disease," Fasciculus 1.
† See "British and Foreign Med. Review," vol. viii. p. 191.

state, by a peculiar softening process. *Chronic inflammation* has a greater tendency to cause parts to become indurated. There are, however, many exceptions to these rules — and softening and induration are often combined.

Inflammation has various *terminations*. More properly speaking, after the process has continued a certain time, it either subsides entirely; or "new products are formed, or other diseased states are produced, as softening, suppuration, ulceration, and mortification." It may end in the adhesion of one inflamed surface, or texture, to another; induce in the vessels a disposition to form pus; bring on ulceration; or completely destroy the vitality of the parts.

When inflammation is about to end in the first manner, termed *resolution*, the pain becomes less, the swelling, tension, and throbbing subside; the redness fades away; the fever and every other symptom gradually abate; and, at length, the part is restored to its natural size and colour. There is no formation of pus, and no permanent injury of structure. According to Kaltenbruenner, critical exudations take place through the sides of the vessels, consisting of a thin serous or sanguineous fluid, poured out on the surface, or in the cellular texture of the part. There may be profuse exhalation of fluids on secreting surfaces. The small coagula of blood, contained within the vessels, or deposited in the parenchyma, are softened, and removed either by the impetus of the current of blood within the vessels, or by interstitial absorption. This termination, which may be rightly called so, is fortunately not only the most favourable, but the most common.

A modification of it, characterised by a more sudden subsidence of all the local symptoms, or by a rapid shrivelling and diminution of the swelling, is described by French pathologists under the name of *delitescence*.

Resolution is often preceded or accompanied by *metastasis*, or *translation of the disease* from one part to another. Thus, inflammation may suddenly leave one tonsil, and attack the other. In mumps, the glandular inflammation often suddenly recedes, and the testicle or breast is then affected. In gout, the inflammation leaves the foot, and attacks the hand or knee, or even the stomach or brain. Rheumatism, on quitting one joint, causes inflammation in another. Sometimes it leaves the joints, and fixes on the membranes of the brain, or the serous covering of the heart.

One frequent consequence of inflammation is *suppuration*, the vessels acquiring the power of forming purulent matter, which either collects in the substance of parts, so as to produce abscesses, or is poured out from their surface in the form of discharges, as illustrated in wounds and ulcers, and the inflammation of mucous membranes. *Suppuration* cannot be properly called a *termination* of inflammation, but only one of its effects or consequences. It is rather a modification of the inflammatory action, than a cessation of it. Indeed, when it occurs, the surrounding parts are frequently in the stage of common adhesive inflammation; and, so far from the disorder having ended, the suppuration may be attended with a severe degree of it.

Another termination, or rather consequence, of inflammation, is *ulceration*.

*Mortification* of the parts affected is the most dangerous and severe result; but it only takes place in inflammations attended with unusual violence, the debility of age or impaired constitution, or some specific peculiarity leading necessarily to the event, as is illustrated in carbuncle; and, upon a smaller scale, even in the common boil, in the

centre of which there is always a core, or slough of cellular tissue. After *acute* inflammation has lasted a certain time, especially on a mucous membrane, it frequently changes into *chronic*, the part then becoming less painful, and the vessels generally less red, but seemingly relaxed, and, one would here almost venture to say, with Dr. Wilson Philip, debilitated.

Dr. Macartney believes, that the only direct and genuine consequences of inflammation are, the effusion of some of the fluid elements of the blood, *which cannot receive organisation;* the breaking down of some of the solid textures of the body; the formation of a new fluid, denominated *pus;* and the disorganisation, or the absolute death, of the inflamed parts. (Op. cit. p. 36.) The *effusion* of *coagulating lymph*, and *ulceration*, are not admitted by this gentleman to be the consequences of an inflammatory action. (p. 37. &c.) While I agree with him, that coagulating lymph may be thrown out by a natural and healthy action, as in the formation of the decidua uteri, it seems to me impossible to adopt the doctrine, that inflammation has not among its effects or consequences the effusion of that substance. With reference to ulceration, does not Dr. Macartney accede to the commonly received doctrine, when he says, "there is every reason to believe, that *ulceration always takes place*, because the vitality, or the organisation of parts, have been impaired by *inflammation*, weakness, pressure, or other external injuries?" (p. 42.) The questions concerning the salutary or pernicious results of such effusion, and whether it may not happen in certain natural processes in the animal economy, without inflammation, appear to me to relate to a different part of the inquiry.

## TREATMENT OF INFLAMMATION.

Although, in many cases, inflammation clearly appears to be a process set up for beneficial purposes, and is to be regarded as salutary and even necessary; yet, more commonly, it happens, that, from its extent, its situation, or its violence, it cannot be considered in this light; and being then more likely to injure or destroy, than to serve the patient, it demands the prompt employment of every means calculated to check and subdue it. Consequences, the most serious and fatal, frequently arise from its attacks, when violent, of great extent, or situated in organs of importance to life, or of great delicacy of texture, unless such attacks be resisted by active measures. Enormous abscesses sometimes form; the functions of important organs are permanently impaired or destroyed; and, what is worse, the patient frequently dies from the amount of local mischief and constitutional disturbance produced. If the bills of mortality were correctly made out, the greater number of deaths would be found to be caused by inflammation in some form or another. This is so true, that the words of Milton, in relation to the forbidden fruit, might, and indeed have been, applied to inflammation, as having

"Brought death into the world and all our woe."

But even when inflammation does not kill by its *violence*, its *extent*, or its *particular situation* in parts of first-rate consequence to life, it frequently gives rise to evils which can never afterwards be repaired. Thus it renders transparent textures opaque; it thickens, hardens, softens, or enlarges the generality of parts affected by it; it causes the effusion of a serous fluid, which does not coagulate spontaneously, and also of fibrine, — one

character of which is its spontaneous coagulation, the latter sometimes becoming vascular and organised, so as to produce lasting adhesions of surfaces together which ought to move freely upon one another, or at all events, not to be united. It also brings on ulceration and mortification. Now, by producing these changes, it often completely destroys the functions of organs, or so impairs them that they can only go on in a disordered, weakened, and imperfect manner. These facts are excellently illustrated in inflammation of the eye, where, if the disorder be not successfully resisted, we see opacities of the transparent textures produced; the pupil blocked up with coagulating lymph; the iris thickened, and rendered immoveable; or the cornea in an ulcerated or sloughing state, so as to occasion a discharge of all the humours, and a total collapse and destruction of the organ. In other inflammations of the eye, adhesions frequently take place between the iris and the inner surface of the cornea, or between the iris and the capsule of the crystalline lens. In fact, in the eye all the effects of inflammation are delineated in a manner that can never be forgotten: transparent parts rendered opaque; parts, which ought to be moveable, fixed by adhesions; textures surprisingly thickened and swollen; the white conjunctiva converted into one uniform vivid redness by the dilatation of the vessels; and even the retina paralysed, and its functions irreparably destroyed. "The iris has its office destroyed by being bound to the adjoining parts; the actions of the heart are embarrassed by extensive adhesion between it and the pericardium; and (continues Dr. Macartney) I have known the general union of the peritoneal surfaces of the intestines cause strangulation of the whole alimentary canal, and death. It is also the agglutination by lymph, which is the most frequent cause of hernia becoming irreducible, and, occasionally, of the parts becoming strangulated. The effusion of lymph in the trachea during croup causes as much danger as the inflammation. So, likewise, when the bladder and urethra are blocked up with lymph." (p. 37.) Respecting the disadvantages, or the benefits, arising from adhesions in different examples of inflammation, Dr. Macartney agrees with other pathologists. But if parts not merely valuable from their functions, like the eye, but absolutely essential to life, become attacked with inflammation, the necessity for active treatment is still more urgent. Thus, when the lungs, the larynx, the brain, the stomach, or the intestines are inflamed, if vigorous antiphlogistic measures be not speedily adopted, and the disorder be suffered to make progress, the patient will generally perish.

The fact, then, being established, that inflammation, so far from being always a salutary process, is sometimes an injurious and a fatal one, it becomes the duty of the surgeon to adopt, in every severe example of it, the most prompt and efficient means to oppose and subdue it.

"The nervous system of the human subject is so complicated, that there is hardly a local affection with which the constitution does not sympathise, nor any constitutional disturbance which may not become the cause of local disease. The same susceptibility, however, communicates a power to the means we may employ for preventing or abating inflammatory action, which (power) does not belong to animals of an inferior organisation; and when by those means we are enabled to remove the sense of injury sustained, or produce a state of insensibility inconsistent with inflammation, the reparative processes (seem to Dr. Macartney to) go on much in the same manner as in animals endowed with an inferior degree of feeling."

*Resolution* being the most favourable termination of inflammation, is

what should always be aimed at, unless it be known from the peculiarity and state of the disorder, that no chance of such termination remains. According to Dr. Wilson Phillip's theory, inflammation is attended with debility of the capillary vessels, and *resolution* is brought about by the increased action of the larger arteries removing this condition of the smaller ones. On the other hand, it might be argued, that such increased action of the arteries leading to the seat of inflammation must have the effect of gorging the minute vessels in a still greater degree, and that, if the foregoing view were correct, the principal object in the treatment would be to promote such increased action, which practice is inconsistent with the dictates of general experience.

In the commencement, there are two principal indications. 1. To remove the exciting cause, if it be still present. 2. To lessen the determination of blood to the part.

With regard to the *exciting cause*, it may not admit of immediate removal, or its operation may have already ceased. Thus, when inflammation is caused by a mechanical injury done in an instant, the exciting cause continues not beyond the moment of its application, the instant of the infliction of the wound, but the mischief remains to be repaired, and this may be regarded as the exciting cause of the reaction which follows, and constitutes inflammation; it is manifest, however, that such mechanical injury of textures cannot be immediately removed, and, indeed, that it can only be gradually rectified by the inflammation itself. But, in many examples, the exciting cause continues in operation, as where sand or other extraneous substances are lodged between the eyelids and the front of the eye, or where a splinter of wood, a bullet, or fragment of gravel, &c., are lodged in parts; and, in such cases, it is absolutely necessary to remove them as soon as possible; for, until this be done, little or no benefit, or, at all events, no perfect cure, will accrue from any mode of treatment.

On the same principle, when pressure, friction, or the presence of urine or irritating fluids in the cellular tissue, is concerned in kindling inflammation and its consequences, the removal of such pressure, &c., and the making of a free outlet for the extravasated urine, are primary objects.

The second indication is *to diminish the flow of blood to the inflamed part*, by which means the surgeon removes, in a great measure, that by which the disease may be said to be fed. The fact being once established, that inflammation is kept up by an increased flow of blood to the part, this indication presents itself as a matter of course, nor can it be affected by any consideration of the exact state of the capillary vessels, or of the rate of the blood's motion in them. Nay, were it right to be altogether influenced by the presumed debilitated condition of these vessels, I should argue, that the indication of diminishing the flow of blood to them would still be the most consonant to reason as well as experience. It is fulfilled either by plans which act directly on the part affected, or by others which act indirectly upon it, that is to say, through the medium of the constitution. There are also other means, which operate on a different principle, viz., on that of the sympathy existing between different organs. Counter-irritation is a remedy of this kind, which is often of essential service when employed with due precaution. The first means, namely, those which operate *directly* on the part affected, are denominated *local* or *topical;* and the second, or those which act *indirectly*, are called *general* or *constitutional*. The *local* consist of *bleeding*, by means of *cupping* or

*leeches*, the application of *cold lotions*, *emollient poultices*, *fomentations*, and, especially after depletion has been duly practised, *blisters*.

In all acute inflammations of any extent or violence, bleeding from a large vein, or the temporal artery, should be practised, and in such a quantity as to produce an effect upon the whole system. The taking away of blood from the system is what the experience of many generations pronounces to be the great *antiphlogistic remedy*, most entitled to reliance; and this is so strictly the fact, that the preservation of life often depends, not only upon blood-letting being speedily and freely performed, but upon its being repeated as frequently as circumstances may require. In inflammation of the brain, lungs, larynx, pleura, peritonæum, stomach, or bowels, the patient must be bled, and this promptly, copiously, and sometimes repeatedly, or life will be lost in a few hours; indeed, to omit blood-letting in such cases would be to leave the patient to the poor chance of an accidental or spontaneous recovery. If there were no blood-vessels in parts, or if there were no blood in the vessels, there could be no inflammation; and if to these truisms, a statement equally certain be taken into the account, namely, that the continuance of inflammation depends on fresh supplies of blood being sent to the part affected, the reason for lessening the mass of blood in the circulation must be manifest. By so doing, the action of the heart and arteries is moderated, and in proportion as the force and velocity of the whole circulation are reduced, the impetus of the blood flowing to the seat of disorder is also diminished. Indeed, if there were not thousands of other examples to convince us of the great usefulness of blood-letting in the cure of inflammation, there is one case, which of itself could never leave any doubt on this important point. If, in severe inflammation of the eye, attended with great redness of the tunica conjunctiva, blood-letting be practised, the redness visibly diminishes in proportion as the blood is abstracted; the colour, which at first was scarlet, a complete sheet of vivid redness, becomes a pale pink, the vessels shrink, and their redness and turgescence are sometimes almost removed by the time thirty or forty ounces have been taken away. When we bleed, then, in ophthalmia, we have something like a demonstration of the benefit of blood-letting. In wounds of the head, chest, or abdomen, the chief danger, when the patient is not destroyed at once by internal hemorrhage, is from the supervention of inflammation of vital organs; and, if the patient were not duly bled on the first signs of that disorder making their appearance, he would soon die. In all such cases, the rule is to bleed expeditiously, freely, and repeatedly, not to be content with taking away scanty quantities of blood, and not be deterred by smallness of the pulse, or other appearances of weakness.

Bleeding is not always necessary in slight inflammation of common parts — I say of *common parts*, because in *important parts*, however *slight* the inflammation may be, bleeding should not be omitted. It is necessary also to consider the *age*, the *strength*, and the *constitution* of the individual. It must be evident, that an aged or weak person will not bear depletion to the same extent as a young or robust individual; yet, notwithstanding the general truth of this proposition, when we are called upon to check an inflammation of any important part, whether the patient be old or young, weak or strong, the principal reliance must be upon blood-letting. A small quantity, however, abstracted from weak aged individuals, is equivalent to a larger quantity taken from the strong. The fact of the usefulness of bleeding for the relief of inflammatory complaints is so well established, that, in every severe instance, we are to employ,

not merely *general bleeding*, but also *topical* or *local bleeding*, by means of *cupping* or *leeches*.

There are, however, some constitutions, not essentially joined with old age or debility, but characterised by excessive nervous irritability, and well known to be incapable of bearing bleeding to any considerable extent. This fact is particularly adverted to by Andral, who observes that in individuals, who, during the course of an acute inflammation, have already lost a considerable quantity of blood, or who, during a tedious convalescence, have been kept for a long time on a low diet, and in others, who, after a severe attack of acute inflammation, continue to be afflicted with a lingering chronic form of it, the nervous system is apt to become violently disturbed by the abstraction of even the slightest quantity of blood. Hence the kind of constitution, and the previous history of the case, are always to be taken into consideration, and measures adopted accordingly. With respect to these nervous irritable temperaments, if bleeding be useful at all in them, it is generally only in the beginning of the inflammation, and, if this opportunity be lost, the practice will not avail afterwards.

In the correctness of the following remark I fully concur. "It is a common practice to draw blood the moment an injury is received, long before there is time for inflammation to set in. This (says Dr. Macartney) appears to me to be worse than useless, as it deprives the practitioner of the opportunity of acting with sufficient energy when the proper time arrives." * Cases of accident, that of fractured ribs, for example, are sometimes suspected not to bear loss of blood like those of inflammation. According to Dr. M. Hall, different diseases induce in the constitution different powers or susceptibilities, in regard to the effects of loss of blood. In cases in which it is doubtful, whether the pain, or other local affection, be the effect of inflammation, or of irritation, "the question is immediately determined by placing the patient upright, and looking upwards, and bleeding to incipient syncope. In inflammation, much blood flows; in irritation, very little. The violence of the disease, the powers of the system, and the due measure of the remedy, are determined at the same time." In inflammation, we are to bleed fully; in irritation, cautiously: if much blood flows before syncope occurs, we may suspect inflammation; if little, however similar the symptoms, Dr. Hall would suspect the case to be of a different nature, perhaps irritation, or exhaustion.† Exceptions to this mode of judging, however, are admitted, and every experienced surgeon must have met with them.

I have already referred to the instruction to be derived from the appearance of the blood taken away; viz. from its buffy and cupped surface; but since these circumstances are not entirely to be depended upon as a criterion of inflammation, and of the necessity for venesection, the surgeon must reflect upon the *state of the pulse*, the *type and degree of fever* present, the *kind of pain* experienced, and the *nature of the function disturbed*. He should likewise pay attention to the character of the *sympathetic* symptoms, as they are termed, such as pain in the shoulder and about the larynx in hepatitis, the vomiting and retraction of the testicle in inflammation of the kidney, &c. From all these considerations taken together, he will generally be able to judge of the *existence*, *extent*, *violence*, and *seat of inflammation*, and form a correct opinion about the propriety of taking away blood.

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* Op. cit. p. 152.

† Principles of Medicine, p. 79.

In urgent cases, it is sometimes advisable to bleed the patient till he faints, *ad deliquium*, as the phrase is; because, when a person faints, all operations in the system are immediately checked or suspended, and among them the action or process of inflammation. Now, for the purpose of inducing *deliquium*, it is frequently proper to make the opening in the vein large, or even to puncture a vein in each arm, so that the blood may flow away more suddenly; for, on the quickness of the evacuation, the success of the attempt will often depend. If the patient be not too ill, it is also sometimes deemed advantageous, with a similar view, to bleed him while he is standing or sitting up in bed, because in these postures half the quantity requisite to make him faint while he is lying down will have the effect. By attending to these directions, inflammation may often be reduced at once, with a very inferior loss of blood to what would be required, if this fluid were taken away in the first instance in a more gradual way.

The plan of bleeding from a large orifice, or from two veins, is only to be adopted in urgent cases, and where the patient is in a state to bear fainting without danger. After fainting commences, the surgeon should always stop the further flow of blood, lest the prostration of the vital power be carried to a dangerous extreme. When, from our acquaintance with the patient's constitution, we know that the loss of an ounce or two of blood will make him faint, we should bleed him in the recumbent posture, and make an opening of moderate size in the vein. Without these precautions, we might not be able to take away blood enough to make any impression on some dangerous forms of inflammation.

*Local* or *topical bleeding* is employed in mild cases, and in the chronic forms of inflammation, where the opening of a large vein is not deemed necessary; and it is likewise resorted to in inflammations which are dangerous on account of their degree or situation, as an auxiliary to venesection, or arteriotomy; but, in such instances, the use of the lancet should never be omitted. So long as plethora has not been duly obviated by general bleeding, topical bleeding will disappoint the expectations of the practitioner; and alone, it will mostly fail to stop the progress of any important inflammation.

Topical bleeding will suffice where the symptoms are not severe enough to require general bleeding, or where, on account of peculiar circumstances, the system will not bear much loss of blood from the arm, or where doubts exist about the propriety of venesection, inasmuch as the nature and state of the disorder may be questionable. Local bleeding, by means of leeches and cupping, is also frequently of considerable service in those inflammations which partake more of the chronic than the acute form. To some parts, after the leeches have fallen off, a cupping-glass may be applied, by which means the discharge of six or eight ounces more blood may often be promptly obtained. In general, when plethora has been obviated, the effect of topical bleeding will prove to be much greater than could be expected from the simple consideration of the moderate quantity of blood often thus taken away. Some pathologists account for this fact by supposing the smallness of the evacuation compensated by the nearness of the bleeding to the part affected, the effect being concentrated, as it were, on that particular part.

By cupping freely, or applying a great number of leeches, however, sufficient blood may be taken away to produce a vast effect upon the system at large. These modes of bleeding may then indeed be regarded in the same light as venesection, or general bleeding.

In some constitutions, leeches must be avoided, as invariably bringing on an attack of erysipelas.

The *symptomatic fever*, which accompanies every severe attack of inflammation, always produces constipation. *The removal of this confined state of the bowels*, then, is *another indication*. For this purpose, mild saline purgatives, which act without much irritation, are sometimes preferred, as the sulphates of soda and magnesia, and the tartrates of potash and soda. In many cases, however, more active purgatives become necessary, such as colocynth with calomel, or calomel with jalap, James's powder, &c. It may be proper also to assist the operation of these last medicines with the infusion of senna, or the saline mixture, in which a proportion of some of the neutral salts has been dissolved. In certain instances, the aid of glysters is also requisite. Purgative medicines have a considerable effect in lessening the strength and frequency of the pulse, and in reducing the force of the circulation; and, on this principle, they must be of service in subduing inflammation; they cause an extraordinary secretion from the whole surface of the mucous membrane of the bowels; and when the immense extent of that surface, and the quantity of fluid, thus abstracted from the circulation, are recollected, we must at once recognise the manner in which purgatives become so beneficial as a means of counteracting inflammation.

Amongst the remedies which act through the medium of the constitution, is *mercury*, the powerful effect of which, in stopping the effusion of coagulating lymph in inflammation, is a very important fact, made out within the last thirty or forty years. The exhibition of calomel, joined with opium, in the treatment of certain visceral inflammations, was first particularly recommended to the notice of the profession, at an earlier period, that is in 1783, by Dr. Robert Hamilton of Lyme Regis. The effect of mercury in stopping the effusion of fibrine or coagulating lymph, and promoting its absorption when already effused, was first brought into great publicity by the late Mr. Saunders and Dr. Farre, whose statements were deduced from the observation of the action of mercury on iritis. Another illustration of the power of mercury in checking the progress of inflammation, and especially in preventing that action of the vessels on which the effusion of fibrine depends, is seen in inflammation of the larynx, or croup. Here the chief reliance is on the lancet, and the free exhibition of mercury; for if the inflammation be not quickly stopped, and its consequence, the effusion of lymph, be not rapidly checked, the death of the patient will be inevitable: he will die partly from the obstruction of the air-passages with fibrine, and partly from the glottis becoming œdematous.

Mercury exerts a similar beneficial influence over inflammation of the viscera and internal organs in general, and it has a peculiar power of controlling the process, so as to prevent those changes from taking place which are so destructive to the organisation of tissues in a state of inflammation. The quantity, which is to be administered, must depend on the violence of the inflammation, and on the nature of the parts affected. Sometimes it is necessary to bring the system rapidly under its influence, as for example, in inflammation of the iris, the retina, the larynx, or the trachea. In such cases, immediately after general and local bleeding, we may give two or three grains of calomel, or five of the hydrargyrum cum cretâ, every alternate hour, till there be some decided affection of the mouth, and amendment in the symptoms. Even larger doses are sometimes given. In the inflammatory diseases of hot climates, which run their course with frightful speed, the rapid introduction of mercury after venesection seems to be the only chance of saving life.

Though mercury has vast effect in arresting the progress of inflammation, when exhibited alone directly after bleeding, it is often more successful when combined with opium, especially if the pain is severe, and there is a tendency to disturbance of the bowels. Here, sometimes, the hydrargyrum cum cretâ, joined with the compound powder of ipecacuanha, is the best formula. In active inflammation, however, neither mercury, nor any other remedy, should be permitted to interfere with blood-letting, which is the first and most powerful means of stopping inflammation, while mercury, perhaps, deserves to rank as the second; or, as Dr. Armstrong used to say, bleeding is the right arm in the management of inflammation, and mercury the left.

But, though mercury is useful in the treatment of inflammation situated in various important organs and textures, it is by no means necessary to put patients under its influence for the relief of every common case of inflammation. This would be making the remedy worse than the disease. There are likewise particular states of the health, brought on by the too free or long employment of mercury, or other causes, in which any inflammation present will not take a favourable course until the state of the constitution has been improved. Here the discontinuance of mercury, instead of its further exhibition, may be the principal means of benefiting the patient.

*Tartarised antimony* is useful in two ways; first, by lessening the dryness of the skin and promoting perspiration; and secondly, in freer doses, by producing nausea, which at once renders perspiration more abundant, and reduces the force of the pulse. No doubt considerable benefit sometimes arises from its employment with these views, as well as from its efficacy in promoting the alvine evacuations; but if we were to depend entirely upon it, if we were to lay the lancet aside for it, I should say, that it would not generally be for the patient's good: the practice would not be less severe, and perhaps inferior in point of efficacy. In Italy, the plan of giving very large doses of tartarised antimony for the cure of inflammation has been common of late years. Thus, in pneumonia, Rasori, one of the advocates for this plan, gave, after blood-letting, not less than eight or ten grains of this preparation in the twenty-four hours. If the disease had made considerable progress in the lungs, he began with twenty or thirty grains, increasing the dose daily till one or several drachms had been taken in the course of the twenty-four hours. Of 832 cases of pneumonia, treated in this manner, only 173 died. Laennec, encouraged by these facts, also employed the same medicine *after bleeding*, but, in the more moderate dose of one grain every four hours, blended with about a drachm and a half of syrup of poppies. Dr. Tweedie finds the irritation of the stomach, resulting from it, very much allayed by giving it in the effervescing saline draught, with a few drops of laudanum.

For many years past, surgeons have occasionally been in the habit of treating violent inflammations of the eye and testicle by means of nauseating doses of tartarised antimony; but partly in consequence of the aversion of most patients to be sickened in this way, and partly from the greater confidence now placed in mercury, the practice has of late considerably declined.

*Colchicum*, as a diuretic, purgative, and nauseating medicine, is useful, but chiefly in some specific inflammations, like those of gout, rheumatism, and some forms of inflammation within the eye, connected with peculiar states of the system.

*Opium*, being a stimulant and a constipating medicine, as well as a narcotic, has sometimes been deemed quite inapplicable to cases of inflammation. Yet, at all periods, it has had its advocates. In examples, accompanied by excessive pain, some practitioners, after bleeding the patient largely, give a full dose of opium, which is sometimes followed by the most happy effects, especially in irritable constitutions. The reaction, which often follows a large bleeding, may generally be prevented by giving two grains of solid opium, or a draught containing one grain of pure acetate or muriate of morphia, administered when the faintness is disappearing. In many instances, one copious bleeding, a full dose of opium, and a mild cathartic, will succeed in stopping inflammation. The opium so tranquillises the nervous system, after the bleeding, that the patient often falls into a refreshing sleep, from which he awakes with a moist skin, and a freedom from pain. If, however, after an interval of three or four hours, the skin should become hot and dry again, and the pulse wiry, the blood-letting and opium, with three or four grains of calomel, are to be repeated.

In the treatment of inflammation, the severity of the pain frequently compels the surgeon to prescribe opium. When suppuration is taking place in situations where the parts and the matter are bound down by tense unyielding structures, the agony may be intolerable. After a surgical operation, when the wounded parts continue inflamed, and more blood cannot be taken away, the surgeon may sometimes give one grain of opium and two of calomel every six or eight hours, with great advantage.

Differences of opinion exist about the general usefulness of giving opium just before and immediately after surgical operations. When the pain after an operation is exceedingly severe, the patient very restless and nervous, with a disposition to spasms or subsultus tendinum, the acetate or muriate of morphia may be prescribed. But the dose must be a full one, that is to say, a grain; for all surgeons of experience agree, that small doses of any preparation of opium, after a surgical operation, only render the patient more uncomfortable and feverish. If laudanum be given, it should be in doses of fifty or sixty drops.

With *bleeding*, *purging*, *antimonials*, and *sometimes mercury* and *opium*, are to be combined the advantages of a very *low diet*, from which all animal food, spirits, wine, and fermented liquors in general, must be strictly excluded; often, indeed, only barley-water, or lemonade, or tea, with a bit of dry toast, ought to be allowed. Quietude of body and mind is to be enjoined, and every thing avoided likely to stimulate the system, accelerate the circulation, or disturb the nervous system, or the inflamed part itself. The return of blood from the seat of inflammation may sometimes be advantageously promoted by a judicious position of the part. To borrow Dr. Macartney's language, where he is speaking of the immersion of a wounded or inflamed part in warm or cold water, freedom from the sense of restraint, pressure, and friction, an easy and elevated position, and avoidance of all motion, are advantages acknowledged by every body. The patient should be placed in a quiet apartment, in which there ought to be no unnecessary conversation, nor any superfluous visitors. The room is to be kept moderately cool, and the patient not heated with heavy blankets. The several measures and plans, here mentioned, constitute what is called the *antiphlogistic treatment*, which is applicable to the relief not only of common, but of specific inflammations, though in these latter cases other remedies are mostly required.

*Local* or *topical remedies for inflammation.*—One effect of this process, in all its acute forms, is to produce a rise in the temperature of the parts affected: not only does the patient experience in them a distressing sensation of heat, but their temperature is actually proved by the thermometer to rise several degrees above what it is in their quiet and healthy state. Now, we should probably be inclined to adopt measures for the relief of this symptom, if it were only for the purpose of freeing the patient from the uncomfortable state in which he is placed by it; but there is another and a still more important reason for doing so. Heat promotes every process going on in the system, and the process of inflammation amongst the rest; therefore, inasmuch as we lower the temperature of the inflamed parts by covering them with linen wetted with cold water, or a cold evaporating lotion, we are doing what will have a beneficial effect in checking inflammation. One drachm of the liquor plumbi acetatis and a pint of water, with about two ounces of camphorated spirit, make a very good lotion for ordinary cases. In some instances, the liquor ammoniæ acetatis, diluted with water, to which a little camphorated spirit is added, may be employed; but whenever the surface is excoriated or ulcerated, the more simple the lotion is the better.

The great principle in view is *to keep up evaporation from the surface of the parts affected*, whereby their temperature will be reduced, and the inflammation checked; but, in order to carry this principle fully into practice, we must wet the linen frequently, and not let it become dry, hard, and stiff, in which state it would have no effect as a means of carrying off the heat, and be more likely to do harm than good.

For the purpose of maintaining the operation of cold and moisture uninterruptedly, the French frequently have recourse to what is termed *irrigation*. A bucket, containing cold water, is slung to the top of the bed, and from a stop-cock the water falls in drops on the inflamed part, which is left uncovered. The water is collected in a sheet of oiled calico, and runs from it into another bucket placed near the patient's bed. A more convenient plan is that of placing the limb in a trough, and after some lint has been laid on the inflamed part, conducting the water to it from a basin by means of a strip of woollen cloth, one end of which is placed in the water, and the other cut into a pointed shape, put on the lint, as recommended by Dr. Macartney. Irrigation is more suitable for the hot months of summer than the winter season. In many cases, however, cold applications fail to afford relief, and *warm moist applications* prove more beneficial. Cold applications are useful on the principle of evaporation, by which the heat of the inflamed part is carried off; warmth and moisture may act by softening the inflamed tissues, and thus lessening tension. It seems to me, that this explanation may sometimes be correct; that it brings with it an appearance of probability, especially where the parts affected are near the surface. Be the theory, however, correct or not, the fact that *warm moist applications frequently answer better than cold ones* is perfectly ascertained. Numerous cases of inflamed breast or testicle are much more benefited by warm emollient poultices than cold lotions. I may also observe, that those inflammations which arise during fevers, and the generality of whitlows, boils, carbuncles, and inflammations about the anus, receive greater relief from warm moist applications than from cold lotions. The warm applications in common use are *poultices* and *fomentations*. One of the most convenient emollient poultices is that composed of linseed meal,

made by first putting the requisite quantity of warm water in a basin, and then adding the linseed meal very gradually, at the same time that they are blended together with a spoon. We proceed in this manner until we have added as much linseed meal as makes the poultice of the desirable consistence. After the poultice has been spread on linen or tow, a little salad oil is sometimes put on it; but, if the poultice be changed at least twice a day, as ought always to be done, the oil may be dispensed with.

The size of the poultice must generally depend upon the extent of the inflammation, though there are cases in which the weight of a large thick poultice cannot be endured. Then lint, or linen wetted with tepid water, may be laid on the part, and covered with oiled silk to keep it from becoming dry.

Whenever we put a poultice upon an inflamed part, we ought to be sure to let it be so placed that it will not slip about, a condition in which it is not likely to afford any benefit.

In the most exquisitely tender kinds of inflammation, a poultice made of bread and water, bread and milk, or bread first steeped in warm water, and then medicated with the diluted liquor plumbi acetatis, or a watery solution of the extract of opium, or hyosciamus, will generally agree better than a linseed poultice. This is often exemplified where the parts affected are not only highly inflamed and full of nerves, but in an irritable, excoriated, or ulcerated state.

With regard to *fomentations*, they are frequently employed in the same cases as emollient poultices, the opportunities of applying them being the periods of changing the latter. A good fomenting liquor is made by boiling half a pound of camomile flowers or poppy heads for twenty minutes in a gallon and a half of water; the liquor may then be strained, and flannels or cloths wrung out of it, and put on the parts as warm as can be conveniently borne.

When the inflamed part can be conveniently immersed in the fomenting liquor or warm water, this is often the best way of fomenting it, that which is accomplished with the least disturbance of it. When inflammation is situated about the anus or perinæum, the patient may sit over a bidet filled with warm water, the steam of which will often afford great relief.

For inflammation about the abdomen, the neck of the bladder, and prostate gland, the slipper and hip baths are in common use.

With respect to the *choice of cold or warm applications*, there is one rule, which we may always safely follow when any doubt exists about the superiority of one plan to the other; viz., that of letting the patient's own feelings decide, for if he be rendered more easy and comfortable by one application than the other, we shall never do wrong in giving it the preference.

Another powerful means of checking and subduing inflammation is *counter-irritation*, which seems to be useful on the principle of exciting *an inflammatory action in the skin*, either in the vicinity of the inflamed part, or on some portion of the surface of the body with which the inflamed part is known to sympathise. Here one inflammation is established for the relief of another, and in proportion as the new is excited, the original and more dangerous inflammation declines. It is an illustration of what the old practitioners used to term *derivation* or *revulsion*, or the turning of the blood or fluids away from the part affected to some neighbouring or distant part. However, we should be upon our guard

against producing counter-irritation too near an inflamed part, more especially while the inflammation is in the acute stage, because, if a proper distance be not observed, the two inflammations are liable to conjoin, and render the disease worse instead of better. Thus, when the eye is inflamed, it is frequently more advantageous to blister the nape of the neck than the temple, where the anterior part of the blistered surface may approach too near the eyelids, and even make them inflame. The nape of the neck is sometimes preferred also on another principle, as being a part of the surface of the body, between which and the eyes a strong sympathy is known to prevail.

But the means, employed to excite counter-irritation, frequently operate at the same time on another principle. They do not merely produce an irritation of parts in the vicinity of those which are inflamed, or an irritation of parts at a distance from the latter, but connected with them by sympathy; they not only act in determining the blood away from the parts affected on this principle; but some of them, like blisters, bring about a great deal of their good effects by occasioning a copious discharge of serum from the vessels of the surface to which they are applied. After the cuticle has been removed, a discharge of pus may also be kept up from the surface of the cutis, if necessary, with savine ointment.

We should not be too hasty in having recourse to counter-irritation; for if we do so in the treatment of acute inflammation, without having first given the patient the benefit of bleeding and other means of depletion, the practice will rarely be of service.

There are other plans for accomplishing the same things which are aimed at with blisters; namely, the production of counter-irritation, and the maintenance of a discharge from the surface of the cutis, in order to relieve inflammation in another situation. Thus the formation of *issues* and *setons*, and the application of *antimonial ointment*, and the *moxa*, are often resorted to, especially where the inflammation is of a chronic character, or the most acute stage of it has been subdued by bleeding and other means. The antimonial ointment is composed of one drachm of tartrate of antimony blended with an ounce of lard, and, when rubbed on the skin, it has the effect of bringing out pustules, and this sometimes, not merely on the part to which the friction is applied, but in other situations, and even on the genitals.

In inflammation, which is either originally chronic, or has become so, after the cessation of its acute stage, I believe counter-irritation, united with topical bleeding, is amongst the most efficient plans which can be adopted.

When inflammation is situated in a mucous membrane, and assumes a chronic form, attended with a morbid secretion, *counter-irritation* in the neighbourhood of the original disease has frequently a most beneficial effect. Then also the application of cold astringent, or even stimulating lotions and ointments, to the surface from which the discharge comes, will often rectify the wrong action of the vessels, and bring them into a state in which they will be again qualified to produce only their healthy secretion. This fact is exemplified in gonorrhœa and purulent ophthalmies.

*Nitrate of silver* has been of late used as an external application to the skin for the relief of inflammation. For this practical fact, built upon no hypothesis or theory, we are indebted to Mr. Higginbottom, of Nottingham. The method frequently succeeds in stopping inflammation of

the fingers, which would otherwise suppurate and form witlows; also in dispersing glandular inflammations, especially those brought on by scrophula in the glands of the neck, groin, or armpit. In University College Hospital, I have often adopted this plan very successfully, for promoting the dispersion of chronic buboes. It answers likewise sometimes for checking erysipelas and the inflammation of absorbents. Duly applied over and a little beyond the pustule of small-pox, nitrate of silver prevents the sloughing, which is the occasion of the pitting sometimes so disfiguring a consequence of this disease.

Sometimes blackening the skin with the nitrate of silver will not only prevent suppuration, but occasion the absorption of matter after it is formed and can be plainly felt. In some cases, it is enough merely to blacken the cuticle; in others, vesication must be produced. The part is first to be gently washed with soap and water, and dried, then moistened with cold water, and the nitrate of silver lightly passed over it once, twice, or thrice, in common cases; but oftener, if vesication be necessary. Afterwards the skin is to be exposed to the air and kept cool.

When inflammation is either originally chronic, or has become so after the subsidence of its acute stages, one principal indication is *to promote the absorption of effused fluids, the coagulating lymph and other deposits, by which the swelling of the parts is yet maintained, and the complete restoration of their functions prevented.* For this purpose, we may have recourse to friction with mercurial, camphorated, or iodine *liniments*, or to *lotions* containing a proportion of the muriate or acetate of ammonia, with vinegar and camphorated spirit.

For the fulfilment of the same indication, a *blister* is also sometimes the most efficient application, particularly where the synovial membranes are affected with chronic inflammation, as a consequence of the acute forms of it. In obstinate cases, a discharge should be kept up with savine ointment, or the blister be renewed from time to time.

In the treatment of chronic inflammation in general, we shall find counter-irritation, the occasional use of leeches, cold astringent applications, the external employment of nitrate of silver, friction with iodine liniments, and sometimes the exhibition of mercury or iodine internally, with purgatives, amongst the best and most efficient plans, the choice of which must depend upon the particular circumstances of each individual case.

The symptomatic fever, arising from inflammation, generally requires only those curative means, which are calculated to subdue the inflammation itself. It is chiefly in nervous irritable constitutions that its violence may be disproportionate to the extent, degree, or importance of the inflammation, and then such treatment as offers the best chance of tranquillising the nervous system, must be combined with antiphlogistic measures; but, bleeding is not to be adopted with unlimited freedom.

## SUPPURATION AND ABSCESSES.

*Suppuration* is that process in the animal body, by which a fluid, termed *pus*, or the matter of wounds, ulcers, abscesses, and of all purulent discharges, is produced. It may occur in or upon any texture or surface that is furnished with blood-vessels, and consequently may take place in or upon any texture susceptible of inflammation, like which it is also so connected with an infinite number of diseases and accidental iujuries, as to form a very important elementary subject in pathology. It is sometimes described as one of the terminations of inflammation; but this language is not strictly correct, inasmuch as suppuration may be, and frequently is, accompanied by a great deal of active inflammation. One should rather say, that it is attended with some modification of the inflammatory process — some change in the symptoms, than that the inflammation ceases.

Suppuration may be a consequence of *acute* or *chronic*, of *common phlegmonous*, or of *unhealthy* or *specific* inflammations, as those characterising carbuncle, malignant pustule, phlegmonous erysipelas, syphilis, scrofula, and numerous cutaneous diseases.

Suppuration, as brought on by acute inflammation, is illustrated in every common abscess following healthy phlegmonous inflammation, all the processes and effects of which are invariably quick, so that if resolution cannot be accomplished in four or five days, suppuration may be apprehended. Specimens of abscess from acute inflammation are seen in every common whitlow; in the generality of milk abscesses; and in every abscess following gun-shot wounds, bad compound fractures, and other mechanical injuries. Certain specific inflammations are likewise productive of suppuration in the acute form, as the venereal bubo, the first stage of purulent ophthalmia, gonorrhœa, &c.

Many specific inflammations lead, however, to suppuration in its chronic shape. The generality of abscesses from scrofula are chronic; and of this nature is the lumbar abscess. Exceptions to this statement, however, are not uncommon in abscesses formed round scrofulous joints; for, though after a time they generally become chronic, they often commence with every mark of acute inflammation.

The very gradual, quiet, and almost imperceptible manner in which some chronic abscesses take place, justifies the suspicion entertained by many, and especially by M. Andral, that suppuration sometimes occurs quite unconnectedly with any inflammatory process.

Suppuration may be induced by a variety of circumstances:—

1. By the intensity and violence of inflammation. 2. By the very nature and peculiarity of the inflammation, which, whether acute or chronic, naturally leads to the formation of a puriform fluid. This is mostly the case with whitlows, and always with purulent ophthalmia, carbuncles, boils, gonorrhœa, and the indolent inflammation preceding lumbar abscess. 3. By exposure of internal cavities and tissues, continued for a certain time; as is illustrated in every wound the sides of which have not been brought together, or which, after having been so brought together, have not united. Also in every case, where the surgeon lays open the tunica vaginalis, for the removal of a collection of blood within it, forming the disease termed *hæmatocele*. 4. Suppuration necessarily attends, or at all events follows, ulceration. The fact is exemplified in the origin and progress of every sore, whether of a healthy, unhealthy,

or specific character. 5. Ulceration is not, however, essential to suppuration, which may be, and commonly is, brought on in mucous tissues by a very slight degree of inflammation, unaccompanied by ulceration, or any breach of surface. The much greater frequency of suppuration in mucous, than serous tissues, is illustrated, not only in gonorrhœa and purulent ophthalmia, but in the bronchial membrane, the lining of the pelvis of the kidney, of the ureter, and bladder, of the frontal and maxillary sinuses, and ethmoid cells. 6. Suppuration, though not frequent in parts lined by a serous membrane, is possible, as is proved in the disease termed empyema; the very case which first led to the discovery of the interesting pathological fact, that suppuration may happen without ulceration, or any dissolution or loss of the solids. It would seem, however, from modern investigations, that, when the surface of a serous membrane is about to suppurate, it first becomes covered with a layer of fibrine, in which many new vessels are developed, often preparatory to the formation of granulations. Dr. Macartney not only joins in this doctrine, but questions, whether, in any instance, the surfaces of the cellular, synovial, serous, and medullary membranes, the pia mater, or periosteum, can furnish genuine pus, *without the deposition and organisation of some coagulable lymph.* 7. Another frequent cause of suppuration is a considerable injury of textures by the application of great degrees of mechanical violence; as seen in contusions, compound fractures and dislocations, and in gun-shot and other wounds, attended with a great deal of contusion and laceration. 8. Foreign bodies, or extraneous substances, and irritating fluids lodged in the cellular tissue, are very frequently exciting causes of suppuration. Diseased or dead bone, or osseous fragments, quite detached, are to be viewed in the light of foreign bodies.

An *abscess* strictly signifies a collection of purulent matter in the substance or tissue of an organ, or part of the body. Frequently the matter of an abscess is contained in an orbicular cavity lined by a cyst; but sometimes it burrows into the adjacent textures, producing what are termed sinuses, or long narrow channels, which, if they open through the skin, or into a cavity lined by a mucous membrane, and continue without any disposition to heal, are termed *fistulæ.* When the pus is poured out from the surface of a wound, ulcer, or inflamed mucous membrane, and the matter does not collect in the tissue of the part, instead of saying there is an *abscess,* surgeons say there is a *discharge,* or simply *suppuration.* Sometimes, from there being no cyst, pus is *infiltrated* into the meshes of the cellular tissue, as the serum is in œdema or anasarca. This infiltration of pus is more commonly observed in the lungs than a circumscribed abscess. Very often pus is *diffused* over the surface upon which it is formed, as exemplified in peritonitis. "But, even in this case, the space containing the pus is sometimes circumscribed by adhesions of adjacent portions of the peritoneum; the pus may at length point externally, or make its way into the intestine or the vagina. In the first case, the abscess may be opened without the risk of exposing the general cavity of the peritoneum. This event (says Dr. M. Hall) I have seen repeatedly after parturition and abortion."* A collection of purulent matter in the cavity of the pleura is termed *empyema.*

It is in the centre of the inflamed part that pus usually begins to be

* Principles of Medicine, p. 12.

deposited, the texture seeming first to become in some manner or another softened, or, at all events, to be partially deprived of its power of cohesion. The formation of an abscess is often preceded by chills, or one or more fits of shivering, termed *rigor*. The probability of suppuration may often be foreseen by the violence of the inflammation and the quickness of its course; and just before matter forms, the pain, throbbing, tension, swelling, and febrile disturbance (supposing the inflammation to be extensive or severe enough to excite fever) all undergo an increase. As external inflammation of the acute kind advances to suppuration, the skin becomes of a deeper red colour, smooth, and glossy. A sense of throbbing and weight in the part continues after the matter is formed, and one portion of the swelling begins to rise or project beyond the rest of it, in a conical form, presenting a paler appearance, or even a light yellowish colour, with a gloss and even a degree of transparency about it, permitting the purulent matter after a time to be plainly discerned. This conical projection, which is termed the *pointing* of the abscess, is attended with a very thin state of the skin in the situation of it, and at length the matter arrives immediately beneath the cuticle, which breaks and permits the contents of the abscess to be discharged. The pointing and bursting of abscesses occur with more or less quickness, in porportion as the inflammation is more or less acute. A phlegmonous abscess will often point and burst in the course of a week, while a chronic one may not do so till several months, or even a longer period, have elapsed. In proportion as pus advances to the surface, the textures, intervening between the cavity of the abscess and the cuticle, are removed by absorption. In general, before an abscess points, a *fluctuation* may be felt in the swelling, one of the surest signs that it contains pus, inasmuch as a true fluctuation can only exist where fluid is present. In many instances, it is distinguishable even when the purulent matter lies at a considerable depth, covered by a great thickness of textures, and unaccompanied by any pointing of the abscess.

Dr. Macartney is satisfied, that the alleviation of the pain of an abscess after perfect suppuration has taken place, is not because the inflammation has terminated, but arises entirely from the change effected in the structure of the part, by which the tension is relieved, the walls of the cavity being rendered thinner by absorption, and thereby the pus better accommodated.

The knowledge of the right manner of examining a tumour suspected to contain matter, so as to have the best chance of distinguishing a fluctuation, is of the highest importance in practice; and here the skill does not consist in pressing each side of the swelling alternately, but in placing two or three fingers on one side of it, and while they are so applied, in tapping briskly on the opposite side with the fingers of the other hand.

The fluctuation will be more or less distinct in proportion to the thinness or thickness of the parts intervening between the abscess and the surface. The thickness or thinness of the pus, too, will materially affect the distinctness of the feel of fluid. When, in consequence of the thin state of the skin, there is a manifest tendency in the abscess to point, the fingers of one hand should be applied to this thinner part of the integuments, while another part is gently tapped with the fingers of the other hand. Thus, the fluctuation will assuredly be rendered perceptible; but the pointing alone, or even the inclination to it, is generally a sufficient indication of the nature of the swelling.

Great mistakes are continually occurring from inattention to the proper method of conducting the manual examination of tumours suspected to

contain pus or other fluids; yet, it must be acknowledged, that some cases are attended with such obscurity as perplexes the most skilful. There is hardly any museum where specimens of medullary cancer are not to be found, into which a trocar or lancet had been introduced on the supposition of the tumours containing fluid. The softness and elasticity of that disease convey a sensation very like what arises from the presence of pus or a serous fluid. In order to avoid mistake, the mere manual examination of a tumour will not always be sufficient; the history of the case must be particularly investigated; every symptom minutely weighed; in what respect the disease resembles others; in what points it differs from them, should be well considered; and then the information, deduced from such reflections, should be joined with that derived from a skilful manual examination of the part. Thus a correct diagnosis may generally be formed.

Deeply-seated abscesses, and those formed beneath unyielding fibrous tissues, fasciæ, aponeuroses, &c. do not readily point. However, even under these circumstances, and when suppuration takes place still further from the surface, so that we cannot feel a fluctuation, we shall have reason to suspect what has happened, if, after a great deal of suffering and symptomatic fever, a kind of crisis should be manifested by an attack of shivering, followed by a subsidence or a modification of the constitutional disturbance, and a sense of weight and coldness in the part, or of uneasiness and numbness, instead of the acute pain previously experienced. This suspicion will be corroborated, if the patient afterwards have nocturnal sweats, emaciation, a small quick pulse, and other hectic symptoms, nor referable to any other cause. *Shiverings* or *rigors* more frequently precede deep-seated suppuration, than the formation of an abscess, near the surface. An œdematous swelling of the integuments over a deep abscess is another change affording light to the practitioner: and so, in particular examples, is the mechanical effect of the pressure of the matter, there being often an interruption of function from this cause, as must happen whenever the collected matter makes pressure on the brain, neck of the bladder, urethra, œsophagus, trachea, &c.

In many constitutions, especially those called scrofulous, a trivial increase in the action of the vessels may be followed by the formation of matter; and the appearance of an abscess is sometimes the first indication that such increased action must have existed, the patient having experienced but little, or even no previous uneasiness, or disturbance, in the part. These slow and indolent formations of matter are very different from others preceded by acute inflammation. The latter, just before they occur, are always attended with an aggravation of all the symptoms, both local and general, an augmentation of pain, excessive throbbing, heat, and tension, &c., all which effects, however, undergo a modification as soon as suppuration is completely established.

The *pointing of abscesses*, which arises from the approach of matter to the surface, must be preceded by a gradual absorption of the parts intervening between the matter and the skin. In this direction, then, the process is quite the reverse of that by which the boundary of the abscess is determined in other directions, where the adhesive inflammation has the effect of closing the cells of the cellular tissue, and consolidating the textures around the purulent fluid.

After the pus has made its way through the cutis, its discharge may for a time be prevented by thickness of the cuticle, which becomes separated from the cutis by the purulent matter under it. This detachment of the cuticle may proceed to a considerable extent; but, at length, the

cuticle bursts, and then the matter escapes. The bursting of the abscess and the partial discharge of the matter, resulting from a spontaneous opening, give great relief, by diminishing the tension of the part, and removing the pressure of the pus. As the matter continues to be secreted, however, the discharge generally continues, and the opening itself may become larger than at first. If the case proceed favourably, the cavity of the abscess gradually diminishes; the adhesive inflammation and the granulating process ensue; and, as soon as the hollow is obliterated, suppuration ceases, and the opening, being no longer necessary for the evacuation of the pus, heals up.

If, however, from the nature of the disease, or the presence of dead or diseased bone, the lodgment of foreign bodies, or from the disturbance of the part caused by its situation or function, or from the difficulty with which the matter escapes, suppuration is kept up for some considerable time, the opening loses its disposition to close, and the passage, with which it communicates, assuming a chronic state, is termed a *fistula*, or *sinus*, though the term *sinus* is sometimes restricted to the passage, which the matter, when it cannot readily get to the surface, burrows for itself in the cellular tissue. We hear a great deal about *fistulæ in ano:* now the reason of their frequent occurrence here is owing partly to the disturbance of the disease by the action of the sphincter ani, and partly to the matter not having a direct and sufficiently ready outlet, and only partially escaping, at intervals, through a long, narrow, and often a tortuous course.

### QUALITIES OF PUS.

The fluid, discharged from simple or phlegmonous abscesses, or from common wounds or ulcers which are in a healing state, is termed *healthy* or *good pus*, which is of a light yellowish colour, often presenting a tinge of green in it, and being nearly of the same consistence as cream. Being heavier than water, it sinks in this fluid; but, if they are shaken up together, the water retains a turbid appearance. Examined with a microscope, pus is found to consist of opaque, light yellow globules, and a clear transparent albuminous fluid. The globules were believed by the late Dr. Pearson to consist of those of the blood, deprived of their natural colour from some change effected in them by the process of suppuration itself, or that action by which they become separated from the circulation. Dr. T. Young's investigations tended to strengthen this doctrine, for he was led to the conclusion, that they really corresponded in size to those of the blood, and were all of the same dimensions, a character which the globules of milk and chyle are alleged not to possess. M. Gendrin believed them to be the globules of the blood, somewhat enlarged, and altered in shape; but, Dr. Hodgkin is of opinion, that they have no resemblance to the latter, inasmuch as they are irregular both in shape and size.* Yet, in noticing the slower motion of the blood as it approaches the dilated capillaries, and in describing the beginning of suppuration, M. Gendrin states, that the globules of the blood gradually lose their colour as they advance, and become globules of pus: and the blood thus changed seemed to him to exude very slowly in the form of pus. Healthy pus is a bland, opaque, inodorous fluid, without any acrid or corrosive

* According to Mr. Gulliver, the pus-globule is composed of central molecules, connected together by a substance which surrounds them, and is analogous to fibrin. The molecules themselves are found by him to differ from any part of the human blood-corpuscle in their form, density, indisposition to putrefaction, and complete insolubility in acetic acid.

properties. When pus is discharged, however, from various ill-conditioned sores, abscesses, or diseased surfaces, or from certain varieties of specific disease, or from parts where it is blended with urine or extravasated blood, or when it issues from a part where a portion of dead or carious bone is lodged, its smell is highly offensive, and its qualities acrid, irritating, and even contagious. The presence of dead bone is often foretold by the peculiar smell of the discharge, with which is found to be blended a quantity of phosphate and muriate of lime. The matter of gonorrhœa has a smell unlike that of pus discharged from other diseases, and that of cancer is so different, perhaps so much more disgusting, than the discharge from any other ulcer, that the presence of a patient with cancer is known to us as soon as we enter his ward. The fluid part of pus is coagulable by heat and the muriate of ammonia, a point in which it differs from the serum of the blood; also by alcohol and acids. Triturated with potash or soda, it forms a soapy fluid, and with ammonia a transparent jelly. When exposed to galvanism, it coagulates with rapidity, and yields a substance like albumen.

Pus contains not only albumen, but fibrine, and it is partly upon these two facts, and its globular appearance, that is founded the inference of its derivation from the blood. In the transparent gelatinous fluid, poured out upon the surface of a wound or an inflamed serous membrane, no globules can at first be seen; but if the part be excluded from the air with a glass, they begin to be perceptible in about a quarter of an hour.

The qualities of pus are diversified according to the nature of the disease that produces it. The matter of an irritable ulcer is thin, and adulterated with an admixture of blood, such kind of discharge being often termed *sanies* or *ichor*. Its peculiarity is, that it contains more salts and albumen in solution than ordinary pus, the clear part becoming turbid when an acid is added, by which the soda, holding the excess of albumen in solution, is neutralised. The matter of phlegmonous abscesses is not like that of a cancerous sore; and that of scrofulous abscesses is different again. In the latter, flakes of fibrine and albumen are blended with a limpid fluid, which contains a large proportion of soda and its muriate.

In some diseases of very different kinds, the mere appearance of pus is nearly the same. The matter of a phlegmonous abscess and that of a venereal bubo are not distinguishable from each other by their look, but only by the differences of their effects on the animal economy. The matter of gonorrhœa, that of the small pox pustule, and that of chicken pox, may present exactly the same appearance to the eye; yet, when applied to a mucous membrane, or the skin, the very different and peculiar effects, resulting from them, mark their extraordinary differences.

The former anxiety to discover a test between mucous and purulent secretions has in a great measure subsided. The old pathologists looked upon pus as a certain proof of ulceration, and consequently when it was expectorated, the lungs were presumed to be in an ulcerated state, and the patient's chance of recovery hopeless. It is now, however, perfectly well known, that pus may be formed by the cutaneous, mucous, and serous textures without any ulceration at all.

### THEORY OF SUPPURATION.

This is a subject, on which different opinions are entertained by different pathologists; some regarding suppuration as a process similar to that of secretion; one, in which the formation of pus is brought about by a particular action of the capillary vessels; while others seem equally

convinced, that pus is merely a transformation of coagulating lymph after it has quitted the vessels, together with some change in the colour, and perhaps in the size and shape of the globules of the blood, either in their transit through the capillary system of the inflamed part, or subsequently to their extravasation. It is observed by M. Gendrin, that all textures are naturally pervaded by a very limpid fluid, which never coagulates spontaneously, though coagulable by alcohol, heat, or weak acids; and that consequently such fluid, which is of an albuminous quality, is not materially different from the serum of the blood. In the meshes of all inflamed textures a similar fluid is deposited; but as soon as the inflammation has attained a certain degree, there is deposited, in addition to the serous fluid, another fluid, which, on account of its fibrinous nature, has the property of coagulating spontaneously. If the inflammation be intense, this spontaneously coagulating substance is of a red colour, or even blood itself; for, in the centre of the inflammation, there may be small clots of blood, and around them a gelatinous and liquid serum.

In a texture that has been for some time inflamed, and is now suppurating, the spontaneously coagulating fluid, fibrine, or lymph, is still noticed at the limits of the inflammation, and with the microscope the peculiar globules of pus may also be recognised in the interstices of the inflamed texture. At the points also, where the infiltration of lymph begins to assume a puriform appearance, true globules of pus may be seen, mixed with those of the blood, which have been only in part deprived of their colouring matter by stagnation, and still present a reddish grey hue.*

In acute abscesses, some of the small vessels seem, to Dr. Macartney, always to give way in the first instance, and blood and serum to be poured out into the surrounding tissue. "In order to separate the disorganised from the healthy structure, lymph is shed, by which the extravasation of blood and serum is restricted within certain limits. This lymph next acquires regularity and organisation, and then, *and not before*, the *secretion* of pus commences." (p. 30.)

The formation of pus would seem to be a consequence of some modification of the blood, as manifested by a change taking place in the colour, transparency, and size of the globules, after its circulation has been arrested in the minute vessels by inflammation. It would seem also that this change usually takes place in the capillary vessels, and that these conduct the globules to the exterior, where they appear to be combined with the serum, under a peculiar liquid form called *pus*.

This is one mode in which pus is formed, a mode compared to the process of secretion; but, it is suspected, that pus may also be formed in the blood, under circumstances in which the influence of the capillary system, as exercising a function of secretion, can take no part. In phlebitis, the conversion of blood into pus, independently of any action of the capillary vessels, is manifest. First, there is a cord-like hardness of the vessel; and then a softness of it, from the coagulated blood having become pus. Here the coagulated blood could not have passed into the circulation; and, as Professor Carswell notices, three remarkable circumstances are constantly observed. 1. Cessation of circulation; 2. Coagulation of the blood; 3. Conversion of the fibrine and globular part of the blood into pus. Inflammation is the common origin of these changes.

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* Gendrin, "Hist. Anat. des Inflammations." "In the first steps towards the formation of an abscess, before the parts are made solid by coagulable lymph, blood is commonly extravasated."—*Macartney, op. cit.* p. 24.

If, also, pus is sometimes met with simply as a foreign body in the blood, where inflammation can have had no share in its production, and in various parts, unaccompanied by the usual characters of inflammation, there can be no doubt of the propriety of adopting the distinction, suggested by Professor Carswell, between the *mere presence of pus* and *suppuration*. This view will lead us to regard the *production of pus* as not restricted to the effect of any process in the capillary vessels induced by inflammation, and to the subsequent separation of the elements of this fluid from the blood. As for *suppuration* itself, this may be essentially dependent on inflammation.*

The hypothesis of the transformation of coagulating lymph or fibrine into pus, independently of the action of the vessels, or of any vital influence of the inflamed parts, would not apply to many examples. By means of it, I think that it would be impossible to account for the great varieties observed in the qualities of pus in the different forms of inflammation, and especially for its specific properties in certain diseases. The vital influence of the vessels, their particular mode of action, must undoubtedly be concerned. It seems to me also, that any attempt to explain the formation of pus from mucous membranes, on this principle, would completely fail. The mucous secretion appears, indeed, to be readily changed into one of a purulent kind; no lymph is separately and primarily effused at all; and generally, in certain stages of the inflammation, the discharge is really a mixture of mucus and pus together.

Amongst the arguments, in support of the doctrine that pus is formed by an action of the vessels analogous to that of the process of secretion, the following merit particular consideration. Suppuration is influenced by many circumstances, which are well known to affect the secretions in general. An ulcer, while pouring out a white, thick, healthy matter happens to become suddenly irritated and inflamed; the discharge is immediately diminished, and degenerates into a scanty, thin, reddish ichor. This fact agrees with the effect of inflammation in lessening and otherwise altering the natural secretions of all organs, which happen to be the seat of it. Who does not know that the quantity and quality of the discharge from a wound, ulcer, or abscess, are often suddenly changed by mental emotion, by an attack of fever, by the state of the digestive functions, and by the diminution or increase of other secretions? Dr. Macartney has seen the influence of fever exemplified on the process of suppuration, in ulcers and in acute abscesses; and, "on one occasion," says he, "I knew the discharge of gonorrhœa to be entirely suppressed during the fever from measles, and afterwards to return when the fever abated." What experienced surgeon is unaware that the nature of purulent discharges is frequently changed by the influence of the nervous actions in the system, by some organic or functional disorder in other parts of the body, with which the suppurating parts have no direct connexion either of function or structure? Nor is this all the argument in favour of suppuration being a process analogous to that of secretion; for, whether one kind of pus is to be produced or another, often seems to depend upon the particular constitutions of individuals, — upon peculiarities in their whole organisation. Thus, in scorbutic patients, the discharge is always a thin, ichorous fluid, more or less blended with blood;

* See Carswell's "Elementary Forms of Disease," Fasciculus 5.

in scrofulous subjects, liquid albumen, with clots of fibrine floating in it, and an admixture of soda and its muriate.

The formation of pus from the surface of the cutis, or a mucous membrane, free from ulceration, may be received as a satisfactory proof that pus may be produced without any dissolution of the solids. This fact attracted the notice of several eminent men about the middle of the last century, especially of Dr. W. Hunter, La Peyronie, De Haen, Quesnay, and Morgagni. In examining the chest of a person, who had died of empyema, or an accumulation of purulent fluid in the cavity of the pleura, Dr. Hunter observed, that every point of this serous membrane was entirely free from ulceration; and La Peyronie, on opening the head of a person who had had a long and profuse discharge of pus from the cavity of the skull previously to death, inferred, from the trivial proportion of brain wanting, in comparison with the immense quantity of matter which had been voided, that the pus must have been formed by the vessels, and not by any dissolution of the solids. But, although this doctrine prevails extensively at the present time, and seems to rest upon a good foundation, the question whether a partial dissolution of textures ever accompanies suppuration is another point. The microscopical researches of Kaltenbrunner tend to prove, not only that the blood, which passes into the inflamed texture, but also a portion of the solids, is converted into pus. We know, that just before purulent matter is formed in the substance of parts, there is a softening, a loosened state of their textures, more particularly in the situation where the pus is first produced, or about the centre of the inflammation. Perhaps a portion of the softened textures may sometimes be blended with the matter; but then it would only be an accidental addition, and not by any means a constant and essential occurrence in the process of suppuration. A few years ago, there was a girl in St. Bartholomew's Hospital for an abscess of the hip. An opening having been made, a mixture of well-formed pus and of an oily fluid was discharged, followed by a considerable lump of adipous substance. Here, no doubt, the fatty matter was only an accidental addition, and not mixed with the purulent matter, as an essential part of it. The matter discharged from some abscesses of the liver, is remarked to have a brownish colour, and hence the suspicion, that portions of that organ may be dissolved and blended with the pus; but whether this is the fact, or whether the matter may derive its peculiar colour from the bile, are points not at present determined.

The following is Dr. Macartney's view of this part of the subject. "In some abscesses (he observes), as those of the liver, spleen, and brain, we sometimes see with the naked eye the lacerated vessels; and, in the first, I have observed the biliary vessels also to be broken, and the bile mixed with the blood, contained in the cavity of the abscess." (*Op. cit.* p. 24.)

Although there is no texture (if the cuticle, the nails, and the hair be excepted) which does not occasionally become inflamed, yet an *abscess*, strictly so named, cannot form in every tissue. For instance, it cannot take place in the dense fabric of fibrous and cartilaginous textures, nor in that of serous membranes. When pus is formed by these tissues, it is effused either upon their surfaces or into the cavities which they invest; but an abscess never forms in their proper substance. On a serous membrane also, the formation of pus is preceded by an effusion of lymph, and, I believe, also by the development of vessels in it, — another consideration in support of the doctrine, that pus is not simply a transform-

ation of such lymph itself, but a fluid, in the production of which the action of the vessels is concerned.

Pus has sometimes been found in the centre of clots of blood in the heart, or large vessels. In the museum of University College is a heart, the right ventricle of which contained a coagulum, within which pus was observed. According to Andral's account, such facts have been noticed, not only in cases where, before death, there had been suppuration going on in other parts of the body, but likewise in other instances where no such condition could be traced. The latter consideration has of course been adduced as an argument in favour of the doctrine, that a coagulum has the power of forming pus within itself. With reference to this part of the subject, it deserves attention, however, that where pus has presented itself simply as a foreign body in the blood, Professor Carswell has invariably found suppuration coexisting in some organ or texture; and, in the contrary cases, as referred by M. Andral, he suspects that the fluid was not pure pus. If such be the origin of some puriform deposits in the blood, they come under the head of *suppuration*, the pus having found its way into the blood from the part where the suppurative process is going on. In such cases, the pus is mostly found in the veins; arteries do not contain it, and, except in uterine phlebitis, Professor Carswell has never seen pus to any great extent in the lymphatics.*

Although suppuration is commonly preceded by inflammation, yet some collections of purulent matter are now and then met with in the dead subject, the existence of which was never denoted by any symptom of inflammation during life, while, in the dead body itself, there are no vestiges of inflammation around the purulent deposit. The colour, consistence, and thickness of the textures are unchanged. The pus, as Andral states, is interposed between their constituent particles, and this is all that can be discovered. On the other hand, Dr. Macartney concurs with those pathologists who believe, that some degree of inflammation is always coexistent with the process of suppuration.

The interior of an abscess appears to be both a secreting and an absorbing surface. Thus, when the pus has been discharged, the cavity soon becomes filled with purulent matter again; and sometimes abscesses, the matter of which is very palpable, completely subside and are dispersed. Purulent fluid is sometimes detected in the absorbent vessels in the vicinity of abscesses. The complete dispersion of buboes, by absorption, after the formation of matter in them, is a frequent occurrence; and the same fact is often exemplified in chronic abscesses. Dr. Macartney has known this happen several times in psoas abscess unattended with disease of the vertebræ (p. 33.); and a similar result I have also sometimes witnessed. Such facts can only be accounted for on the principle of the lining of an abscess being both a secreting and an absorbing surface. When, indeed, the abscess has existed some time, the matter is contained in what deserves, on every account, to be called a cyst, the consistence and texture of which give it very much the character of a mucous membrane. Fistulæ and sinuses are invested by a similar structure.

Purulent matter, formed in the textures of the body, generally has a tendency to make its way to the surface, and to be ultimately discharged in this direction. John Hunter regarded this as an established principle

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* See Carswell's "Elementary Forms of Disease," Fasciculus 5.

in the animal economy, the usefulness of which in promoting the cure of many diseases is sufficiently manifest. Abscesses will make their way through a considerable thickness of parts to reach the skin, and this even when merely a delicate serous membrane intervenes between the purulent matter and the cavity of the chest or belly. In fact, such membrane, instead of giving way under these circumstances, usually becomes thickened and strengthened.

There is one peculiarity in the course taken by pus, which may at first seem rather at variauce with the principle that abscesses have a tendency to make their way to the surface: I allude to a certain disposition in some abscesses to burst into any neighbouring cavity, or duct, lined by a mucous membrane. Thus abscesses near the urethra frequently pass into that canal; abscesses near the rectum commonly discharge themselves into that intestine; and abscesses of the liver frequently burst into the duodenum or colon. In these instances, I think, we may discern the same kind of reason for the direction which the matter takes, when so situated, as is plainly manifested when the pus passes towards the external surface of the body; namely, the pus, by passing into a contiguous canal, passage, or bowel, lined by a mucous membrane, is often taking in reality the most direct course to find an outlet from the system.

Nothing forms a greater impediment to the passage of matter towards the skin, than the interposition of a dense fascia. Then the pus is apt to spread extensively under the fascia and between the muscles, causing sinuses, and an extent of mischief seriously interfering with a prompt cure.

### TREATMENT OF ABSCESSES.

In every instance of abscess, attended with acute inflammation, one plain indication presents itself, viz. that of lessening the inflammation which has given rise to the formation of matter, and which is still going on in the surrounding parts. Suppuration is not a termination of inflammation, but only a modification of it; a change, in which the increased action of the vessels is altered, not stopped. Indeed, that the parts around the abscess are often severely inflamed, is a fact completely manifest to the eye. Whether the swelling has suppurated or not, inflammation is still present; its degree may differ in different cases; but the reality of its existence must not be overlooked in practice. A different view, however, must be taken of an abscess which has existed some time, which has perhaps been burst for several days, and which may be said to have lost its acute character. In stating, then, that the tissues immediately around an abscess are more or less inflamed, I am particularly referring to the early stages of suppuration, as a consequence of acute or phlegmonous inflammation.

After matter has been formed, it may not always indeed be necessary to have recourse to measures which will seriously reduce the strength of the system; it may not always be right to bleed the patient again in the arm, or to restrict him to quite so low a diet as that to which he may previously have been confined; yet other general means, calculated to check inflammation, and in particular mild saline purgatives, and abstinence from all external and internal stimuli, and from every thing likely to quicken the circulation, or to disturb the mind or body, or the suppurating part itself, must still be proper. Also, while the parts around the abscess continue painful, red, tense, and hot, and the patient is not

too much reduced, the application, and even the repetition, of leeches will be beneficial.

When no chance remains of acute inflammation ending in resolution, it is a common and a good rule to discontinue cold applications, and substitute warm ones. These last will materially soothe the pain, abate the violence of the inflammation, and accelerate the arrival of that stage, in which the matter will either make its way out, or be in a fit state to be discharged. Such applications, together with leeches, mild aperient medicines, a lowish diet, opium, if the suffering be great, and keeping the part at rest, will constitute the most useful practice. By conducting the treatment of the early stage of phlegmonous or other acute abscesses on the principles of a moderate antiphlogistic plan, matter already deposited may sometimes be dispersed, when, without such practice, no chance of this success would exist.

Another general indication is to remove all sources of irritation, — every thing that is exciting or keeping up the inflammation and suppuration. Thus, when abscesses in the perinæum, or about the neck of the bladder, originate from the effects of a stricture in the urethra, or when an abscess is produced by the irritation of a foreign body — the presence of dead bone, &c., the removal of the exciting cause is an essential part of the surgeon's duty.

When an abscess is completely formed, and the accumulation of matter in the part is denoted by the fluctuation, pointing, and other circumstances already explained, it is a common rule in surgery to free the part without delay from the matter collected in it. After purulent matter has been formed, and become confined in the part, its very pressure is a cause of severe pain, if not of an aggravation of the inflammation itself. I can conceive, that the discharge of the contents of the abscess not only alleviates pain by removing pressure and tension, but is also importantly useful in putting an end to these causes of inflammation. If an abscess be small, and making quick progress to the surface, with pointing, and a thin state of the skin, denoting that it will soon burst, whether a puncture be made or not, is a consideration of little importance; for here no risk prevails of the patient's suffering being long protracted, or of the matter accumulating or spreading to any extent. It is not often that abscesses from acute inflammation are dispersed; they generally come forward, and every attempt to prevent it, for the most part, only retards the cure. Perhaps we might have prevented matter from forming at all by suitable treatment in the earlier stage of inflammation; but, the abscess being already formed, its absorption is what cannot usually be expected. However, certain abscesses, rapidly formed in a very reduced state of the constitution, and without much inflammation, generally have a greater tendency than others to be dispersed, because, under these circumstances, the whole absorbent system is actively at work; and then, if the kidneys, the mucous membrane of the bronchial tubes, or the bowels, or the vessels of the skin, be excited to augment their respective secretions, the pus collected in some other part, and especially that collected in or about absorbent glands, will sometimes be dispersed. When patients are using mercury, kept perfectly quiet, and the integuments touched with the nitrate of silver, buboes, containing an ounce or two of matter, occasionally subside. Perhaps these last cases furnish the most frequent instances of the fact under consideration. The remains of large lumbar abscesses are also sometimes dispersed by absorption; and the effect of the nitrate of silver on whitlows and on scrofulous abscesses about the

neck, is also an exemplification of the possibility of bringing about the removal of pus by the action of the absorbents.

All surgeons agree about the propriety of opening abscesses under the following circumstances, as soon as a fluctuation can be felt, or even sooner, if there be other symptoms leaving no doubt of matter being formed and confined.

1. Abscesses arising from the extravasation of stimulating fluids in the cellular tissue, as urine or fecal matter.

2. Abscesses from acute inflammation, situated in parts abounding in fat and loose cellular tissue, where sinuses are apt to follow the confinement of the pus. Examples: abscesses about the anus and rectum, groin, or armpit.

3. Abscesses under fibrous expansions, dense unyielding fasciæ, or within the sheaths of tendons. Examples: abscesses under the fascia of the thigh, leg, or fore-arm, or under the palmar or plantar fascia; deep-seated whitlows.

4. Abscesses from diseased or dead bone, or within the medullary texture or natural cavities of bones. Examples: suppuration within the antrum, diploe of the skull, or abscesses from necrosis.

5. Abscesses, attended with any risk of the matter making its way into the chest or the abdomen.

6. Abscesses under the sterno-cleido mastoid muscle, in the cellular tissue separating this muscle from the deeper parts.

7. Abscesses, whose contents produce urgent and dangerous functional disturbance by the pressure on important organs, as illustrated in abscesses near the urethra, neck of the bladder, or near the trachea, larynx, œsophagus, or about the fauces, or on the dura mater. At the request of Dr. Campbell, I visited a child in Welbeck Street, on the point of suffocation from the pressure of an abscess on the trachea, which had formed with great rapidity around the thyroid gland. The discharge of the pus afforded prompt relief.

8. Abscesses, where the matter lies close to a bone, should be opened without delay. Periostitis with suppuration is a case requiring such practice; also abscesses under the occipito-frontalis muscle.

9. The generality of chronic abscesses should be opened early, because a long while elapses before they burst of themselves, and, in the mean time, they continue to increase, and at length frequently become formidable on account of their magnitude.

Abscesses are commonly opened with a cutting instrument, which is generally preferable to caustic, as letting out the matter more expeditiously, and with less pain, occasioning no loss of substance, and consequently a smaller cicatrix, and forming the outlet for the pus in the most advantageous direction, and of the exact size required. Caustic is now and then employed, however, for opening buboes or abscesses in the groin, in order to make a larger and more permanent opening, than a mere puncture, and to destroy a portion of the diseased skin. By this means, it is conceived that the formation of sinuses is more likely to be hindered, the healing of the cavity from the bottom ensured, and an undermined state of the integuments prevented. Generally speaking, caustic is not an eligible means of opening abscesses; for its action is tedious, painful, productive of loss of substance, and disfigurement, and incapable of being regulated with any precision, so that after all a cutting instrument must sometimes be used. A seton is now and then introduced through a chronic abscess, either where the surgeon wishes the matter to escape gradually, or to excite a degree of irritation in the cavity, so as to make it granulate.

When only a small puncture is needed, a common lancet, or a sharp-pointed narrow straight bistoury, answers very well. When a larger opening is necessary, an abscess lancet, a double-edged bistoury, or any sharp-pointed scalpel, may be employed. By moving the edge of one of these instruments forward after the part has been punctured, the opening may be made of an advantageous size, with the greatest facility and quickness. In opening abscesses, situated near important organs, the surgeon may make the requisite enlargement of the first opening with a curved bistoury, guided on a director.

The best place for the puncture is generally where the fluctuation is most perceptible, or where the pointing takes place; for, here the skin is thinnest: this consideration, however, is not to make us unmindful of the advantages of a depending opening, which lets the matter readily escape, and often removes all occasion either for the enlargement of the first opening, or for the formation of a second in another place. This latter, which is termed a *counter opening*, becomes necessary when an abscess bursts at a point from which the matter cannot escape with sufficient readiness.

The size of the opening should be such as will allow the matter to escape with facility. When the matter is thick, or contains flakes of coagulated albumen, the opening should be a free one, to enable them and the pus to pass through it.

Another maxim is to maintain the opening until the cavity of the abscess is so far reduced, that another accumulation of matter is not likely to occur from the spontaneous closure of the outlet. There is sometimes an exception to this rule, with respect to large chronic abscesses, where Abernethy thought it safer, after discharging the matter, to heal the puncture at once, and afterwards repeat it when the matter had collected again. In this way, he conceived, that inflammation of the cyst of the abscess, and severe constitutional disturbance, were most likely to be avoided.

*Sinuses* are produced by the matter not readily getting to the surface, or not having an outlet made for it with due promptitude. Here the principal indication is to make an opening in such a situation and of such a size as will prevent all further lodgment of pus; for this purpose, the first opening may be enlarged, or sometimes a counter-opening made.

*Fistulæ* are disposed to occur whenever there is something at the bottom of, or in the position of the abscess, keeping up suppuration a long while, or preventing the ready escape of the matter that forms; also where the abscess is subject to continual disturbance from the action of muscles; hence one cause of *fistulæ in ano*. Fistulæ arise also from the passage of the contents of certain bowels or receptacles through the abscess, or from its having a communication with some excretory tube: hence lachrymal, salivary, and perinæal fistulæ.

In the treatment of fistulæ, the indications are to make a freer and more direct opening; to remove whatever is keeping up suppuration; to destroy any stricture or obstruction of an excretory tube, causing the urine or other fluid to pass through the fistula: and, in fistulæ in ano, to divide the sphincter, the action of which being then temporarily stopped, no longer disturbs the part and impedes the cure.

In the treatment of abscesses attended with fistulæ and sinuses, or a backwardness to heal from the pus not passing out readily enough, a position calculated to facilitate the escape of the matter from the opening, or the skilful application of a compress and bandage over the place

where the matter collects, frequently supersedes all occasion for fresh incisions.

When fistulæ and sinuses cannot be cured by attention to the foregoing principles, and they have become perfectly indolent, their course should be traced with a probe or director, and laid open with a curved bistoury. Now and then, instead of this method, a seton, or a stimulating injection is tried, but these measures are attended with uncertainty, and by no means in favour with the most judicious surgeons.

The old painful plan of squeezing out every drop of pus from an abscess that has been opened, and the practice of distending the cavity with lint, are now exploded. In fistulæ in ano, which have been divided, a piece of soft lint may be gently interposed between the sides of the wound, directly after the operation, in order to prevent the superficial part of the incision from healing sooner than the deeper part of it, the result of which might be, another confinement of matter, and a return of the fistula.

As a general rule, all acute abscesses require poultices and fomentations, not only during their formation, but for some time longer, that is, until they have burst or been opened, the swelling and surrounding inflammation have abated, and the discharge has been considerably reduced. Such applications are then to be discontinued, and common dressings and a bandage applied. In proportion as the inflammatory action subsides, the patient's diet is to be improved: and, if the discharge continue in large quantities, or repeated abscesses form, either from some mechanical injury, or structural or organic disease, it will be necessary to support the patient's strength, because a *hectic* state now comes on, one prominent feature of which is debility.

## HECTIC FEVER.

Hectic Fever is essentially characterised by a frequent weak pulse, flushings in the face, the hands, or the feet, and either profuse night sweats, or diarrhœa. The irritation of a local injury upon a healthy constitution produces that disordered state of it, termed the *symptomatic*, or *sympathetic inflammatory* fever. This is the *immediate* consequence of local irritation. The system, fatigued and debilitated by the continuance of a disease which it cannot subdue, at length loses the power of entering into those strong actions, which characterise the preceding description of fever. However, exhausted as it is, it still sympathises with the local irritation. The exciting cause is almost always some local disease, and generally a great, if not an incurable one; so that this fever seems to be a feeble and hopeless struggle of a constitution about to be overpowered, without any apparent tendency to the removal of the cause. *Hectic* fever, contrasted with the sympathetic inflammatory fever, is to be regarded as the *remote* consequence of local injury or disease.

The constitutional symptoms, which attend the formation of pus in long-continued profuse suppurations, or which arise as effects of many obstinate and incurable local diseases, even without any suppuration, are generally comprehended under the name of hectic fever. However, some writers still believe, that hectic fever is in every instance connected, if

not with the absorption, at least, with the formation of pus.* My own observations do not allow me to entertain such an opinion. How commonly do we see patients suffering considerably from hectic symptoms in cases of white swelling, diseased hip-joints, tuberculated lungs, and curvature of the spine, long before any suppuration has taken place? I should say, that the long-continued irritation of any severe local disease upon the constitution, whether accompanied with suppuration, or not, generally produces hectic symptoms. Dr. T. Young informs us, that, when he was fifteen years of age, he had himself severe hectic, and every other symptom, usually attending the formation of pulmonary tubercles, though they never arrived at the period of suppuration. And, in another place, he correctly remarks, there are cases in which a particular change in the state of the fluids, secreted by diseased parts, seems to bring on hectic symptoms, as when an abscess is opened, and the pus is exposed to the air. But, says he, this state of the fluids is not the only cause of hectic, for it often occurs, not only without an open abscess, but *without any abscess at all.* And, on the other hand, in cancerous cases, where there is a very unhealthy suppuration, with great pain, there is often no material hectic to the last.† It is true, at the same time, that hectic fever is most commonly preceded by suppuration; but the only reason of this fact probably is, that the greater number of local diseases, which come under the care of the surgeon, are in their advanced stages accompanied with ulceration or abscesses. We see that certain local diseases, which cannot be called severe, though they secrete for a long time a great deal of purulent matter, do not bring on hectic symptoms. We may keep open an issue for a year, or the urethra may discharge a good deal of pus daily for an immense length of time in tedious cases of gonorrhœa, and yet hectic fever does not arise. Suppuration alone, unless exceedingly profuse, in which circumstance it must always be the effect of a severe form of local disease, is not to be regarded as the essential cause of hectic.

Neither does the hypothesis, which ascribes the cause of this fever to the absorption of pus, appear to have a better foundation. The inside of every abscess is both a secreting and an absorbing surface, and, by the combined action of the arteries and lymphatics, the matter is incessantly undergoing changes. If then the absorption of pus were a cause of hectic symptoms, they would accompany every abscess, without exception. Yet experience teaches us, that this is far from being the case: and that abscesses continue for a very long time without the patient becoming hectic. Nay, we observe that pus, even of the worst quality, may be absorbed without producing a single hectic symptom; for we daily see the matter of phlegmonous abscesses, scrofulous suppurations, and venereal buboes, manifestly and entirely removed by the absorbents, and yet no hectic symptoms are the consequence.

Hectic fever comes on at very different periods after the commencement of any serious local disease. This is probably owing to peculiarities of constitution, or the particular structure and functions of the part, whose disease operates as a cause. The more delicate and feeble the patient naturally is, and the more severe and incurable the local disease,

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* Thomson on Inflammation, p. 326.

† A Practical and Historical Treatise on Consumptive Diseases, 8vo. 1815, p. 6. 10. 53.

the sooner do the hectic symptoms generally begin, and the more rapid is their progress. Disease of the lungs will bring on hectic fever sooner than disease of a joint.

Sometimes the first accessions of this fever are almost imperceptible; a slight degree of emaciation, a pulse a little quicker than ordinary, with a trivial increase of heat, particularly after meals, being the only early symptoms. As the fever becomes more established, the symptoms are generally of the following kind: a frequent small pulse, which quickens towards evening, but is always ten or twenty strokes in a minute faster than in health; a moist skin; pale copious urine, with sediment; a good deal of debility; the tongue seldom so much furred as in most other fevers, its edges being of a bright red colour, and the papillæ swollen and prominent; a florid, circumscribed suffusion of the cheeks; loss of appetite; sometimes an ejection of all food from the stomach; a great readiness to be thrown into sweats; profuse nocturnal perspirations; frequently a constitutional purging; repeated chills and flushes of heat; derangement of the nervous system; loss of sleep; indigestion; heartburn; flatulence. When, however, the biliary system is undisturbed, the digestive powers are little impaired, and the appetite remains good to the last. In an advanced stage, the hair falls off, and the nails become bent.

Hectic fever is more or less remittent, but never wholly intermittent. The pulse is generally from 100 to 140 in a minute; seldom falling below 100, even in the time of a remission, and, in some cases, never being under 120: while, in other constitutions, the pulse of health may be so slow that ninety strokes in a minute would be enough to indicate an exacerbation.

The principal exacerbations generally occur about five in the afternoon; and, an increase of the febrile symptoms always follows a full meal at any time of the day. The exacerbations, which are mostly preceded by chills, are marked by a sensation of burning heat in the palms of the hands, which become red and mottled, and frequently in the soles of the feet. A circumscribed redness is seen in the cheeks, the colour of which, in persons of a florid and delicate complexion, has also, during the remission, a more abrupt termination than in health. Whatever may be the form of the exacerbations in the daytime, they are generally succeeded towards the end of the night by copious sweats. When a diarrhœa supervenes in the latter stages of the disease, the sweats commonly disappear. A reddish sediment of uric acid is mostly observable in the urine after the sweats; but it is absent during the hot fit, when the urine is usually pale and limpid.

Hectic fever is divided into two kinds; viz. one, which arises from the absolute incurability of the local complaint; another, which depends upon a disease that is curable, if the patient's constitution had powers sufficient.*

### TREATMENT OF HECTIC FEVER.

The exciting cause of every disease must be removed, ere a perfect cure can be expected. If copious and long-continued suppuration give rise to that affection of the constitution denominated hectic fever, how can the febrile disturbance cease while the discharge of matter continues? If the irritation of a scrofulous joint were to excite hectic fever, we should

* See Hunter's Treatise on the Blood, Inflammation, &c., p. 497.

in vain expect to put an end to the constitutional disorder, unless the local cause were first removed. In short, as Dr. T. Young observes, the radical cure of symptomatic hectic fever can only be attempted by remedies calculated to remove the primary disease, on which it is dependent.

When the local complaint, connected with the fever, is totally incurable, the diseased part must, if possible, be removed by a manual operation. But when the local disease presents the prospect of being cured, provided the state of the constitution were improved, the surgeon is to endeavour to accomplish the latter object. Frequently, however, the nicest judgment is requisite to determine, how long it is safe to exert the power of medical surgery against the influence of an obstinate local disease on the constitution; for, although patients in an abject state of weakness, arising from irremediable local disease, have often been restored to health by the removal of the morbid part, yet many have been suffered to sink so low that no future treatment could save them.

When an incurable disease in an extremity is removed by amputation, the hectic fever immediately begins to abate. "I have known," says John Hunter, "a hectic pulse at 120 sink to 90 in a few hours, upon the removal of the hectic cause; I have known persons sleep soundly the first night, without an opiate, who had not slept tolerably for weeks before; I have known cold sweats stop immediately, as well as those called colliquative; I have known a purging stop immediately upon the removal of the hectic cause, and the urine drop its sediment."

But, though the radical cure of hectic can never be effected, unless the primary disease be cured or removed, the severity of this fever may often be palliated, and its progress retarded, by appropriate remedies. As weakness is one of the principal features of hectic fever, blood-letting is never admissible; except, perhaps, in a very few examples, where the disorder is attended with unequivocal marks of inflammation in some vital organ. For the same reason, purging must be avoided.

I am afraid no medicine has the direct power of communicating strength to the human constitution; and it is more than probable that bark itself and quinine only prove serviceable in hectic fever, by sometimes improving the tone of the digestive organs. While the patient eats and digests well, I believe, they are never of any service.

Bark was a medicine that filled the old practitioners with a blind sort of confidence in the worst of cases. They saw dreadful forms of disease, accompanied with hectic symptoms, sometimes get well while their patients were taking bark; but they forgot the vis medicatrix naturæ, whose efficacy often conferred an undeserved reputation on this, as well as on many other articles of the materia medica. When first I entered the profession, it was the fashion to prescribe bark to a very great extent; patients were sometimes literally crammed with it; they were frequently purged, sickened, and weakened by it, instead of being strengthened. Nature, however, occasionally overcame both the disease and the supposed remedy; and the ruling prejudices were confirmed. The best surgeons of the present day use bark much less frequently and copiously than their predecessors. They sometimes give it in hectic fever, with the view of improving the appetite, but never on the supposition that it can directly strengthen the patient in proportion to the quantity taken into the stomach. The infusion or decoction, and the sulphate of quinine, are the most eligible preparations. When the hectic symptoms have somewhat abated, and general debility remains, steel medicines frequently prove the best tonics.

The patient is much more likely to be strengthened by nourishing food, easy of digestion, than by bark, and it should be taken frequently, and in small quantities at a time. Residing in a pure, salubrious air, is also a matter of great importance. In these cases, wine, gentle cordials, and aromatic draughts, are useful; and opium is a valuable medicine, not only for procuring sleep and alleviating pain, but, when joined with ipecacuanha, for checking the diarrhœa which is so frequently present.

Digitalis has been praised for its beneficial effects in hectic fever; but Dr. John Thomson, who tried it, did not find this commendation well founded. The frequency of the pulse, says Dr. Young, may, indeed, often be reduced by it from 120 to 50 strokes in a minute; but it is extremely uncertain in its operation, and frequently violent and unmanageable in its effects: nor is it either immediately or ultimately beneficial in simple hectic affections. For checking the nocturnal sweats, diluted sulphuric acid is generally considered the best remedy, when the bowels will bear it.

When the local disease is curable, if the constitution could bear it long enough, or the health were improved, medicine may be availing; but the utmost, which can be expected from it in all other instances, is a temporary palliation of the symptoms. These, however, will recur, and in the end prove fatal, unless the diseased part, the cause of the febrile disorder, admit of removal by a surgical operation.

## MORTIFICATION.

1. By the term *mortification* is signified *the death of a part of the body*, frequently of a considerable part of it, or the conversion of such part into a dark-coloured, black, fetid, cold insensible mass, with which the general nervous and vascular systems no longer have any organic connexion. In the bones, the state, corresponding to mortification of the soft parts, is called *necrosis*.

Dr. Carswell justly observes, that as the descriptive characters of mortification were originally drawn from the appearances which it presents in external parts of the body, they are also employed by the pathologist, as the means of enabling him to detect it in internal organs after death. "It may, however, be fairly questioned," he says, "whether the application of the term mortification has not been too restricted; and whether parts, deprived of their vitality and separated from the living tissues, should not be designated by the same appellation as those which, similarly situated, differ from them only in point of colour and, perhaps, smell. Softening of the cerebral substance, of the mucous, and frequently of the serous membranes, constitutes a state of positive death;" though the softened substance, in these instances, presents neither the peculiar colour, nor the colour of external mortified parts.*

The entire and permanent cessation of every action and function in the part is absolutely essential to what is understood by *mortification*; for sensibility and power of motion may be annihilated, and yet the part affected may continue to live, as is familiarly illustrated in paralysis. The temperature of a palsied limb is generally diminished, and so pro-

* See Carswell's "Elementary Forms of Disease," Fasciculus 7.

bably is the momentum of the blood in it; still, the fluids pursue their usual course in it, nutrition and absorption are carried on, and the parts retain for an indefinite period what may be considered as an inferior degree of vitality.

We know that it is the property of living matter to resist putrefaction; but no sooner is life withdrawn from any of the animal textures, than they become subject to the action of chemical affinities; they are decomposed, new combinations are formed, and various fluids and different kinds of gas evolved. Hence putrefaction, and the disagreeable smell of parts in the state of mortification. Heat, sensibility, motion, and arterial pulsation, may be abolished in parts for several days, but afterwards gradually return. We see this fact exemplified in the effects of cold, and in the epidemic cholera, where from the interruption of circulation and secretion, and from the loss of temperature in parts, one might expect that mortification would be common, yet it is exceedingly rare. Thus, in three hundred cases of cholera, under Magendie, in the Hôtel Dieu, there was but a single example of mortification, and, in that solitary case, portions of the fingers were in the state resembling the form of mortification, which will be presently described under the name of *gangræna senilis*. In another hospital at Paris, that of St. Louis, only one instance of mortification presented itself amongst the numerous cholera patients, the extremity of the nose being attacked. Generally, however, in cholera patients, if they recover, cold, insensible, and destitute of arterial pulsation as some parts of the system may have been, such state does not bring on mortification, and consequently it is as different from true mortification as suspended animation is from real death. An erroneous judgment may generally be avoided by observing, that, when the part is not truly mortified, the cuticle is not detached from the cutis, and no fetid gas is evolved.

It is correctly observed by Professor Carswell, that mortification is much more frequently observed in those organs in which the vascular system predominates, or in which an inordinate accumulation of blood is readily produced, on account of their greater sensibility, and their direct exposure to the influence of the causes of inflammation. Hence its greater frequency in the skin and cellular tissue, mucous membranes, and lungs, than in other textures; and hence its comparative rarity in serous and fibrous textures. The latter, indeed, are stated never to be found mortified, unless the cellular tissue from whose vessels they derived their nutrition has previously been diseased. In all the deeper forms of mortification, the cellular tissue is destroyed to a much greater extent than the skin and muscles; a fact to be remembered in judging of questions concerning amputation, and especially in deciding about the part of the limb to which the knife should be applied.

The most common form of mortification, namely, that which is called *humid*, on account of the abundance of moisture noticed in the dead parts, has two stages. To the early stage, while some marks of vitality yet remain in the disordered textures, the term *gangrene* is particularly applied.

*Gangrene*, then, is the condition of parts where mortification is not actually formed, but forming; it is the intermediate stage between the height of inflammation and the complete death of the parts. The latter event receives the technical name of *sphacelus*, in which state the parts are of a dark brown or black colour, always devoid of circulation, sensibility, and natural heat, forming what are called in the language of surgery, *sloughs*. The best pathologists consider the state of parts,

denoted by the term *gangrene*, as not absolutely incapable of recovery, the blood sometimes resuming its wonted course again, the natural temperature returning, and the healthy characters and functions of the part being restored.

Proper as it may be to have the distinctions of *gangrene* and *sphacelus*, the two terms are often used synonymously.

Mortification, when considered generally, and in relation to the causes by which it is produced, or the morbid conditions of the part in which it occurs, admits of the arrangement of its several kinds under three heads, as suggested by Dr. Carswell.

1. Mortification from cessation of the circulation.

2. Mortification from the violent operation of mechanical, chemical, and physical agents.

3. Mortification from the deleterious influence of certain poisons.

Cessation of the circulation in a part may be produced, 1st, by inflammation; 2dly, by mechanical causes, which obstruct the passage of the blood; 3dly, by local or general debility.*

That inflammation brings on mortification by occasioning a stoppage of the circulation in the part affected, is a fact now well ascertained. Mortification is not, however, a frequent effect of common or phlegmonous inflammation in a sound constitution, except when the exciting causes are unusually severe, or protracted in their operation. Thus, in severe burns, bad gun-shot injuries, violently contused and lacerated wounds, compound and comminuted fractures, and other injuries produced by great degrees of mechanical violence, or by means acting chemically on the body, a portion of the hurt parts is frequently destroyed at once, and must be thrown off in the form of a slough; while other parts of them, not actually killed, are yet so injured that they are seized with violent inflammation, which quickly terminates in gangrene and sphacelus. In some other instances, the inflammation ends in mortification on another principle, namely, because the action of the exciting cause is protracted beyond a certain time, as when urine is effused in the cellular tissue, and suffered to remain in it too long; or when a portion of intestine in a hernia continues beyond a certain period in a state of strangulation.

When mortification follows an external injury, as a bad compound fracture, or a severe and extensive laceration of the soft parts, it is invariably preceded by redness, swelling, and other marks of inflammation; the cuticle is raised in the shape of vesications, containing a dark bloody serum; the texture of the skin is softened, and assumes, first a dark purplish, greenish, or livid hue, and then a blackish colour; the cellular tissue is destroyed; putrefactive changes commence; air is generated in the disordered parts, so as to give rise to an emphysema of them, a crepitation being perceived on touching them; the exhalations from them are exceedingly fetid, and, about the textures destroyed, there is generally more or less humidity; — hence the term *humid gangrene*, by which this form of mortification is distinguished from another, characterised by the disorganised parts being nearly destitute of moisture, and therefore called *dry gangrene*.†

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* See Carswell's "Elementary Forms of Disease," Fasciculus 7.

† The following are some of Dr. Macartney's views of this part of the subject: — "When the disorganisation is produced by an unrestrained effusion of serum, and consists of an unravelling of the structure of the parts, instead of an essential change in the elements of the body, it is commonly distinguished by the name of *moist gangrene*.

"The other kind of disorganisation, which inflamed parts occasionally suffer, is not

*Humid* mortification is sometimes named *acute,* as contrasted with other varieties of it, which originate with little or no preceding inflammation, not from *external violence,* but from *internal causes;* and, being slow in their progress, are called *chronic.*

When the *humid* species of mortification follows bad gun-shot injuries, severe compound fractures, and other mechanical violence, it is sometimes named *traumatic gangrene.*

Besides these principal divisions of mortification, there is another variety, which is often suspected to be of a *contagious* nature, and consists in a rapid and very singular demolition of the parts attacked, which are not converted into common sloughs, but into a whitish or ash-coloured viscid or pulpy substance, studded here and there with specks of blood. It is a disorder that may be said to be neither like ordinary mortification, nor common ulceration, but something between the two; it has received the name of *hospital gangrene.*

The following are the principal causes by which mortification is produced, and its most remarkable differences and peculiarities are determined.

1. *Inflammation, attended with violence.* Whenever inflammation produces mortification, the stagnation of the blood in the vessels appears to have a chief share in occasioning the death of the parts.

2. *Inflammation, attended with weakness;* whether in the part itself, as exemplified in certain modifications of texture; or in the constitution, as after fever, long courses of mercury, and great reduction of the powers of the system by any cause whatsoever. Great impairment of the constitution, whether brought on by previous disease, as in dropsical and scorbutic persons, or by intemperance, or by a gradual decay of the vital powers from old age.

3. *Inflammation of a specific or malignant nature,* like particular forms of erysipelas, the carbuncle, small pox pustule, malignant pustule, and pestilential bubo.

4. *Stoppage, or serious interruption of the circulation and nervous energy in parts from other causes.* A mere diminution of the nervous energy alone will not occasion mortification, because paralytic limbs live for an indefinite period; but that it facilitates the occurrence cannot be doubted; and hence the greater risk of mortification when the principal artery of a limb is wounded, together with a large nervous trunk, than when wounded by itself. There are two forms of mortification arising from the cessation of *arterial circulation;* the first, depending on a spontaneous rupture of the internal and middle coats of a large artery, and the obstruction of it with coagulated blood, or fibrine*; the second, on the obliteration both of the trunks and branches of the arteries of a limb by fibrine, or by fibrous or osseous substances from some other cause.†

The blood may be prevented from arriving at, or returning from, a part of the body by mere mechanical causes. In both cases, as Professor Carswell remarks, mortification is the consequence of the cessation of the function of nutrition, either from a deficiency of the arterial, or the stagnation of the venous blood.

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only attended with the death of the part, but a new and peculiar arrangement of the animal substance, totally different from that, which takes by the death of a part, in consequence of mechanic injury, or its being separated from the rest of the body." Op. cit. p. 35.

* See Turner, in Edin. Med. Chir. Trans. vol. iii.

† Carswell's "Elementary Forms of Disease," Fasciculus on mortification.

Dupuytren suspected, that the cause of gangræna senilis might depend upon acute inflammation of the principal arteries of the parts affected (arteritis), which arteries become red, the blood coagulating in them, followed by their obliteration, and a complete stoppage of the circulation. This doctrine has not, however, been confirmed in this country; and Professor Carswell considers some of the appearances described by Dupuytren as evidence of arteritis, rather as indications of the worst forms of phlebitis.

With regard to *ossification of arteries*, as a cause of mortification, Dupuytren looks upon such condition of the arteries and the occurrence of gangrene as a mere coincidence. A simple ossification of arteries, he maintains, does not materially obstruct the flow of blood through them; and certainly it may exist without the circulation undergoing any perceptible check from it. How many bodies, says he, are dissected, in which all the arteries of a limb are found ossified, yet without having produced gangræna senilis? What surgeon, he asks, in operating for aneurism, or in amputating, has not met with arteries completely ossified, and yet the blood passed through such vessels as freely as if they had been quite exempt from disease? He argues, therefore, that the obliteration of arteries, the stoppage of the flow of blood through them, are the real causes of the disease. Dr. Carswell, as already noticed, does not regard arteritis as the cause of gangræna senilis; but he so far coincides with Dupuytren as to state that, in every case of gangræna senilis which he has examined after death, the arteries of the limb were obliterated to such an extent as to interrupt the circulation. In five or six cases, the obstructing cause consisted of a fibrous tissue, formed either in the coats or cavities of arteries, and which had converted these vessels into nearly solid cords of ligamentous consistence. This state was traced from the toes nearly half way up the leg; it was always connected with ossification of the larger branches and trunks of the thigh and other parts of the body. In two other cases, the obstruction depended on extensive ossification of the principal arteries of the limb; and, in several others, on fibrine formed round calcareous spiculæ projecting into the vessels.

5. Another common exciting cause of mortification is *irritation* in a thousand forms; friction, stimulating applications, effused urine.

6. *Severe degrees of mechanical injury* from external violence.

7. *Applications* or *agents which chemically destroy the parts*, as high degrees of heat, lightning, concentrated acids, and various caustic substances.

8. *Intense cold*, especially when followed by the sudden exposure of the parts to a much higher terperature. Here, strictly speaking, the cold is only a predisposing cause, and the parts would generally not mortify, if the exciting cause, namely, the sudden exposure to warmth, were not afterwards applied.

9. *Organic disease of the heart, aorta, or their valves.* This doctrine, I observe, is admitted by Dupuytren, who states, that the generality of individuals, affected with gangrene from arteritis, have either been addicted to intemperance, or are the subjects of chronic diseases of the heart, or of the valves of the aorta, or of the great vessels.

10. Certain *deleterious articles of food*, as the ergot, or cockspur-rye, or barley mixed with the raphanus.

11. *Specific contagion*, as exemplified in hospital gangrene.

When any considerable portion of the body is attacked with mortification, the whole system is thrown into a state of alarming derangement, accompanied by a sudden and remarkable depression of all its powers.

However, if the sloughing be preceded by violent inflammation, as is generally the case where it is the result of mechanical injuries, the first stages of the complaint are attended with inflammatory fever; the strong actions of which usually cease, either before, or as soon as, the parts are in the state of sphacelus. But the degree and kind of constitutional disturbance are not alike in all cases of mortification. Much will depend upon the extent of the disorder, the nature of the parts affected, and the acute or chronic form of the complaint. When the sloughing is confined to a small portion of the skin, or cellular tissue, and has arisen from acute inflammation, the common symptoms of inflammatory fever may be little or not at all aggravated by what has happened; but, if the mortification be extensive, the countenance will quickly assume a wild cadaverous look, the stomach often be severely disordered, vomiting generally occur, and the diaphragm, being affected with an irresistible spasmodic contraction, a frequent, loud, and distressing hiccough will be produced; at the same time the intestinal canal will be distended with a prodigious quantity of gas, and the surface of the body covered with cold clammy perspirations; the pulse will be small, rapid, and irregular,; subsultus tendinum will occur, and the patient, especially in bad cases of *traumatic* gangrene, be soon affected with delirium or coma. In such instances, the utmost prostration of all the powers of life is generally manifested. When things reach this stage, the patient soon dies.

In other cases, the course of the disease is slower, and the mortification would stop, and perhaps life be saved, if the weakening effects of a diarrhœa could be prevented, or the state of the stomach be improved.

The *hiccough,* which I have noticed as a symptom or effect of mortification, deserves particular attention, because it is often one of the chief circumstances by which we judge of the state of internal parts threatened with mortification. Thus, it is a symptom which every experienced surseon has a well-founded dread of in strangulated hernia, where it was formerly regarded as a sure indication of gangrenous mischief within the hernial sac. But this precept was carried beyond the limits of truth. I have in several instances operated upon strangulated hernia, where hiccough was one of the symptoms, though no portion of the protruded bowels was in a mortified state.

In *chronic mortification,* or *dry gangrene,* the constitutional symptoms are often of a slower character, and the patient may live several weeks, with a pulse varying from 100 to 120, with his digestive functions tolerably well performed, and his intellects clear, until perhaps about a week before the fatal result. Of this fact I saw a remarkable example in a gentleman, whom I attended with Sir Astley Cooper and Mr. Hughes of Holborn.

All mortifications from a mechanical obstacle to the venous circulation present one common character, viz. an excessive accumulation of blood in the venous trunks, branches, and capillaries of the affected part. Owing, however, to the accumulation of serosity beneath the skin, as Dr. Carswell observes, such venous congestion is not at first perceived in that species of mortification of the legs which succeeds to disease of the heart. Indeed, as this able pathologist notices, the first local sign that an obstacle exists to the return of the venous blood from the inferior extremities, is manifested by slight œdema around the ankles, which increases and spreads throughout the cellular tissue, and the skin assumes a smooth, pale, and waxy appearance. At length, the subcutaneous veins gradually increase in bulk and number, coalesce in several points, and communicate

a slightly mottled aspect to the skin, of a dull red or purple colour. On one or more of these points, where the congestion is greatest, phlyctenæ, or large bullæ are formed. When these burst, the skin underneath presents a dark red, or brown colour, and is soon converted into a dirty yellow, or ash-grey slough. The separation of the slough is sometimes preceded by an increase of redness in the surrounding skin, evidently inflammatory; but, in other instances, the redness is very slight, and plainly owing to mere venous congestion, occasioned not only by disease of the heart, but also by the pressure of the serosity accumulated in the cellular tissue of the limb.*

When a part, or limb, is seized with mortification, *the blood coagulates in the large vessels for some distance from the boundary of the dead parts.* It is on this account that the separation of sloughs is not commonly attended with hemorrhage, which is afterwards prevented, not only by the clots formed in the arteries, but also by the effects of the adhesive inflammation.

The coagulum always extends within the vessel as far as the first important collateral branch. This fact explains a circumstance sometimes noticed in practice, viz. when the incisions in amputation are made within a certain distance of mortified parts, there may be little or no bleeding from the divided vessels.

Hemorrhage, on the detachment of a slough, is certainly not a common circumstance: it is seen, however, now and then, when the disease is a combination of phagedenic ulceration and sloughing, and sometimes as a consequence of gun-shot wounds, implicating the side of a considerable artery; but not in ordinary cases.

The *prognosis* is much influenced by the consideration of the nature of the exciting causes, and whether they admit of removal, or not. If the disorder originate from organic disease of the heart, or from extensive ossification of the arteries, combined with some other cause (for this alone must not, I think, be set down as adequate to the production of mortification), it may be regarded as incurable, because we have it not in our power to remedy those particular states of the heart and arteries which excite the disorder.

On the other hand, if mortification arise from the presence of any kind of irritation, pressure, or friction, which can be effectually removed, we may entertain the hope of stopping the extension of the complaint. Thus, if sloughing of the cellular tissue of the perinæum and scrotum arise from the irritation of effused urine, we may, by making free incisions for the discharge of such fluid, and by passing a catheter or tube to hinder the renewal of the effusion, remove the exciting cause, and thus stop the gangrenous mischief. However, after urine is once effused, so irritating is it to the cellular tissue, that more or less sloughing will generally follow, even though ample and deep incisions for its escape be made with the utmost promptitude. Still, however, the practice is useful in preventing the extension of the mischief. In all cases of mortification, the prognosis depends also very materially upon the age, strength, and constitution of the patient; the greater or lesser importance of the part affected; the rapid or slow progress of the disorder; its extent; and the circumstance of its proceeding, or not, from internal causes.

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* See Carswell's "Elementary Forms of Disease." This work contains the best description of mortification of the inferior extremities from disease of the heart, ever published.

A mortification in what is familiarly called a *bad* habit of body, a constitution ill suited to bear any disease favourably, may be set down as exceedingly dangerous; while a limited sloughing from external violence, in a healthy person, may not be attended with any severe or perilous symptoms whatsoever.

On the other hand, if mortification be not of too great extent, and arise in a healthy person from the presence of any kind of irritation, pressure, or constriction, which can be promptly and effectually removed, there is the fairest prospect of bringing the case to a favourable termination. If the part attacked by mortification, however, be one whose functions are of high importance in the animal economy, the case is attended with great peril, even though the individual may be of an excellent constitution, and the portion of the organ destroyed but of small extent; a fact frequently illustrated in strangulated hernia, attended with mortification. The rapid progress of traumatic gangrene, so quickly and often inducing coma, delirium, and death; the slower, but still more certainly destructive course of gangrœna senilis, forbidding in its early stages an operation, on account of its intimate association with internal causes; and the well known severity and disastrous consequences of hospital gangrene, must always be remembered in giving our judgment concerning the issue of this disorder. Great prostration of strength, a low, rapid, faltering pulse; a stomach which can retain neither food nor medicine; and an attack of diarrhœa, especially when joined with coma or delirium, are symptoms leaving little or no hope of recovery.

In the *treatment* of every species of mortification, there are three principal indications. 1. To endeavour to stop its progress. 2. To promote the separation of the mortified from the living parts. 3. To heal the ulcer resulting from the loss of substance, or, where an operation has been deemed necessary for the fulfilment of the second indication, to cure the wound thus produced.

1. With respect to the first of these indications, it naturally leads to the object of ascertaining and removing the original cause of the disorder: I mean that cause which first gave rise to the intense inflammation of the parts, and which, perhaps, may still continue to operate. This is a common principle, which should be observed here, as well as in all other parts of surgery. Sometimes we have it in our power to remove the exciting cause altogether; as, when we let out by suitable incisions, extravasated urine, and hinder its further effusion by the judicious employment of the catheter; or when we discharge from the cellular tissue the fluid, which occasions a prodigious distension of that texture in the severe forms of phlegmonous erysipelas; or when we take away extraneous substances, splinters of bone, and remove and diminish irritation in a variety of forms. Frequently also sloughing is produced and kept up by the employment of hurtful remedies, and then the change to a better practice is the same thing as removing the cause of the disease in other instances, and has an equally beneficial effect. In general, however, when gangrene arrises from intense inflammation, the exciting cause is only momentary: it has already ceased; but the injury, which the parts have sustained from it, is of a more lasting nature, and must be followed by a high degree of inflammation, and sloughing to a greater or lesser extent.

There can be no doubt, that the extent of mortification may be considerably influenced by the mode of treatment, adopted during its incipient stage, termed gangrene. When the disorder is the effect of

inflammation, we are bound to believe, nay, we see, that the living circumference is inflamed in the highest degree. Reason and observation, therefore, seem both to concur with respect to the general propriety of antiphlogistic measures in this state and species of mortification, especially leeching, saline aperient medicines, and calomel with opium. The plan, however, is to be pursued with moderation and caution: it is right, so long as inflammatory fever and acute local inflammation are co-existent with mortification; but, even under these circumstances, evacuations must not be resorted to with the same freedom and frequency, as in examples of inflammation unaccompanied with mortification. In particular, venesection is to be ventured upon only in young, robust, plethoric subjects. The necessity of this kind of circumspection depends upon the fact, that, whenever a considerable portion of the body mortifies, the constitution immediately feels the shock in every part of it. There is hardly any interval between the genuine inflammatory fever, in which the action of the sanguiferous seems to proceed even with preternatural force, and another state of the constitution, in which the predominating symptoms are prostration of strength, and violent agitation of the whole nervous system. In fact, more or less debility always rapidly supervenes; and if the patient be further lowered by the lancet, purgatives, and too spare a regimen, his condition will be rendered hopeless.

Some years ago, the treatment of gangrene and sphacelus was often conducted upon principles which had little foundation. It was presumed, that cinchona had a specific virtue in stopping and resisting the progress of the disorder. To this medicine, diluted sulphuric acid was added, when a general tendency to putrefaction was suspected in the system; or cordials and aromatics, as wine, brandy, musk, ammonia, confectio aromatica, &c., when there was great prostration of strength; and opium, when severe nervous symptoms, and extreme pain were experienced. Musk and ammonia were recommended many years ago by Mr. White, of Manchester, in examples attended with spasmodic twitches. My friend, Dr. Gibson, Professor of Surgery in the University of Pennsylvania, gives his testimony in favour of the latter medicine, and also speaks favourably of the effects in some cases of camphor, with or without opium, small doses of the chloride of mercury, and of liquor ammoniæ acetatis combined with laudanum.*

The opinion, respecting the specific power of bark for the stoppage of mortification, is rejected by every modern surgeon of judgment and experience; without the denial, however, that it is a medicine, which, in particular states of the disorder, may be administered with advantage. Even then the benefit never arises from the specific power, which it was formerly supposed to have, of stopping mortification, but from its being an eligible bitter, by which the tone of the digestive organs may sometimes be improved. It is not long since it was the custom to prescribe it in powder, or substance (as it was termed), and in as large quantities as the patient could be prevailed upon to swallow. But no sooner was it clearly ascertained that the utility of bark did not really depend upon its specific virtue, than the plan of cramming patients with it was universally abandoned; and it is now only administered in such moderate and reasonable doses, as are not likely to disorder the stomach and bowels, and defeat the very purpose for which alone it can ever be justly recom-

* See "Institutes and Practice of Surgery," vol. i. p. 28. ed. 5. Philadelphia, 1838.

mended. It is not, however, in the early stage of mortification, combined with acute inflammation, that bark, prescribed in any way, can be of service.

When mortification happens from an external local injury in a sound constitution; when it no longer spreads, and the living margin appears red for a small distance from the line of separation, bark is clearly unnecessary.

Mortification, according to its particular nature, causes, and circumstances, may be attended either with sympathetic inflammatory fever, or with another fever, which is characterised by extreme debility, and is either like typhus, or the disorder sometimes described under the name of *sympathetic irritative fever*.

The first fever takes place when mortification arises from external causes in a healthy constitution. Here bark is usually hurtful. The other state of the system may undoubtedly require it, though, if the fever be what is called irritative, and great excitement of the nervous system, delirium, picking of the bed-clothes, subsultus tendinum, &c., prevail, anodynes, antispasmodics, blisters, and local treatment, will do a thousand times more real good, if any chances of life still remain, than bark in any dose or formula whatever.

In condemning this medicine, however, for certain states of mortification, I am far from wishing the reader to suppose, that even in the progress of these very identical cases it may not sometimes become necessary, although not at all indicated at an earlier period. Every experienced surgeon knows, that the natural change of circumstances in the course of numerous diseases renders the exhibition of some medicines absolutely indispensable, which, had they been given at first, would have had the most pernicious effects. When the inflammation surrounding the sphacelus has abated, the patient is low, the appetite bad, and the kind of fever and state of the chylopoietic viscera are not such as to prohibit bark, it should be administered with aromatic confection, wine, fermented liquors, and a light nutritious diet. The sulphate of quinine should also not be forgotten, as a very convenient preparation, which the stomach and bowels will generally bear well. If delirium occur, camphor or musk ought to be prescribed, and a blister applied to the head. In many of these cases, also, the patients would be carried off by diarrhœa, were not the surgeon particularly attentive to the diet, and prompt in the judicious administration of opium, the mistura cretæ, &c. Indeed, with respect to opium, and the preparations of it, the muriate and acetate of morphia, they are perhaps the most valuable of all the internal remedies, employed in the treatment of mortification, and should be employed in every stage and form of the complaint, attended either with severe pain, or spasmodic or nervous symptoms, and they ought not to be given merely at night, but every four or six hours, so as to keep the constitution under their influence.

With regard to local applications, for cases of mortification, attended with acute inflammation, experience appears to decide in favour of common emollient linseed poultices and fomentations. When the gangrenous part is turned into a darkish, or black, fibrous, insensible mass, it is, indeed, of little consequence what is applied to it, as the living circumference claims almost exclusive attention. Both during the extension of the disorder, and afterwards, when the sphacelation has stopped, a simple linseed poultice, or one containing a proportion of finely powdered recently burnt charcoal, is as good an application as can be employed.

Some surgeons are partial to fermenting poultices, and with these not much fault can be found; for, though perhaps no particular good can be strictly imputed to their supposed antiseptic quality, the carbonic acid gas produced by them is not stimulating enough, nor sufficiently in contact with the living flesh, to counteract their good effects as emollient applications. They have always appeared to me better calculated for mortification, unattended with intense inflammation, than for the particular cases which we are here considering.

As I have repeatedly said, it matters not what is put upon such parts as are actually dead, and, if the surgeon choose, he may lay upon them turpentine, spirituous balsams, camphorated spirit, a solution of the chloruret of soda, or lime, the pyroligneous acid, a lotion of creosote, or any thing else which he may prefer, with the view of checking the fetor and putrefaction. But, except in some instances of phagedæna gangrænosa, where it is necessary to destroy the textures directly connected with the parts affected, it is of high importance that the living flesh around and underneath a slough be not injured and irritated by any sort of applications. No one, who has sound ideas of the nature of the animal economy, would talk of invigorating the parts with spirits and balsams, in order to avert mortification. Yet, once so prevalent was this doctrine, that it was a frequent practice to cut and scarify the parts for the express purpose of letting such applications have free ingress to the subjacent living textures.

Incisions and scarifications in gangrenous parts can do no good, if they are merely made in the sloughs; and, if they extend through the dead to the living flesh, they are not only likely to effect no rational purpose, but must be productive of pain, hemorrhage, and frequently of fresh sloughing. When, however, a slough is large, and a part of it loose, the cutting away such portion is commendable on the principle of lessening the fetor. Were also much sanies to lodge under a slough, a careful incision through the dead part might be useful in affording an exit to the matter. But this proceeding can never be justifiable when the living parts are to be irritated or wounded.

2. The second general indication is to promote the separation of the mortified from the living parts.

Although a slough may be scratched, or cut, without pain or harm to the patient, it cannot be pulled away immediately after its formation, without pain, hemorrhage, and even a risk of renewing the spreading of mortification. The dead part is yet adherent to the living flesh, and cannot be prudently taken away before the absorbents have removed the particles of matter, which compose the uniting medium. The separation of dead from living parts is a vital process, not explicable on physical principles, nor by the laws of dead matter. When it is about to take place, a red line, varying in breadth in different cases, and said to be produced by the adhesive inflammation, usually appears on the living surface, contiguous to the dead. The adhesive inflammation, in fact, seems to be the means which nature employs for stopping the progress of mortification, and preparing the living surface for the separation which is about to be produced. By it, she fills the cavities of the cellular tissue with coagulating lymph, assists in closing the extremities of the blood-vessels, and establishes the commencement of those operations by which granulations are to be formed, and the loss of substance repaired. Soon after the formation of the red line of separation, slight solutions of continuity may generally be seen, beginning at various points, and re-

sembling very minute ulcers, which, uniting together, form a hollow line, or chink, which extends all round between the dead and living parts. This loss of substance, which is at first superficial, generally proceeds more and more deeply, till the separation of the sloughs is entirely affected. In this process, which does not materially differ from that of common ulceration, the absorbent vessels are actively engaged, and it is by them that the particles which form the link between the dead and living flesh are removed. From the moment that the separation commences, a discharge, at first of a serous, and afterwards of a puriform appearance, begins to take place from the line of detachment, and it becomes more and more abundant in proportion as the falling off of the slough exposes the subjacent raw granulating surface. In young subjects, and in vigorous constitutions, the separation of the sloughs is accomplished with much more celerity than in the old and feeble. The texture and situation of the parts affected make also a considerable difference in this respect, and, generally speaking, the harder and less vascular they are, and the more remote from the source of the circulation, the longer they are in throwing off their sloughs.

When a part, or limb, is seized with mortification, the blood coagulates in the large vessels, for some distance from the line which bounds the sphacelation. Hence, the separation of the sloughs is not usually attended with hemorrhage, and the security is generally still further increased by the effects of the adhesive inflammation already described. The cause of the formation of the coagulum in the vessels, as Mr. Hodgson remarks, is by no means evident, although it is probable that the condition of a mortified vessel may interrupt the passage of the blood through it, and, consequently, a coagulum is formed, extending to the next important collateral branch. It is also the coagulation of the blood in the arteries, near a sphacelated part, which accounts for there being sometimes no hemorrhage of importance, nor any occasion for ligatures, when amputation is performed a little above the line of separation.*

With the exception of cases in which amputation of the limb is urgently indicated, the separation of a slough should generally be left as much as possible to nature. All that the surgeon can usefully do, is to take away every portion of the slough as soon as it is entirely separated from the living textures. An opposite line of conduct, as I have already stated, would often excite unnecessary irritation, pain, and hemorrhage, and even renew the spreading of the disorder. A trivial degree of violence will sometimes bring on the latter evil, nor can we be surprised at it, when we advert to the deranged state of the whole constitution, always resulting from the effects of an extensive mortification. If it be at all practicable to expedite the process by which a slough is thrown off, the good is to be derived rather from general than from local treatment. By internal medicines, a judicious regimen and diet, and especially by attention to ventilation and cleanliness, the general health may be improved, and, in this manner, the system enabled to throw off the sloughs, or dead parts, with greater expedition; but until they are actually loose, we cannot interfere for the purpose of taking them away. I know of no applications, which have any particular virtue in quickening their detachment, and the more simple they are the better. In fact, none are better than common linseed poultices, with or without a proportion of powdered charcoal or

* See Petit in Mém. de l'Acad. Royale des Sciences, an. 1732. Thomson's Lectures, p. 552., and Hodgson on Diseases of Arteries and Veins, p. 13. 8vo. Lond. 1815.

some of the solution of the chloruret of soda: or, if the surgeon like, he may have recourse to the fermenting cataplasm already specified. Much stress has been laid upon the usefulness of antiseptics and tonics as local applications; as a solution of the chloruret of soda in water, or camphor mixture, turpentine, camphorated spirit, &c. Bark in a variety of shapes has also been used for covering the parts affected. So far as my experience goes, I should say, that the cases, in which the chlorides or chlorurets of soda and lime, carrot and fermenting poultices, and various acid or spirituous or other lotions, prove most useful, are those in which mortification presents itself in the characters of phagedæna and hospital gangrene. In these instances, concentrated nitric acid and the liquor arsenicalis, mixed with an equal quantity of distilled water, have obtained high repute. It is also in such cases that the actual cautery is still sometimes made use of abroad.

3. The third general indication is to heal the ulcer, or, in the event of amputation, the wound resulting from the loss of substance. But, on this topic, I need not dwell at present, as the principles, on which this indication is to be fulfilled, are explained in the respective articles on wounds, ulcers, and amputation.

### GANGRÆNA SENILIS.

This is generally an example of *chronic* mortification, and also of *dry* gangrene, though, in respect to the rate of its progress, and the quantity of fluid about the destroyed textures, there is considerable difference in different cases. Thus some proceed to their fatal termination in a week, as happened in an instance which I lately attended with Mr. Baker of Staines; while others do not terminate in this manner till several weeks have elapsed, as was the case with a gentleman in Gray's Inn, whom I attended with Mr. Hughes of Holborn. In Mrs. W. of Guildford Street, who was a patient of mine, the disorder continued more than nine months before she fell a victim to it, and then it had not destroyed the whole of the foot. The disorder is always, however, completely different from that which follows the ordinary forms of acute inflammation, coming on more insidiously, and at first with less threatening symptoms, though, if possible, tending with still greater certainty to a fatal result than any other species of mortification. The first change usually noticed is a dark red purple, or almost black, discolouration of the fleshy or under portion of one of the toes, without, in general, any previous swelling, increase of temperature, or sensibility of the part. I have known the disorder begin on other parts of the foot: thus, in Mrs. W., above referred to, it commenced on the heel. Some few examples of its attacking the upper extremity have come under my notice. At this present time, there is an old woman in University College Hospital under my care, the ends of several of whose fingers were attacked; the disorder has stopped, and she is now recovering, with the loss of the third phalanx of one of the fingers. I should mention, that she had also some sloughing of the integuments of the foot. Dupuytren gives one instance of its commencement in the fingers. In the winter of 1834-35, a woman, aged seventy-five, was in our hospital, one of whose arms perished nearly up to the axilla, from this species of gangrene, and, nature having separated the dead from the living parts down to the bone, this was divided with a saw, and the woman recovered.

Frequently while the skin about the toes is of a deep purple colour, it is of a lighter hue higher up the limb, and still higher up only mottled or

marbled. Here the parts begin to give a sensation to the hand of great coldness, which increases the nearer the part examined is to the foot. Still the patient retains the power of moving the ankle; a circumstance, explicable by the fact, that most of the muscles of the foot ascend nearly as high as the knee, to which point the disease has not extended. If the femoral artery be now examined with the fingers, its pulsations will be felt to be very feeble, or the vessel converted into a hard, almost incompressible cord.

Gangræna senilis begins at the greatest distance from the source of the circulation, almost always with a mere discolouration or spot on the side or inferior part of one of the small toes, soon followed by an uneasiness, numbness, and an extraordinary fall of temperature in the foot. Although the disease is usually regarded as dry gangrene, the cuticle rises up here and there in the form of vesications, filled with a dark very fetid serosity, and on their bursting, the black mortified cutis may be seen at the bottom of them. When the disease creeps up the limb very slowly, the swelling of the parts about to perish may be very trivial; but, in other examples, there may be inflammatory redness, accompanied by heat, pain, and tumefaction, and the upper part of the leg may be of twice its natural size. According to Dr. Carswell, the bulk of the affected parts depends chiefly on the situation and extent of the obstacle to the circulation. If the obstacle be extensive, the quantity of blood admitted to the foot is too small to give rise to congestion; and this not taking place, there is little or no effusion of serosity. Hence there is no increase of bulk in mortification from this cause; and, if the obstruction has been effected slowly, the foot and leg may even be atrophiated, previously to their being attacked with mortification, the dead parts being shrunk, dry, and indurated.*

Sometimes the disease in its early stage is attended with great constitutional disturbance, intolerable pain, constant restlessness, a small, frequent, irregular pulse, hiccough, vomiting, twitches of the muscles, and coma or delirium. Under such circumstances the patient usually dies by the time the mortification has reached the ankle, or even earlier, that is, in eight or ten days. In other examples, however, the patient at first suffers but little constitutional derangement, and is surprised to hear that a small discolouration of one of his toes, and a degree of uneasiness in the foot, should be a case of considerable danger. This was singularly illustrated in the gentleman in Gray's Inn, whom I attended in the summer of 1828, with Sir Astley Cooper and Mr. Hughes. The case was also remarkable as presenting an instance of the disorder in both legs at once. But notwithstanding this double attack, the constitutional disturbance advanced so slowly, that the patient used to eat a mutton chop for dinner every day, and to digest very well until within three days of his death, which did not take place till nearly five weeks after the commencement of the sloughing. The pulse, during the greater part of this time was from 100 to 110, though occasionally it rose to 130, and the intellects were clear until the final stage. In this interesting case, two circumstances were particularly remarked: — 1st. That the disease never spread, without each extension of it being preceded by violent burning pain in the part about to be destroyed, so that a correct judgment could always be formed beforehand from the degree of suffering, whether the next extension of the disorder would be considerable or not. 2dly. That the

* See Dr. Carswell's "Illustrations of the Elementary Forms of Disease," Fasciculus 7.

process of mortification, and its appearances in one leg, were totally different from those presented in the other. In the left, the disorder began on the inside of one of the little toes; in the right, a general diminution in the temperature of the foot and leg came on very gradually, with scarcely any discolouration of the skin, any detachment of the cuticle, or any particular change in the appearance of the toes. The coldness was followed by a total loss of sensibility in the parts, and the cessation of the circulation, and every other action in them. The skin was in this leg shrunk, dried or mummified, but it was little changed in colour. In University College Hospital, there is at this present time (June 1839), a woman, aged about forty-five, both of whose feet have been destroyed by gangræna senilis. In one limb, the parts are separating; and, in the other, the line of demarcation is beginning to show itself, but, from the feeble state of the pulse, occasional delirium, and impairment of the functions of the stomach, I judge that the patient cannot live many days.*

With respect to the loss of temperature in parts about to be destroyed by gangræna senilis, Dupuytren states, that he has carefully noticed with the thermometer, that such parts, before they perish, actually become much colder than any of the surrounding media. It seems to be well ascertained, that this is a species of mortification arising from obstruction in the arterial system. The results of Dr. Carswell's investigations confirm this view; for, though he does not coincide with Dupuytren in referring the cause of such obstruction to arteritis, he has found the arteries more or less blocked up with fibrine or other deposits. It is not perhaps completely settled, how far an ossified state of the arteries should be set down as a cause. In elderly persons, some of these vessels are always ossified; yet, in the parts to which they are distributed, nutrition appears to go on tolerably well, and the textures usually escape gangrene. It may be argued, therefore, that as one form of chronic mortification is mostly met with in persons of advanced age, in whom there is generally some ossification of the arterial system, whether mortification happen or not, such ossification cannot be the cause of mortification, when this does happen, but only an accidental complication or coincidence. I believe, however, that it must be regarded at all events as a predisposing cause, and that when joined with organic disease of the heart, an impaired constitution or derangement of the health, it must promote the occurrence of gangrene. One can hardly suppose that an artery, when converted into a rigid bony tube, can be so well calculated for carrying on the circulation, as it is in its naturally elastic and contractile state. Yet, without some further cause of impediment to the blood's motion, no mortification would arise.

Dupuytren believed, that this chronic form of mortification is owing neither to debility nor impairment of constitution, nor to ossification of arteries, but to arteritis, or an inflammation of the inner coat of the principal arteries leading to the parts affected, whence follow coagulation of

* This prognosis was verified. In the *post mortem* examination, ossification and thickening of the semilunar valves of the aorta were observed, and tubercular ulceration of the cœcum and beginning of the colon. The femoral, tibial, and peroneal arteries, and the dorsal artery of the foot, in each limb were slit up, but no obstruction of them with any kind of substance existed. As no fine injection was thrown into the vessels, it was impossible to offer an opinion respecting the actual state of the minute vessels, which, according to Cruveilhier, are essentially blocked up and obstructed, whatever may be the state of the arterial trunks, which he represents as an accidental circumstance, and varying in different cases.

the blood in them, and their obstruction with coagulating lymph, so that if amputation be performed, no ligatures are required. Old age and debility, he maintains, are not the cause, because he has seen the same description of mortification in a child ten years of age, in a young woman of twenty-two, and in a person of forty. At the same time, he acknowledges that hard drinking, and disease of the valves of the heart, are generally concerned as exciting causes of arteritis, and that such arteritis may take place in the diseased arteries of old subjects, as well as in the sound ones of young persons. With respect to these points, if they were all admitted, they do not seem to me to invalidate the great truths, that this species of mortification is rare in young individuals, and that it occurs chiefly in persons above fifty, whose constitutions have been impaired by time and mode of living, and whose arterial system is in a state demonstrating an obstructed circulation in the limb.

Dupuytren declares, that by means of venesection and opium, he has saved two thirds, or even three fourths, of his patients; whereas, the disease, as it is commonly treated in this country, is generally fatal, the number of persons living till its destructive process stops, and the dead parts are separated by nature, or the amputating knife, not exceeding, perhaps, one in twenty. Were Dupuytren's practice to be attended with so much greater success than our own, doubtless it should be immediately substituted for the latter, little as our confidence might be in his doctrine of arteritis being the cause of the disease. I fear, however, that he has either exaggerated his success, or frequently mistaken the kind of mortification in which he employed the lancet with advantage. When we find him describing this mortification as common in young persons, there seems to be indeed some reason for the latter suspicion.

I have heard of the practice being tried in one or two examples in London, but without success. Dr. Gibson, of Philadelphia, relates the particulars of a case under Dr. Carmichael, of Virginia, in which both feet were attacked with dry gangrene, and Dupuytren's plan was tried. "The first bleeding to faintness afforded great relief from the pain, as it did on every trial, which was repeated during the disease not less frequently than eight or ten times. Purgatives assisted, as usual, in the antiphlogistic treatment, and the most agreeable local adjuvant was snow or iced water." The blood was buffy and cupped. Opium was sparingly used. About the sixth week, Dr. Carmichael removed one of the legs below the knee, and, upon inspection of the artery, it was found so filled with granulated, albuminous, or fibrous matter, that no ligature was applied, or tourniquet used, nor was there the least hemorrhage. In the tenth week, the other limb was amputated. The patient gradually improved, and became convalescent, but died shortly afterwards.*

In gangræna senilis, opium is a medicine of much greater value than bark. This was a truth particularly insisted upon by Mr. Pott, who, however, rather overrated the power of opium, which he represents almost as a specific or sure means of stopping the extension of the disease. I believe it to be the most useful of all medicines in this example of mortification, but by no means endued with so much power over the complaint as Mr. Pott's statements might lead a young surgeon to imagine. In fact, when we advert to the cause of the disorder, what medicine can be expected to have great power over it? Dr. Gibson has tried opium both in small and very large doses, without finding the ex-

* See Gibson's "Institutes and Practice of Surgery," vol. i. p. 36. *ed. 5.*

pectations held out by Pott realised in a single instance. In one example, he began with moderate doses, and gradually increased them, till the patient took 500 drops of laudanum every twelve hours; yet little relief was experienced, and the case had a fatal termination. When opium is prescribed, the patient should be kept continually under its influence, and the dose therefore be repeated every four or six hours, either in the common forms, or those of the acetate or muriate of morphia.

Besides opium, other medicines have been extensively tried — as sulphate of quinine, diluted sulphuric acid, hyosciamus, camphor, musk, æther, the subcarbonate of ammonia, wine, and various cordials.

The best topical applications are those which are not productive of irritation; hence, emollient poultices and fomentations are generally preferred. Surgeons often try the solution of the chloride of soda or lime; but, the application is merely commendable as a disinfecting agent, and not on the ground of its having any specific virtue in stopping mortification. The chlorides of soda and lime I have seen fairly and freely employed; but what experience revealed will only justify this report of them: they lessen the disagreeable effluvia, but they neither check the mortification, nor afford ease to the patient.

About a year and a half ago, an old man was under my care in University College Hospital, with gangræna senilis of one of the toes, in a recent stage. I had then just learned from Sir Benjamin Brodie that in Greenwich Hospital, where this disease is common amongst the aged pensioners, the practice had been followed of covering the whole limb with lamb's wool, in order to maintain its temperature, and this sometimes with a beneficial result. I tried the method in the case here referred to, and the man recovered, with the loss of part of the toe.

As this form of mortification proceeds from internal causes, it is one to which the ancient rule applies, that amputation ought not to be undertaken until the red line of demarcation is completely formed, and the sloughing has decidedly stopped.

### MORTIFICATION FROM DEBILITY.

Besides the foregoing species of mortification, there are others which are preceded by a state of local and general debility, where (to use the words of Professor Carswell) the physiological and physical properties of the fluids and solids are so modified, that every function of the economy is slowly, ineffectually, or imperfectly performed. Such is the sloughing of the gums, cheeks, palate, and fauces, in persons whose systems are universally deranged by the abuse of mercury, and such is mortification coming on as the effect of scorbutus, typhoid fevers, and the disease termed cancrum oris. In mortification from debility, a local accumulation of blood generally constitutes the first perceptible change in the part. This may take place from the part being subjected to pressure, slight friction, puncture, or other similar causes. "In some of these cases the blood accumulates, partly from the influence of gravitation and partly from compression of the veins."

The treatment of all these descriptions of mortification requires the removal of the predisposing and exciting causes. The constitution must be strengthened, and its derangement, whatever that may be, rectified, and the pressure, friction, or other irritation, acting as the exciting cause of mortification, removed if practicable.

### MORTIFICATION FROM INJURY OF LARGE ARTERIES AND NERVES.

In the arrangement of the arterial system, nature seems as if she had foreseen the danger that would arise from an interruption of the supply of blood, and she has, therefore, so multiplied the reciprocal communications or inosculations, in all the different orders or branches of this system of vessels, that the largest trunks are tied almost daily by the enterprising hand of the modern surgeon, and yet, if there be not other causes concerned, this single one is rarely followed by mortification. She appears, however, not to have extended in an equal degree a similar cautious and provident arrangement to the nerves. The destruction of a principal trunk, in this latter system, is invariably followed by paralysis; and, when this circumstance is coupled with the division or ligature of the principal artery of the same limb or part to which the branches of that nerve are distributed, the chances of mortification are much increased. There are, however, some facts recorded, which prove, that the communications of some of the smaller nerves are sufficiently direct to qualify them to become, in point of function, substitutes for each other.

I have said, that the division or ligature of the main artery of a limb and of the principal nerve, together, may occasion mortification. Cases are related in which the consequences were only a paralysis and wasting of the member; but Delpech was not aware of any instances of this kind, where the lower extremity was the part concerned; and, with respect to the arm, which is not supplied by a single nerve, hardly any sort of accident can injure the whole of the brachial plexus; the median being the nerve, which is commonly wounded, or tied, with the artery. He observes, however, that notwithstanding the advantage of several nerves, it has almost always happened, that when the nerve accompanying the axillary artery has been included in a ligature with it, the limb has mortified.*

It is true, that, in many of these cases, we are also to take into the account the share which a large, extensive wound of the soft parts, or their contusion, laceration, &c. have in the production of gangrene. We rarely or never see a case, in which the injury simply consists in the division or ligature of the main artery and one of the principal nerves of a limb, unaccompanied either with great additional injury, much weakness from the profuse and sudden hemorrhage, the irritation of a previous operation, the injection of the cellular tissue with blood, or a diseased state of the member, any of which conditions may be such as to have considerable influence in bringing on gangrene. On the whole, perhaps, we are not yet authorised to infer, that the mere interruption of the circulation through the main artery of a limb, and the simultaneous stoppage of the nervous influence derived from one of the principal nerves of the member, would generally occasion mortification, if there were no other additional violence, nor injury, existing in the part or constitution.† Whatever may be the result of future experiments upon

* Précis des Maladies reputées Chirurgicales, t. i. p. 98.

† Some years ago I was present with Mr. G. Young at an operation, in which Mr. Lawrence divided by a circular incision, not only the principal arteries and nerves of the finger, but every fibre of the part, with the exception of the tendons and bone. Yet, contrary to all expectation, the blood still gushed profusely from vessels, which could only receive their supply of blood through the medium of such ramifications as passed through

this point, no doubt, I think, can be entertained of the fact, that when the stoppage of the circulation through the main artery of a limb is conjoined with loss of the nervous influence in the same member, there is always a much greater risk of mortification, than if the case were simply an interruption of the flow of blood through the vessel. Indeed, so great is the success which now attends operations on aneurism, that I might perhaps assert, with perfect accuracy, that gangrene never arises solely from the ligature of an arterial trunk unless the patient be of advanced age; the circulation languid from previous debility; many of the collateral branches destroyed or injured; or some other important cause co-operate in producing the evil.

When mortification follows the ligature, or division, of a principal artery and nerve, the part is from the first cold, insensible, heavy, benumbed, and motionless; its natural heat is permanently lost; the pulsation of its arteries cannot be felt; the cuticle separates; the skin becomes brown and shrivelled; and fetid exhalations soon leave no doubt of the nature of the mischief. This species of gangrene is usually very extensive, being a sphacelus affecting the whole of the limb. It is somewhat less dangerous when it comes on later, and begins at the extremity of the limb; under which circumstances, its progress is ordinarily slower, and its effects sometimes restricted to a partial destruction of the member.

When once this kind of mortification has arisen, every means which it is in the power of the surgeon to adopt will be found insufficient to stop its progress. Hence, in tying the main artery of a limb, too much care cannot be taken to exclude from the ligature the accompanying nerve. We should also avoid every thing likely to obstruct the circulation through the collateral branches and capillary system of vessels. After operations for aneurism no compression should be employed, and the limb kept moderately warm.

When the case is decidedly an extensive sphacelus, the only chance of preservation depends upon the immediate performance of amputation, high up; and, if practicable, above the place where the artery has either been divided, or tied. In certain examples, however, in which the first appearance of mortification does not happen till some days after the injury, when the sloughing occurs at the extremity of the limb, and is slower in its advances, the disorder will sometimes terminate in a partial destruction of the integuments of the hand, or foot, and the limb may be saved. But here the surgeon must be most vigilant; for if, in his anxiety to avoid operating, he give the disease time to extend up the limb, the patient will certainly lose his life.

### MORTIFICATION FROM PRESSURE.

Somewhat related to the kind of mortification, which we have just now described, is that which originates from pressure, whereby the circulation in the smaller vessels, and the nervous influence in the parts, are interrupted. However, the great extent of the capillary system, and the

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the tendons and bone. It was equally curious, that though the principal arteries and nerves were all fairly divided, and the cut carried entirely round the part, mortification was not the consequence. The operation succeeded in checking the progress of an aneurism by anastomosis, which had increased and become attended with many unpleasant symptoms, notwithstanding the radial and ulnar arteries had both been previously taken up by Mr. Hodgson. Some account of this case is given in Medico-Chir. Trans. vol. ix. part 1. p. 216.

prodigious number of its inosculations, make the circulation in it so free, that it must be a powerful and long-continued pressure to stop this important function. The cause may act either upon a limited point of the external surface of the body, or upon the whole circumference of a limb; and, in both instances, the effect may extend to a greater or lesser depth. When the constitution is enfeebled, pressure much more readily brings on mortification. Of this every surgeon of experience must have seen repeated proofs in the mortification which attacks the integuments covering the sacrum, os ilium, trochanter major, scapulæ, heels, and elbows of patients who have been long confined in bed by fevers, injuries of the spine, bad fractures, &c. The constant pressure of such parts of the skin, between the bedding and bony prominences, obstructs the circulation through them at a period when the flow of blood is already languid from general debility. They become soft, of a dull brown, or purplish colour, red at the circumference, œdematous, and, at last, black and senseless. The sloughing commences at the point where the pressure is greatest; thence spreads more or less widely, and terminates in the formation of a foul, ill-conditioned, gangrenous ulcer. Some cases present themselves, in which the skin is so extensively destroyed, that, upon the separation of the slough, the sacrum and neighbouring bones are denuded, and visible at the bottom of the ulcer, the discharge and irritation from which prove rapidly fatal. Patients sometimes get over severe fevers, bad fractures, &c., and ultimately fall sacrifices to this secondary disease.

With respect to the treatment of this particular case, I need not remind the practitioner, that he should always be apprehensive of this species of sloughing in patients, who are weakened by disease and compelled to lie for several weeks and months in bed. In cases of injury or disease of the spine, of compound fractures of the lower extremity, of fractures of the neck, of the thigh-bone, and in typhoid fevers, such mortification is much disposed to occur. He ought, therefore, to prevent the occurrence by now and then shifting the posture of the sick; and, especially, he should not forget to examine from time to time the state of the parts most subject to attack. On the first appearance of any redness, or discolouration in them, they may be bathed with the liquor plumbi acetatis dilutus, and then covered with a piece of the emplastrum plumbi, or, what is still better, the emplastrum saponis. The posture should at the same time be so altered that the parts affected may not be lain upon. The judicious arrangement of small pillows, or cushions, under particular points, will often give the surgeon essential assistance in the accomplishment of this highly important indication; and of late years the hydrostatic bed has been employed with considerable advantage. When sloughing and ulceration have actually taken place, the following applications are in common use: lint dipped in camphorated spirit, or turpentine; carrot or emollient poultices; lint wetted with a solution of opium, or a solution of the chloruret of soda in the camphor mixture or distilled water; and common pledgets. This indetermination concerning what is really the best kind of dressing, sufficiently proves that not much is to be expected from the virtues of local applications. Improving and strengthening the constitution; changing the patient's posture; the use of the hydrostatic bed; and, above all things, the strictest attention to keeping the parts affected clean, and to the avoidance of whatever is irritating to them; are the great leading principles by which the surgeon should be governed.

The circular compression of limbs by tourniquets and tight bandages, if continued too long, will induce mortification. The smaller the extent of the compression, the greater is the risk; and bandages, which operate equally upon every part of a limb, though they may be somewhat tenser, can be borne with greater safety than a narrow band or ligature, which acts only upon a very confined space. Yet, let it not be imagined, that the danger of immoderate, long-continued compression is entirely obviated by equalising the pressure, and increasing the extent of the compressed surface. There are few surgeons, who have not beheld melancholy proofs of the fatal consequences of tight bandages. The greater skill now generally evinced in equalising the pressure upon the whole limb, we must admit, has much diminished the number of these unfortunate examples; but they do still sometimes happen. A surgeon, therefore, should never forget, that, frequently when he is applying a roller, the nature of the disease or injury will necessarily be followed by a great deal of swelling, and for this due allowance should be made in first putting on the bandage. For the same reason, the part should be from time to time carefully examined, and if found to be too much constricted, it should be instantly liberated. Compression is only safe, while it gives no uneasiness; and, when it appears to produce pain, the suspicions of the practitioner ought to be immediately awakened to its dangers. In the practice of surgery, it is sometimes proper to wet bandages with cold water, or particular lotions; but, whenever this is done, the fluid makes the linen shrink so considerably, that, if the change be not guarded against, the constriction produced will often bring on a rapid mortification of the limb, and the death of the patient. Let surgeons also continually bear in mind, that tourniquets are only designed as temporary means of suppressing hemorrhage, and that if their application be long continued, they will surely have the most disastrous consequences. The perils of immoderate circular compression of limbs proceed, not only from the obstruction which it causes in the circulation, both through the arteries and veins, especially the latter, but also from the interruption of the nervous influence and action of the absorbents. It is a remark made by Professor Carswell, that although the physical characters of mortification, produced by a mechanical obstacle to the venous circulation, present considerable variety in different organs, they present one common character, viz. an excessive accumulation of blood in the venous system, trunks, branches, and capillaries of the affected part. There is a great accumulation of serosity in the cellular tissue, which by its pressure further retards the return of blood, and has a chief share in bringing on mortification. It is likewise this accumulation of serosity beneath the skin that at first conceals the congestion of the venous system. Stagnation of the venous circulation may depend on obliteration of veins by pressure, by accidental products formed in their cellular sheath, by the presence of fibrine or other solid substances within the veins, and, lastly, by diseases of the heart greatly interfering with the return of the venous blood.*

With regard to the treatment, the indication in an early stage of the mischief is very simple, viz. to remove the bandage, or tourniquet, and have recourse to fomentations. When the disorder has advanced further, and actually amounts to gangrene, the conduct of the surgeon must be regulated by the extent of the mischief. If it be partial, let him, after removing the compression, foment the parts and vigilantly observe the

* See Dr. Carswell's "Illustrations of the Elementary Forms of Disease," Fascic. 7.

changes which occur; for it is the nature of this species of mortification often to spread with incredible rapidity up to the very trunk, and thus in a few hours destroy every possibility of saving either the patient's limb, or his life. Whenever there is reason to apprehend that the case will be of this serious description, if amputation be delayed, the operation should be adopted as the only possible means of affording the patient any chance of preservation.

### MORTIFICATION FROM THE DELETERIOUS INFLUENCE OF CERTAIN POISONS.

As illustrations of it, I may mention the mortification of the cellular tissue consequent to the bites of venomous reptiles; the disease called *hospital gangrene;* the *malignant pustule*, and the form of mortification arising from the use of unsound rye as an article of food. The subcutaneous gangrenous mischief, following the bites of snakes, will be described under the head of *poisoned wounds.*

*Hospital gangrene* is very different from every other form of mortification, not only with respect to its appearance, mode of occurrence, and the peculiarity of its causes, but also with regard to its treatment. It is characterised by its contagious nature, its disposition to attack wounds and ulcers in hospitals crowded with such cases, and by its conversion of the soft parts into a putrid, glutinous, or pulpy substance, and not into a firm distinct slough, like what is formed in other species of mortification. On this account, it is sometimes classed with ulcers, and even named the *hospital sore;* and there is really some difficulty in deciding, whether it should be arranged with mortification or with ulcers. Certainly, it has a very strong resemblance to the worst forms of phagedenic ulceration.

True hospital gangrene is undoubtedly communicable by the application of the discharge to an abraded or ulcerated surface in another person. It must, however, have its first origin in some other way, and Dr. Carswell considers it as affording an example of a septic agent being generated in a morbid condition of the solids, and giving rise to a similar disease, when communicated from one individual to another, by means of the dressings, or other direct modes of transmission. Upon an abraded surface, it begins in the form of one or more small vesicles at the edge of the abrasion. These vesicles are very soon converted into greyish or ash-coloured sloughs; or if they happen to contain a dark-coloured fluid, and to burst, they put on the appearance of a thin coagulum of a dirty brown colour. At the same time, the part becomes acutely painful, and a pulpy slough is rapidly formed over the whole sore. Hence, by Gerson, the disease is actually named *pulpy gangrene.*

When this pulpy substance comes away, the subjacent surface presents a healthy granulating appearance; but, this favourable look is only transient, as the destructive process soon begins again.

When hospital gangrene attacks a wound or ulcer, the part becomes painful, and a viscid light-coloured matter exudes from the granulations, which lose their red colour, and exhibit spots of a greyish dirty white hue, resembling aphthæ. These spots, all uniting together, completely change the look of the whole wound. The parts have also a much greater disposition to bleed, than what is noticed in any other variety of mortification.

A red purplish œdematous circle is next formed in the surrounding skin. The edges of the ulcer become hardened and everted; and the

sloughs, such as they are, put on the appearance of the fœtal brain in a putrid state.

Hospital gangrene spares hardly any textures. Amongst the severe cases, seen by Mr. Blackadder in the military hospitals in Spain, there was one, in which one half of the cranium was denuded, and as black as charcoal. In another, the large arteries and nerves of both thighs were exposed and dissected, the integuments and cellular tissue being entirely removed, with the exception of a narrow strip of skin at the external side of each of the limbs. In other instances, the cavities of large joints were extensively laid open; and, in one man, all the skin and cellular tissue of the neck were completely destroyed. In *the advanced stage*, hemorrhages come on; the bleeding can rarely be stopped by ligatures; no coagulum is produced in the vessels, nor does any healing process take place in them. The pulse is rapid and feeble, and the tongue covered with a brownish or black fur. At an earlier period, the pulse is fuller and not so quick, and the tongue generally white. In many examples, the lymphatic glands are affected with inflammation and swelling.

As for the *prognosis*, this disease is universally admitted to be one of the most dangerous complications to which wounds and ulcers are liable. Slight cases may sometimes be cured, but the more severe ones generally prove fatal, and this, in many instances, by a repetition of attacks.

The exciting cause of hospital gangrene is commonly believed to be *an infection generated in a crowded hospital*, and especially *one filled with wounded persons*. The situation of such hospital on low marshy ground, and the hot season of the year, are generally considered to promote the origin and extension of the disease.

Although the most experienced army surgeons concur in the belief, that hospital gangrene spreads by contagion, little doubt can be entertained, that the number of cases is also increased by the operation of the causes, which give rise to the first examples of it in any particular hospital. Unless we adopt this view, we should not be able to explain the commencement of the disease in the patients first attacked.

In the early stage, bleeding is recommended by some, and condemned by others, who also object to it on the ground, that there is risk of the puncture becoming itself infected. Bark generally proves unavailing. Emetics have been tried, and, though occasionally spoken of with approbation, they are mostly represented as inferior to purgatives. In every stage of the disease, unattended with diarrhœa, the citric and diluted sulphuric acids have beneficial effects; and, with respect to opium, the agony of the disease is such as always to render its employment in some form or another indispensable. However, on the whole, it may be stated, that no internal remedies can be depended upon for stopping hospital gangrene.

The patient, if possible, should be removed from the hospital, and put into another well ventilated building; and the linen, bedding, and floor sprinkled or washed with a solution of the chloride of lime or soda.

During the last war, the French had a great deal of hospital gangrene in their military establishments, and, at that time, their practice consisted in applying the actual cautery to the parts affected. Now, however, they seem to place great confidence in the solution of the chloride of lime or soda; such confidence, that Lisfranc has expressed a belief, that, by these means, the disorder will be kept in future from committing the kind of ravages formerly observed. The report of the effects of the

latter on the disorder, as it occurred amongst the wounded in the French army at the siege of Antwerp, is also favourable.*

Mr. Blackadder recommends liquor arsenicalis, diluted with an equal quantity of water, as an effectual application. He first washes the diseased parts with a solution of the subcarbonate of potass, and then dips lint in the arsenical lotion, and lays it on the parts, the lint being renewed every quarter or half an hour. After the sloughs separate, the surface is dressed with gently stimulating ointments. Mr. Welbank regards gangrenous phagedæna, especially that form of it met with in the wards of hospitals appropriated to syphilitic patients, as the same disease as hospital gangrene. In its treatment, he prefers applying to the parts the undiluted nitrous acid, in the manner to be noticed when we come to the subject of phagedenic ulcers. Delpech speaks very favourably of the effects of hydrochloric acid as a local application.

### MORTIFICATION FROM EATING UNSOUND GRAIN, ESPECIALLY SPURRED RYE.

This, which is one of the worst forms of mortification, and generally attacks the lower extremities, is sometimes accompanied, or preceded by vertigo, drowsiness, and a malignant kind of fever, with a sensation of numbness in the legs, which are painful, slightly swollen, but not inflamed. The skin is cold and livid, and the sphacelus commences in the centre of the limb, not at first involving the skin. In a second series of cases, the sphacelated parts are dry, livid, or black; these appearances commencing in the toes, and extending gradually upwards as far as the thighs. In a third series of cases, the disease commences with lassitude, and a sensation of insects creeping under the skin, but without any febrile symptoms. Soon afterwards, the extremities become cold, pale, wrinkled, and benumbed, and at last quite insensible and incapable of motion, acute pain being next experienced in the centre of the limb. There is now fever and headach, pain extending from the hands and feet to the shoulders, legs, and thighs; and next the affected parts become dry, shrunk, and black, and drop off at the joints. Entire limbs are thus separated without hemorrhage. Lastly, in other cases, the chief symptoms are at first spasmodic contractions of the limbs, afterwards great mental weakness, voracity of appetite, and fatuity, followed by sphacelus.† In the treatment, the immediate discontinuance of the deleterious article of food, the support of the constitution by tonics, and suitable diet, and the promotion of the separation of the sphacelated parts, are the chief indications. It is an example of mortification unpreceded by inflammation, and probably taking place, as Professor Carswell suggests, by the operation of the poisonous grain on the parts affected, through the medium of the blood, or nervous system.

A remarkable instance has lately been recorded of dry gangrene in a child, three years and seven months old, where there was no possibility of ascribing the attack to any particularity in diet. The left leg and both arms were in an advanced state of destruction from dry gangrene. The right forearm had been detached by nature at the elbow-joint; but the slough had extended above the joint, where a second attempt at separation was in progress. The left foot had been entirely detached with the

* H. Larrey, "Hist. Chir. du Siége de la Citadelle d'Anvers," p. *55*.

† See Professor Carswell's "Illustrations of the Elementary Forms of *Disease*," Fasciculus 7.

epiphyses just above the ankle-joint, leaving the ends of the tibia and fibula exposed. From the right foot, the phalanges of the second and third toes had been removed.*

The forms of mortification exhibited in malignant pustule, carbuncle, and phlegmonous erysipelas, and those occasioned by exposure of the animal textures to high degrees of heat or to very low temperatures, will be described in subsequent parts of this work.

### OF AMPUTATION FOR MORTIFICATION.

In many accidental injuries, the operation should be performed without any delay, so that mortification may have no time to begin. Numerous gun-shot wounds of the extremities, badly lacerated and contused wounds, and severe compound fractures, will inevitably be followed by gangrene, and the patient's death, if an imprudent attempt be made to save the part. Here amputation should be done immediately after the accident, the wound of the operation being infinitely less hazardous, than an extensive and spreading sphacelus.

As a general rule, it is best to leave the separation of a slough chiefly to nature. There are two exceptions to this maxim: the first is, *when one part of the slough is perfectly loose*, while the rest of it continues attached; under these circumstances, the loose portion should be gently cut away, and removed at once, so as to lessen the fetid effluvia, and allow the healing processes to commence in the situation of the loosened slough. The other exception is, *when the whole thickness of a limb is mortified; but, unless the mortification be traumatic, the line of demarcation must be awaited, as well as a favourable state of the constitution for amputation.* However, even in this case, if the patient lived long enough, nature would complete the separation. The soft parts would first separate down to the bones; the bony connexion itself would afterwards be destroyed by a slow process, termed *exfoliation;* and the ulcer finally heal. Yet, leaving the detachment of the whole thickness of a mortified limb to be accomplished by nature is seldom advisable, because the patient would not usually outlive the profuse discharge, the tedious confinement, and the long continued irritation, which he would have to encounter. Then another objection to the plan is, that, if he were to get through these difficulties, and live till the dead portion of the limb had completely separated, and the parts healed, he would remain with an unserviceable stump, one not properly formed, not capable of bearing pressure, and such as would never continue firmly healed.

In mortification, the precise time for the performance of amputation is a consideration of the highest importance. Some years ago, the common rule in surgery was, never to amputate until the progress of the mortification had been stopped, and the red line of separation had been formed. This maxim ought still to be observed in every instance of mortification proceeding from internal or constitutional causes. Here, we have a criterion, by which the question is at once easily settled. We must not amputate in mortifications from internal causes, until the red line of separation is distinctly formed; that is, until the disorder has ceased to spread, and has become bounded by the adhesive inflammation. In truth, sometimes amputation may be advantageously deferred even beyond the period of the first appearance of the line of separation, and of the stop-

* S. Solly, in "London Med. Gazette" for June 1839.

page of the mortification. Such delay would be proper, if the patient were so reduced at the critical moment in question as to be likely to die under the operation. Here some little time should be allowed, in order to let the system rally, which it will sometimes do, with the aid of opium, tonic medicines, a moderate quantity of wine, or brandy, light nutritious food, and the admission of plenty of fresh air into the patient's chamber. For the purpose also of lessening the disagreeable effluvia, a solution of the chloride of soda, or lime, may be employed with great advantage. The dead parts should be covered with linen wet with it, and the floor be washed or freely sprinkled with it.

The next thing which I am anxious to explain is, that modern experience does not confirm the propriety of awaiting the formation of the red line of separation, or, in other words, a decided stop of the disorder, in every example of mortification before amputation is practised. The wisdom of the rule is acknowledged in mortifications from *internal causes;* but, if the maxim were extended to some other examples, the patients would certainly go to their doom without having, what may be called, a fair chance of being saved. They would die before the mortification had stopped, or sink into a state, in which the performance of amputation would be altogether hopeless. We are under great obligations to Baron Larrey for many convincing facts and arguments in proof of the necessity of deviating from the ancient rule in what he calls *traumatic gangrene*, or *the mortification arising from gun-shot wounds, compound fractures, and other forms of external violence.* In such cases, it would generally be absurd to think of waiting for the mortification to stop, or for the appearance of the red line of separation, because the patient would almost always die of the extension of the disease, and its effects upon the whole constitution, before such appearance presented itself — sometimes in the short space of six hours.

Now, it is found, that if amputation be done early, and in a sound part of the limb, sufficiently distant from the sloughing, the stump will, generally, not be seized with mortification, and the patient will have by far the best chance of recovery.

I have recommended this practice to be adopted in several cases, in which I have been consulted; and, in the army, I had many opportunities of doing the operation myself, under the circumstances which have been described, that is, where the mortification was spreading, and mostly with success. A few years ago, I was consulted by a glazier, who had fallen from a ladder, and met with a compound fracture of the lower end of the humerus, in consequence of which the hand and forearm were seized with a rapidly spreading mortification. In fact, when I was called in, the hand and forearm were in the state of sphacelus, and the cellular tissue of the upper arm was distended with serous fluid up to the shoulder. The patient was at the same time beginning to be affected with stupor and disorder of the intellectual faculties, and his pulse was weak, rapid, and irregular. As there was no time to be lost, the limb was immediately amputated at the shoulder joint. Every thing went on favourably after the operation for five or six weeks — the stump healed, with the exception of a trifling fistulous opening; but, just at this period, when a complete cure was expected, an extensive abscess formed over the scapula, and ultimately proved fatal. However, as this patient would certainly not have lived twenty-four hours from the time of my first visit if the operation had not been done, I deem the case to be one strongly in favour of the rule of amputating in traumatic gangrene, even while the

disorder is yet in a spreading state. Some practitioners make one exception to prompt amputation in traumatic gangrene, viz. where it arises in a bad habit of body from a slight mechanical injury. Here, under any treatment, the prognosis must be unfavourable.

*Mortification of the foot from injury of the femoral artery* by a bullet, or other mechanical means, is another instance in which the old maxim should be abandoned. Here the only chance of saving the patient's life depends upon the early performance of amputation, as high up at least as the wound in the artery.

*Mortification from obstruction of the circulation by aneurism, or after the ligature of the artery for the cure of that disease,* or *for the stoppage of hemorrhage,* furnish additional exceptions to the rule of not amputating until the line of separation is formed between the dead and living parts. Here the sloughing generally commences at the extremity of the limb. I believe, indeed, that the mortification, following the ligature of an artery for the cure of aneurism, is a case in which, whatever may have been inculcated with regard to other forms of gangrene, the early performance of amputation, at some distance from the dead part, has always been recommended; and the old surgeons themselves never waited until the mortification had actually stopped. Before deciding to amputate, however, we must be sure, that the mortification involves the parts more deeply than the skin; for a partial sloughing of the integuments of the foot after aneurism sometimes takes place, the ulcer heals up, and the limb is preserved.

In the seventeenth volume of the Med. Chir. Trans. I recorded the particulars of an aneurism in the ham, which, in consequence of the sac bursting under the upper part of the gastrocnemius, and the copious effusion of blood in the cellular tissue of the leg, down to the very heel, was followed by mortification. Tying the femoral artery had no effect in checking its progress, so that I was compelled to amputate just on a line with the ligature on the femoral artery five days after the operation for aneurism. Now, although the limb was amputated *while the mortification was spreading rapidly,* a great part of the stump healed by the first intention; and the patient, an organ builder, now living in the Waterloo Road, was soon able, with the assistance of a cork leg, to follow his trade again.

## ULCERATION AND ULCERS.

*Ulceration* is the process by which an *ulcer* or *sore* is produced; an operation, in which the absorbent vessels are usually supposed to be more actively concerned than the arteries.

An *ulcer* or *sore,* previously to the stage in which it is filled up by granulations, is a *chasm* formed on some external or internal surface of the body by the removal of portions of the tissues back into the system, the absorbents appearing as if they took away the old particles more quickly, than substitutes for them are prepared and deposited by the action of the secerning arteries.*

* "The term *ulcer* is indiscriminately applied to the vacancy that is caused by absorption, and to the same part, when filled up with granulations, secreting pus, and perhaps

Morbid absorption of the solid parts, or that which takes place without being accompanied by a corresponding deposit and repair, may extend to the whole machine, every part of which shall become smaller and lighter; or it may be limited in its operation to some particular part, organ, or region. Examples: 1. The wasting of the body in febrile diseases, or of muscles in paralysis, and atrophy of the testicle from various causes. This form of morbid absorption is termed *interstitial*, because it takes place in the interstices of parts, which still remain entire.

2. Another form is that by which the solid parts, covering abscesses, aneurisms, and deep-seated tumours, are thinned and removed. To this Mr. Hunter applied the expression *progressive absorption*, apparently on account of its being the means by which tumours and foreign bodies make progress in any particular direction. The phrase has been criticised, because all absorption is really progressive, and in this objection to it I fully concur.

3. A third modification of morbid absorption is denominated *ulcerative*, in which not only a loss of substance, but a solution of continuity—an ulcer is occasioned. *Ulcerative absorption*, therefore, is only a synonyme of *ulceration*.

*Ulceration* is a process very different from *erosion*, or from any sort of decomposition, or destruction of parts by chemical agents. It is not produced by any imaginary corrosive properties of pus or the fluids of the part affected. Healthy pus has no corrosive qualities: indeed, in the early stages of ulceration, and while the ulcerative process is extending with the greatest rapidity, hardly any of this fluid is formed; yet when the pus is abundant, and therefore most likely to produce corrosion, if it had the power, the ulceration has stopped, and the sore is generally healing.

Some writers offer what they call a physiological explanation of the chief phænomena of ulceration; but what they say amounts to nothing more than a statement in different terms of the circumstances I have explained. Thus, when we are told, that nutrition ceases in an ulcerating part, while the destructive action of the absorbent system continues, we are merely informed in other words, that the old particles of the textures attacked by ulceration are taken away by the absorbents, without any effectual attempt to replace them being made by the arterial system.

While ulceration is going on, the secerning arteries, those organs which, in the natural and healthy state, bring and deposit the new materials of every part of the body in proportion as the old are removed, appear to lose this power, and even they, as well as the rest of the organisation, are taken away; nay, after the process of ulceration has begun, the absorbents themselves, which once existed in the situation of the chasm, are no longer there; they have disappeared, and not a vestige of them, nor sometimes perhaps of any other part of the previous structure, remains. It is commonly presumed, therefore, that so long as ulceration is spreading, the unsparing action of these very busy organs, these minute vessels, is accomplishing their own destruction, as well as that of every other constituent part of the textures affected.

There is a limit, beyond which nature will not allow us to pry into her secret and mysterious operations; and our knowledge of the *theory* of ulceration is very confined.

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daily proceeding to be healed. An ulcer, in the state in which it is commonly 10.)
the conjoint product of absorption, and of a new growth." (*Macartney*, op.

When we express a difficulty in conceiving how a part of the body can be removed by itself, we cannot get that difficulty obviated by our being referred to some other inexplicable, but unquestionable operation or fact, exemplified in the animal economy. Thus, when I am told, that there is not more difficulty in understanding how parts of the body can remove themselves, than in comprehending how they can form themselves, the position may be true, but it leaves me in the same uninformed state, respecting the minutiæ of ulceration, in which I found myself previously to this reference or comparison.

It is even uncertain whether in ulceration the veins may not have a considerable share in the removal of the tissues; for they are known to be enlarged in the immediate vicinity of the seat of ulceration, while the lymphatics themselves are alleged not to be so.

Whatever may be the agents of absorption on this occasion, whether lymphatics, or veins, or both descriptions of vessels, and whatever may be the exact manner in which these vessels are themselves removed in the process of ulceration, we may conclude with John Hunter, that when it becomes necessary that any of the substance of the body should be removed by the actions of the system itself, nature must not only confer new activity on the agents of absorption, but put the tissues about to be absorbed into a state which yields to this operation.

*All textures do not ulcerate with equal readiness.* It is true, that every organised part of the body seems liable to ulceration; but we see this process much more frequently in the cutaneous and mucous textures than others. The synovial membranes are often the seat of ulceration, as we see exemplified in the progress of inflammation of joints, and especially scrofulous disease of them. Muscles, fasciæ, and the trunks of nerves and blood-vessels resist the ravages of ulceration for a considerable time, far longer than skin, cellular membrane, or mucous tissues. The process of ulceration is rare in serous membranes; and, when it does occur in them, their contiguous surfaces have generally contracted adhesions, through which the ulceration proceeds.* Some of these facts are exemplified in the progress of abscesses to the surface of the body, which do not usually make their way through muscles by causing ulcerative absorption of any portion of them, in order to reach the surface or nearest part of the skin, but often take a very circuitous course, through the cellular tissue, to the point where they present externally.

Ulceration seldom begins originally in muscle, tendon, fascia, a serous texture, blood-vessels, absorbents, or nerves, though, in the progress of disease, all these tissues and organs may be attacked. When a limb mortifies, and the patient continues to live, the ulcerative process, by which the dead parts are detached from the living, gradually extends through all tissues.

Arteries of magnitude, situated in the midst of ulceration, do not readily ulcerate themselves, except in cancer, hospital gangrene, and certain forms of phagedæna termed gangrenous. Even in the midst of phagedenic ulceration and hospital gangrene, a large artery will often lie a considerable time without giving way, and, when the bleeding commences, it is mostly not from the trunk, but from the branches.

It would seem, from investigations made by Cruveilheir in France, and Mr. Key, in this country, that, in the ulceration of some textures of inferior vascularity, like tendons and cartilages, there is formed, previously

* See Dr. M. Hall's "Principles of Medicine," p. 27.

to the commencement of the ulcerative process, a vascular substance between the fibres of the tendon, or by the synovial membrane immediately in contact with the cartilage, and that such new vascular substance becomes the organ by which such tissues are removed. This view, however, which is not adopted by my friend Sir Benjamin Brodie in relation to diseases of joints, requires further examination. Fasciæ, tendons, and ligaments are the tissues least subject to ulceration.

I have represented an ulcer to be a *chasm, a solution of continuity, produced in some internal or external surface of the body by the process of absorption*, and have stated that the absorbents, whether lymphatics or veins, appear to be more actively concerned in the formation of such chasm, than any other order of vessels.

That the vessels, which are the organs of absorption, are the principal means by which the ulcer is produced, seems to be corroborated by the fact, that, in particular states of the constitution, when old sores break out afresh, the callus, or substance forming the bond of union between the extremities of old fractures, is removed, and the bones, which perhaps have been firmly united for many years, suddenly become flexible, and the fractures are disunited again. Such occurrences were exemplified in the crew of the Centurion, in Lord Anson's memorable voyage.

These facts prove the truth of one of Mr. Hunter's doctrines, viz. that all parts not entering into the original structure of the body are weaker than the rest of our organisation, and, on this account, more prone to ulceration and mortification. A cicatrix is a substitute for the old and original skin, but, it is inferior to it in vital power; and the same is the case with callus, as compared with the primitive osseous texture.

### SYMPTOMS OF ULCERATION.

The formation of an ulcer is preceded by more or less pain, heat, redness, a degree of swelling, and other marks of inflammation in the part. The pain is mostly of a sharp pricking or lancinating kind, though it varies in different textures, in the different kinds of disease productive of ulceration, and according as the ulcerative absorption is quick or slow. In numerous instances, the cuticle is loosened, and a little vesicle or pustule is formed, and on its bursting, a breach is discovered in the subjacent surface of the skin. Sometimes there is at first a single minute excavation; sometimes several ulcerated points contiguous to one another, which quickly joining together, make a sore of some magnitude. On a mucous membrane, ulceration often begins with small, round, ash-coloured solutions of continuity, as familiarly exemplified in the mouth and fauces.

The existence of inflammation as an attendant on ulceration is proved not merely by the circumstances already specified, but by the regular closure of the canals of the large blood-vessels, as the particles of the tissues attacked are taken away. At all events, it is the modern doctrine, that such closure is effected by means of the adhesive inflammation.

While no attempt at reparation is made, ulceration always presents an excavation or chasm, the edges of which are red, sharp, and often jagged and irregular. The surface of the exposed textures is of a dirty white or yellowish colour, with an appearance of shreds upon it, as if every atom of the parts destroyed had not been completely removed. The surface is also generally covered with a thin discharge, or a kind of sanies, or thin matter frequently tinged with blood.

While ulceration is extending itself, the margin of the adjoining skin

is hot, red, and painful; but directly a disposition to heal commences, this state ceases. If not checked, ulceration may extend to any depth, and affect any textures. In many instances, the ulcerative process appears to be diffused over a considerable extent of surface; and in others again, it is limited to a very narrow line, producing a chink or fissure, an appearance similar to that which occurs in the separation of mortified parts.

The progress of ulceration is extremely various in different textures, and in the same texture in different individuals, according to the nature of the inflammation, and no doubt also according to the particular constitution of the person in whom it occurs. In some instances, it is exceedingly slow or chronic in its progress, the sores which it forms remaining for a long while open, without any disposition to spread. In other cases, ulceration advances with great rapidity, removing or destroying considerable portions of the body in a few hours.

### ULCERS.

If we restrict the definition of an ulcer, or sore, to a chasm or breach in the solids, occasioned by the process of ulceration, we then have no difficulty in determining what cases should be classed as ulcers; but certain cases are frequently termed ulcers, which are not formed in this manner. Thus, when a suppurating and granulating surface is the consequence of a wound, that has continued for a long while unhealed, there may be the appearance of a cavity from the simple retraction and separation of the parts; but none of their substance may have been truly removed, either by the accident itself, or by any subsequent action of the absorbent system; yet it is not uncommon to give the name of *ulcer* to a case of this kind, which was originally a wound.

In mortification, both *acute* and *chronic*, the sloughs are loosened by a process similar to common ulceration, by what Dr. John Thomson has proposed to called *disjunctive absorption*. In these instances, therefore, the surface, exposed by the detachment of the slough, will certainly come within the definition of an *ulcer*.

The same must be the case with the *solution of continuity, resulting from every abscess that bursts of itself*, because, after the skin has been thinned to a certain extent by progressive absorption, ulcerative absorption takes place. If *suppurating wounds, after a certain duration*, are to exchange their name for that of *ulcers*, then one common definition of an ulcer will not be applicable; viz. *a solution of continuity in the solids, accompanied with loss of substance, and a discharge of purulent matter*. Nor would Callisen's definition answer, "a solution of *continuity gradually produced in organised parts*." But, if the term ulcer be restricted to the effects of the process of ulceration, then, of course, *loss of substance*, and the *gradual manner* in which the chasm is produced, are very good criterions. With this understanding, Callisen's definition is the best that I know of.

With respect to the *causes of ulcers*, the most frequent are *inflammation* and *abscesses*, which have burst; the *separation of sloughs; pressure on parts in a state of inflammation*, as is too often exemplified in the effects of chains on prisoners, of harness on horses, of badly padded splints on broken limbs; and of the long continuance of patients with fractures, fevers, paralytic affections, and other tedious diseases, in the recumbent position. Ulcers are also produced by many kinds and forms of *external irritation*. In the lower extremities, a frequent cause of ulcers is *a varicous*

*state of the veins.* The production of sores is frequently the consequence of *diseases, which begin in the bones, cartilages, or synovial membranes* of the joints, the ulcers in the soft parts being then generally preceded by abscesses. In some diseases of the joints, ulceration of the cartilages is one of the primary, or earliest changes.

But, ulcers frequently arise from *constitutional diseases*, several of which are of a *specific* nature, as is illustrated in scrofula, lues venerea, scurvy, cancer, and fungus hæmatodes. Hence, one of the best and most practical divisions of ulcers, is into *local* and *constitutional;* but, true and natural as it is, it should be adopted with a clear understanding, that many sores, which at first depend entirely upon internal causes, and are in the beginning of a *specific* nature, are often so materially changed, long before cicatrization is completed, that, in their latter stages, they are strictly *local* complaints.

On the other hand, many sores, which are at their commencement only of a *local* nature, and quite unconnected with internal causes, are afterwards changed, or influenced by some general affection of the system, and become in every sense of the expression *constitutional ulcers.*

*Ulcers continually vary in their nature and appearance with every fluctuation in the constitution or change of health.* Directly a patient, who has a healthy ulcer on his leg, or some other part of his body, secreting a due quantity of good pus from small granulations, of a florid vermilion colour, such as are seen in the best conditioned sores, is attacked by fever, a rapid change is noticed in the aspect of the sore, it will immediately become pale, and cease to pour out any other discharge, than a small quantity of thin ichor. Its surface then becomes dry, its granulations slough, or are absorbed, and the healing process is completely stopped.

*The state of ulcers likewise materially depends on the treatment of them.* Thus, by improper dressings, excesses in diet, and too much disturbance of the part, an indolent sore may be converted into a very painful and irritable one.

The *prognosis* generally depends, first, upon the *nature of the predisposing and exciting causes*, and the facility or difficulty of their removal; secondly, upon the *kind of parts attacked*, whether of great importance or not in the animal economy; thirdly, *upon the patient's age, constitution, and mode of life;* fourthly, upon the *extent of the ulcer;* fifthly, *upon its peculiar nature:* thus a venereal sore may generally be healed with facility, because one medicine is well known to exert considerable power over the venereal disease; but, a scrofulous ulcer is commonly much more difficult of cure, because we are in possession of no remedy so decidedly efficacious in scrofula as mercury is in the venereal disease. We know of nothing that will at once rectify that state of the system, with which a scrofulous sore is intimately connected. As for a cancerous sore, I believe, that it can never be cured, without some process, or operation, that has the effect of destroying, or extirpating the cancerous tissue. With this understanding, then, it would not be correct, to assert, that such a sore is absolutely incurable. I have known the whole of a breast, affected with carcinomatous ulceration, to be destroyed by sloughing, and the part afterwards heal. There was living very lately in Great Ormond Yard, Queen Square, a woman, above eighty, who had had cancer in both breasts, which, when I saw her, had entirely sloughed away, and healed up, leaving only some induration, and a prodigious disfigured cicatrix.

Ulcers on the trunk, or near the source of the circulation, generally heal in less time than others farther from the heart, or on the limbs; and every surgeon is well aware, that sores on the arms commonly heal with much greater expedition than such as occur on the legs. The depending position of the leg retards the return of the venous blood, checks the freedom of the circulation, and thus has a disadvantageous effect on the healing processes.

The process, by which ulcers heal, is precisely the same as that which brings about the cure of suppurating wounds. It includes the important subjects of *granulation* and *cicatrization*, which will be noticed when the treatment of such wounds as cannot be healed by the first intention come under consideration. Therefore, I shall merely observe at present, that when ulceration is checked, and the preternatural activity of the absorbents of the part is reduced, the capillary secerning arteries regain their power, and by their means a process of reparation is begun, by which the cavity of the sore—the chasm produced by the absorbents—is filled up with granulations, and the surrounding old skin gradually drawn a considerable way over the part originally occupied by the ulcer, so that, comparatively speaking, little new skin is required, which is rather difficult of formation, and never so strong and serviceable as the old.

In the *treatment of ulcers*, the chief indications are *to remove and diminish the causes which have given rise to their formation;* and to let the patient have the advantage of a *suitable diet* and *regimen*, particularly of *rest*, and a judicious *position* of the part, *pure air*, *cleanliness*, and such *internal medicines* and *dressings* as the circumstances of the case may demand.

With respect to *the removal of the exciting cause*, the necessity for it is so manifest as scarcely to need any comment. Supposing an ulcer were to originate from and be kept up by the presence of a dead portion of bone directly under it, how could we expect it to heal the sore so long as such piece of bone continued in the part? If a sore were to arise from scurvy, it would be in vain to attempt its cure, without removing that peculiar derangement of the health with which the local complaint is intimately connected. I have mentioned the effect of scurvy in causing the absorption of the substance composing a cicatrix, and of the uniting medium of fractures termed *callus*. How then can we be surprised at our inability to heal sores, while this disordered condition of the whole animal economy remains unrectified? In order to give some idea of the universal derangement of the system resulting from scurvy in an aggravated form, I may here refer to preparations in the Museum of University College, London, demonstrating that, in advanced stages of this disease, the muscular system is affected in a very singular manner, blood exuding from the vessels, and becoming copiously deposited between the muscular fibres.

Scrofula and syphilis, as exciting causes of ulcers, require the same principle to be acted upon, and so does a stricture in the urethra, as the cause of ulcers and fistulæ in perinæo.

Some other sores, if they are not produced, are certainly kept from healing, by *disturbance of the digestive functions*, the regulation and improvement of which then become essential indications.

However, I am far from meaning to assert, that every sore requires, as a matter of course, the exhibition of medicines; many sores will heal under the use of simple dressings without a single dose of physic being given. In all cases where the sore is healing well, and the constitution

sound, the utmost that the surgeon is called upon to do with medicines is to regulate the patient's bowels.

But *constitutional ulcers*, and especially those which are *specific*, *irritable*, *phagedenic*, or in any other way *ill-conditioned*, may often be more benefited by general than by local treatment. In the management of every description of ulcers, one grand object is *to keep the surrounding skin clean*, and not to let the discharge accumulate and dry upon it. Were this rule neglected, the skin would become irritated, and it will always be found, that when any inflammation is excited in the integuments at the circumference of an ulcer, it not only interrupts the healing process at the edges of the sore, but is likely to be followed by a renewal and extension of the ulceration.

All ulcers may be arranged under three classes: *healthy* and *unhealthy*, amongst which last are those termed *specific*. The first, or *healthy* ulcer, can only be of one kind — the *simple sore*, the simple purulent *ulcer* as it is sometimes termed — characterised by its freedom from all diseased action, and its disposition to heal up in the most favourable manner.

The *second*, or *unhealthy class of ulcers*, comprises *irritable*, *indolent*, and *phagedenic* ulcers; those connected with *varicous veins;* many others depending upon *disorder of the digestive functions*, and various definite or indefinite derangements of the health.

The *third class*, or *specific*, comprehends *scrofulous*, *cancerous*, *venereal*, *scorbutic*, &c. Many ulcers, proceeding from cutaneous diseases, are specific. We need not here dwell upon the absurdity and confusion of assigning the importance of distinct species of ulcers to those, which happen to be attended merely by accidental changes, or complications, to which all sores, without exception, are liable. Thus *fistulous* and *sinuous ulcer*, *inflamed ulcer*, *carious ulcer*, *sloughing ulcer*, and *fungous ulcer*, are expressions occasionally made use of to denote distinct species of sores, whereas they ought, at most, only to signify certain states or complications incidentally conjoined with an ulcer, and which may occasionally attend any kind of sore whatsoever.

*Simple* or *healthy ulcers* are known by the small size, florid colour, firm consistence, and pointed shape of their granulations, which resemble minute cones, and are less disposed, than some other kinds of granulations, to rise higher than the level of the surrounding skin. The pus secreted by them is white and thick, and not adherent to their surface. When they have risen to the level of the neighbouring skin, those at the margin of the ulcer become smooth and covered with a thin bluish semi-transparent film, which soon turns opaque, being converted into the new skin, which is quickly covered by cuticle. Such is a healthy ulcer, or one in which the process of cure is going on favourably in a person of sound undisturbed constitution. The florid red, or vermilion colour of the granulations, denotes a free and vigorous circulation in them. Their colour is not, however, precisely the same in every position of the limb; for when the part is kept in the depending posture, the florid redness frequently changes to a deeper, or purple colour, in consequence of the retardation of the venous circulation. Under these circumstances, as Mr. Hunter conceived, the blood in the minute arteries probably assumes also the dark colour of that which fills the veins.

The *treatment* is simple, because the well-directed operations of nature ought not to be too much interfered with. The surrounding skin should be kept clean; and soft lint having been applied to absorb the redundating matter, it may be covered with a pledget of any mild unir-

ointment, like those of spermaceti, marsh-mallows, or calamine. In this manner the evaporation of the thin fluid part of the pus, and the production of a scab will be prevented. The lint ought never to be laid over the edges of the ulcer, where the fine bluish pellicle lies. One important part of the process of cicatrization is the extension of the old skin over a considerable portion of the surface previously occupied by the sore. Now this process would be much retarded if the granulations, especially those near the edges of the ulcer, were suffered to become too high. It may therefore become necessary to repress them by touching them now and then with the nitrate of silver. In doing this, the main skill consists in not applying it completely to the edge, so as to disturb the semi-transparent film, or beginning of the new skin, but only just so far towards it as the high appearance of the granulations may require. Some practitioners use the sulphate of copper for this purpose; but it is very inferior in its effects to the nitrate of silver, which I join Delpech in thinking the best of all escharotics for sores, because it appears to possess the greatest power of expediting the contraction and absorption of the granulations, or the change established in them for the purpose of making the old skin more effectually cover a considerable portion of the ulcer.

The healing of sores on the lower extremity, even of those which rank as simple ones, is seriously impeded by the patient's walking about, and keeping the limb in the perpendicular position. The effect, which the latter circumstance has in lessening the florid colour of the granulations, I have already explained. Now when the patient will not confine himself in the recumbent posture, or refrain from taking exercise, it will generally be found advisable to afford as steady a support to the limb as can be obtained from the application of a roller, or laced stocking. In this manner, the weight of the column of blood in the large veins is in a great measure prevented from retarding the circulation, and the part is placed in a state of comparative rest. A bandage is also useful on another principle; it keeps the granulations from rising up too much, and thus renders the use of caustic less necessary. It also maintains a briskness and vigour in the healing process. However, if a bandage is to do any good, it must be applied skilfully, and with particular attention to let the pressure act evenly and moderately upon the whole surface of the limb, and not partially.

In University College Hospital, simple ulcers are seldom dressed with ointments, but covered with the *water dressing*. A piece of fine soft lint is wetted with cold or tepid water, laid over the ulcer, and covered with oiled silk, to prevent evaporation. Dr. Macartney, who has taken an active part in advocating this method, employs two, three, or four layers of lint, and dispenses with a bandage. If the sore require gentle stimulation, a weak solution of sulphate of zinc or copper may be employed, in the same way, instead of simple water; and, if a stronger application become necessary, the best is the nitrate of silver.

When the patient cannot avoid walking about, simple ulcers may be cured by encircling the limb in the situation of the sores, and for a little way above and below them, with long strips of adhesive plaster, which should be long enough to reach all round the limb, and have two or three inches to spare at each end. The middle of each strip is to be applied to the side of the limb most remote from the sore, and the two ends are then to be brought completely across it, one overlapping the other.

*Another class of ulcers* comprises those named *irritable.* A sore will always partake of the nature of the constitution, and, if this should be what is termed an *irritable* one, the sore will generally be more or less *irritable.* It will also be irritable, in various impaired states of the health, in persons who may not naturally have what is called an irritable temperament. In this point of view, I think, there is decidedly a difference between an *irritable* and an *inflamed* ulcer.

These remarks receive some confirmation from a fact mentioned by Sir Everard Home, namely, that an irritable ulcer cannot always be known at once by its mere appearance, and its character is sometimes not manifested till the surgeon ventures to use some slightly stimulating application, or to make pressure. This would be explained, however, by some practical surgeons in another way, viz. by their view of an irritable sore being always attended with weakness and over-action. Yet, an irritable sore is frequently marked by particular appearances. Thus the margin of the surrounding skin is often jagged, sharp, and, as it were, undermined. Concavities of different sizes are seen at the bottom of the ulcer, without any distinct formation of granulations. The discharge is mostly thin and bloody, the disease attended with excessive pain, and a remarkable tendency to hemorrhage, when its surface is slightly touched with a probe. In many instances, some of the ulcerated surface is covered with a dirty ash-coloured slough, on the separation of which new granulations arise, but are soon absorbed again, or they slough directly after their formation.

It seems as if local circumstances had influence in making an ulcer irritable; for, sores of this character are often met with in the skin covering the lower end of the fibula, or in the integuments situated over the shin, or the ligament of the patella.

In the treatment, complete quietude of the part, and the employment of soothing applications, leeches, and aperients, are generally proper at first. Bathing the part in a warm decoction of poppy heads, exposing it to steam, and covering it with a warm soft bread poultice made with the lotion of the acetate of lead, or with water to which a little of an aqueous solution of opium or hyosciamus has been added, are very beneficial plans. Dressing the ulcer with lint wetted with tepid water, and covered with a piece of oiled silk to prevent the lint from becoming dry, will sometimes agree with the sore better than any thing else. In private practice, I have lately had several cases, with which no mode of treatment agreed, excepting that now referred to. However, no success will attend this, or any other practice, unless care be taken to keep the limb in an elevated posture, and in a state of perfect repose.

Sometimes dressing an irritable ulcer with lint dipped in a solution of opium (five grains to an ounce of water) or of the extract of hyosciamus, answers well; but a still better application, after a time, is found in many instances to be a lotion containing from two to five drops of nitric acid to one ounce of distilled water, with or without a proportion of opium in it. The black wash or lotion, consisting of ten grains or a scruple of calomel to one ounce of lime water, is sometimes employed. The pressure of a bandage is invariably pernicious.

When the surrounding skin is red, swelled, and painful, and the patient full of blood, general and topical bleeding are indicated; but the sore is then rather an inflamed than merely an irritable one; or partakes of both characters.

When the irritability of an ulcer seems to be connected with [illegible]der

of the digestive functions, the blue pill or calomel with light tonics and aperients may be prescribed; or the compound infusion of gentian with the sulphate of soda, the liquor potassæ, or carbonate of soda, and leeches to the epigastrium, according to circumstances.

In the generality of irritable sores, it is necessary to keep the patient more or less under the influence of opium, or the preparations of morphia or hyosciamus. Costiveness must always be obviated, and, when much debility is present, the sulphate of quinine, or the infusion of cascarilla with diluted sulphuric acid, will often prove valuable medicines.

*Indolent ulcers* constitute at least three fourths of the sores for which surgical assistance is required, and are principally met with upon the lower extremities. The edges of the skin, encompassing such an ulcer, are generally thick, prominent, and rounded. The granulations are pale, smooth, large, and flabby, with a peculiar gloss or semi-transparency about them. They secrete an imperfect thin kind of pus, blended with flakes of coagulating lymph, which adhere more or less to the surface of the ulcer. The pale colour of the granulations denotes a want of briskness and vigour in their circulation. Indeed, such is the indolence of some of these ulcers, that granulations are not formed at all; but the bottom of the sores represents a pale brown flat surface, and the disease looks as if a portion of the skin had been taken away, and no attempt at reparation made. For a considerable distance around the ulcer, the parts are swollen and indurated: sometimes indeed the whole of the leg is enlarged and œdematous; yet the swelling is not soft and yielding like common œdema, but firm and incompressible. In nine out of ten cases, indolent ulcers form on the leg, and the nearer they are to the ankle, the more difficult they are to cure. The patient is also generally above the middle age. In the majority of cases, the pain is so trifling, that the patient is scarcely conscious of having a sore at all.

The mode of dressing an ulcer may communicate this indolent character to it; thus, when fomentations, emollient poultices, or lint wetted with tepid water, and covered with oiled silk, are continued too long, the granulations become large, pale, and flabby, and the healing will not proceed. But, if we could succeed in healing the sore with such applications, and with the work of such granulations, the cicatrix would be too weak to remain sound a long time; and the part would soon break out again into a fresh sore. On the other hand, if we take care to stimulate these weak granulations by means of suitable dressings, they undergo considerable improvement in their nature, becoming smaller, more compact, redder, and free from their former gloss or semi-transparency, and the cicatrix will be likely to prove lasting and serviceable.

With respect to *applications to indolent ulcers*, the following are in common use: a solution of the nitrate of silver in the proportion of five or ten grains to an ounce of distilled water; the application of the nitrate of silver in substance; the diluted nitrous acid; the ointment of the nitrate of quicksilver, mixed with an equal quantity of spermaceti ointment; the compound tincture of benzoin; the yellow basilicon ointment, with one drachm of red precipitate to each ounce of it.

When the surface of a chronic ulcer is foul, the discharge thin and offensive, the chloruret of soda in a poultice, or lotion, will often produce vast improvement. The strength of the application should be regulated; but, from three to six parts of distilled water to one of the concentrated solution sold in the shops, will suffice for ordinary use. When a lotion is used, lint should be dipped in it, put on the ulcer, and covered either with a common pledget, or piece of oiled silk, to prevent evaporation.

Perhaps, however, nothing is more useful in the treatment of indolent ulcers than well-regulated pressure, made with a common roller, a stocking bandage, or strips of adhesive plaster, put on in Baynton's manner. Pieces of soft linen are to be then laid over the part, and the whole leg evenly covered with a calico roller. If the discharge be not very profuse, the plaster need not be changed oftener than every other day. In summer, or when the parts are disposed to inflame, we cut the plasters at the point opposite the sore, and keep the bandage and plasters wet with cold spring water. Under this treatment, the swelling of the limb subsides, the callous edges are levelled, the surface of the ulcer granulates, assumes a healthier colour, begins to form good pus, and to heal up. When common adhesive plaster is found to be too irritating to the skin, we may employ either the emplastrum plumbi, or the brown soap plaster and ordinary adhesive plaster blended together in equal quantities. We should be careful, however, not to extend this practice to irritable ulcers.

Mr. Higginbottom treats indolent sores in the following way: he keeps the patient in bed twenty-four hours, and puts a poultice on the part; he then applies the nitrate of silver, not merely to the ulcer, but to the surrounding skin; afterwards covering the sore with strips of adhesive plaster, and a bandage.

When the ulcer is on the foot or lower part of the leg, the strips of plaster may be applied as follows: they are to be fifteen inches long and two wide; the foot being placed at a right angle with the leg, one of the strips is applied from the first bone of the great toe, along the inner edge of the foot, round the os calcis, to the first bone of the little toe; the middle of another strip is placed under the heel, and its ends carried perpendicularly up over each side of the leg; the circular and perpendicular strips are then continued alternately, and thus the foot and ankle are entirely covered, the strips having a very neat appearance, and not only making the requisite pressure, but keeping the ankle perfectly quiet.

*Phagedenic ulcers* literally mean any sores which eat away the parts, as it were, and truly their appearance conveys such an idea. Their surface, which has a yellowish, or livid appearance, is so irregular, that one might suppose it had been really produced in the manner referred to. The matter secreted is only in small quantity, generally adherent to the surface of the sore, and not unfrequently tinged with blood.

Phagedenic ulcers are frequently met with in syphilitic cases, but they occur also under many other circumstances. Thus, *cancrum oris*, as it is termed, is a true specimen of phagedenic ulceration of the mucous membrane of the lips and cheeks; and the gangrenous affection of the pudenda in children, described by Mr. K. Wood, is another variety of the same disease. We may also observe that, though scrofula generally produces sores of an indolent character, it sometimes gives rise to phagedenic ulceration of a very troublesome and inveterate description. But, when phagedæna takes place in syphilis or scrofula, it is an accidental complication, and not any essential part of those specific complaints.

Phagedenic ulceration in its worst forms, as arising in syphilitic cases, or perhaps, as we should rather say, those seen in the foul wards of hospitals, and produced by the bad atmosphere of such places, the noxious effect of mercury itself, and a constitution impaired by excesses bears a considerable resemblance to hospital gangrene. It begins f[illegible] some minute point of ulceration or abrasion, or as a small [illegible]

rounded by a halo of dusky red inflammation. It is often met with in the lowest class of filthy gin-drinking prostitutes; and one variety of it is well known at St. Thomas's and Guy's hospitals under the name of the *Swan Alley sore*, in consequence of the many young girls, who come from that notorious place, being afflicted with it. Its most common situations are the cleft of the nates, the groin, or the upper part of the thigh. I have seen it occupy the arm from the shoulder to the elbow, so as to expose the brachial artery in the greater part of its track; but much more frequently in the groin, where, and in the thigh, its ravages were such as to lay bare the femoral artery. The disease is attended with severe darting pain, which is at first remittent, but afterwards incessant. The exposed surface is covered with a straw-coloured flocculent substance, and a viscid secretion. The surrounding edges are thickened, abrupt, frequently everted, and always connected with a mass of swollen reddened integuments.

Hemorrhage soon occurs, and, returning from time to time, contributes seriously to the reduction of the patient's strength. The fetidness of the discharge is such, that no person can enter the ward without being conscious of its peculiarity. A man of experience recognises it almost as a proof of the nature of the disease. At length, the sore having become deep, a copious quantity of foul matter, and shreds of a pulpy substance, are taken away every time the dressings are changed.

The disease is often terrific, on account of the rapidity of its progress. Its commencment is sometimes attended with little febrile disturbance, but, in its advanced stages, the general indisposition is as alarming as it was at first slight. The patient is sleepless from constant agony, the appetite lost, the tongue covered with a white or brownish fur, the epigastrium tender, together with severe headach, an accelerated pulse, a sallow skin, and, when the disease spreads with great rapidity, bilious vomiting, or diarrhœa. Delirium is rare.

Disease of this description sometimes attacks several patients in the same ward, hospital, or district. Hence it is occasionally supposed to be of the same nature as hospital gangrene, and to be, like it, contagious. It is some corroboration of this opinion to remember, that here, as well as in hospital gangrene, local remedies are at least as important as constitutional ones. In the commencement of phagedæna, bleeding will sometimes relieve the pain, and have other good effects, yet on account of the natural tendency of this disease to hemorrhage, venesection should not be carried to any great extent. Local bleeding is not approved of, however, because the leech-bites sometimes assume the same morbid action, just as is seen in hospital gangrene. It does not appear that bark, quinine, or the diluted acids, have any specific power over the disorder, though, in the stages of debility, they may be prescribed, while there is no diarrhœa. They should also be given with port wine, and a nutritious but light diet. Opium, and especially the muriate or acetate of morphia, are the best internal medicines, and the patient should be kept constantly under their influence, with due attention to the regulation of the bowels.

Mr. Welbank, who drew up an excellent history of gangrenous phagedæna, found the application of the undiluted nitric acid to the surface of the disease the surest means of stopping it ravages. The surrounding skin is first to be protected by a thick coating of cerate. Lint is then to be dipped in the acid, and pressed on the part. The surface, having thus been converted into a firm and dry mass, is next to be covered with

simple dressings, and an evaporating lotion. If any other sloughs form after the separation of the first, the use of the nitric acid is to be repeated.

In France, a solution of the chloruret or chloride of sodium is much employed as an application to phagedenic sores. The strength is one part of the concentrated solution to eight or ten of distilled water. The fluid may be blended with a poultice, or lint may be dipped in it.

Many phagedenic diseases arise from the patient's being in a bad atmosphere, and then the best medicines and applications will be of little use, unless the patient be removed from the pernicious influence of the unwholesome air and effluvia to which he is exposed.

Pure air, free ventilation, cleanliness, fumigating the room or ward, sprinkling it with the chloride of sodium or lime, are all proper measures in the treatment of phagedenic ulcers. We are to employ purgatives and venesection, when there is inflammation, &c.; and when great debility is present, bark, quinine, the diluted sulphuric or nitrous acid, with a light nutritious diet, and wine. As for dressings, carrot poultices, bread poultices, a watery solution of opium or hyosciamus, the liq. opii sedativus, with a pledget or poultice over the lint; a bread poultice made up with a solution of the chloride of soda; the nitrous acid lotion, or the black or yellow wash, may be tried. In bad cases, amounting to gangrenous phagedæna, it is sometimes necessary to apply the liquor arsen. diluted, or the concentrated nitric acid itself.

Dupuytren's powder, composed of four parts of arsenical acid and ninety-six of submuriate of mercury, has proved efficacious in curing certain phagedenic ulcerations about the face; but it must never be put on any ulcerated surface to an extent beyond what a shilling would cover.

*Ulcers connected with varicous veins* are peculiar to the lower extremities, and mostly occur either on the inside of the leg, near the ankle, or on the instep. A varicous state of the veins seems to produce vast disorder in the capillary circulation, and a tendency to chronic inflammation in the skin of the leg, often denoted by brown dusky discolourations of the integuments, terminating in the formation of an ulcer. The edges of the sore are generally indurated, raised, and callous, while its colour and that of the neighbouring skin are brownish or livid. The pain is considerable, but often more felt in the neighbourhood of the sore, and in the course of the principal veins, than in the sore itself.

In the early stage of varicous ulcers, while inflammation is present, leeches and simple dressings, with evaporating lotions, purgative medicines, quietude in bed, and low diet, are the best means of relief. Sometimes, however, fomentations answer better than cold evaporating lotions; and frequently the best application to the ulcer at first is lint wetted with tepid water, and covered with oiled silk. Afterwards, one of the principal indications is to take off the weight of the column of blood in the diseased veins, or to obliterate all direct communication between those veins and the venous branches returning from the parts about the ulcer. Hence, the practice of taking up the trunk of the vena saphena as it passes behind the knee joint; an operation now very properly abandoned, on account of the dangerous consequences frequently arising from the tying of large veins; namely, those resulting from *phlebitis*.

Instead of this method, Sir Benjamin Brodie suggested another, which consisted in passing a narrow convex-edged bistoury under the vein with the flat side of the blade at first turned towards the vessel, and

simply dividing it, without cutting the skin over it. There are some other practitioners who attack varicous veins with caustic, applying it so as to bring on a degree of inflammation in the dilated vein, near the part of the skin on which it is put, just sufficient to produce an effusion of fibrine within the vessel, and its subsequent obliteration. But, a better plan is that of passing a long steel pin under each of the veins which it is wished to obliterate, and then applying some thread, or silk, in the manner of the twisted suture. The pin should be withdrawn on the third day, and not be left to make its way out by ulceration. Except in cases attended with remarkable obstinacy and severity, the patient should be content with a well applied bandage, laced stocking, or the stocking roller, with dressings adapted to the particular condition in which the ulcer and surrounding skin may happen to be.* If inflamed, we should defer the bandage, but keep the patient in bed, use leeches, simple dressings, and evaporating lotions, or poultices, and fomentations, always keeping the limb strictly quiet in the recumbent position, or rather with the foot and leg raised above the level of the thigh. When the sore is foul, we may employ poultices, or dress it with a solution of the chloruret of sodium. When the inflammation has subsided, we may have recourse to equable pressure, applied from the toes to the knee, with any dressing or application which the appearance of the granulations may require.

With regard to specific ulcers, those produced by scrofula, the venereal disease, fungus hæmatodes, chimney sweeper's cancer, common cancer, &c. will be considered in future parts of this volume.

Sir Everard Home has described, as a specific ulcer, a sore that sometimes occurs on the instep, or foot, attended with enormous thickening of the integuments, something like that of elephantiasis. The disease is met with in persons who have lived freely. The application, said by him to agree best with this kind of sore, is the ointment of the nitrate of quicksilver, with a proportion of camphor in it. He also describes a *fungated ulcer* of the calf of the leg and sole, which he represents as curable by the internal and external use of arsenic, unless attended by disease of the lymphatic glands, when he always found it incurable. A case, corresponding to the latter, was under my care in University College Hospital in the year 1835, and the parts are preserved in the museum of the college. The disease, which implicated also the inguinal and lumbar glands, presented a combination of medullary with scirrhous cancer.

Hitherto the observations, delivered in this work, have chiefly related to common inflammation, and its occasional consequences; but other kinds of inflammation and their effects remain to be considered, without some knowledge of which we should not be able to acquire even an elementary proficiency in surgery. The species of inflammation, which will next be noticed, are *erysipelas, diffuse inflammation of the cellular tissue,* and the *inflammation accompanying boils, carbuncles,* and the *malignant pustule.* All these varieties are characterised by peculiarities not seen in common inflammation, nor in the inflammation directly resulting from certain specific diseases, as syphilis, scrofula, and cancer.

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* Some additional remarks on this subject will be found in the section on "Diseases of the Veins."

## ERYSIPELAS.

A peculiar inflammation of the skin, characterised in its simple and genuine form by the bright red colour of the part affected; by a propensity to spread with remarkable rapidity; by a diffused, not a circumscribed, swelling of the skin and cellular tissue under it; and an indisposition in the morbid action to be speedily checked by the establishment of that process, which Mr. Hunter called the adhesive inflammation.

To define it merely as an inflammation of the skin, would not, however, be correct, because in one of its forms it affects the subcutaneous cellular tissue even in a greater degree than the skin. Besides, in many instances, the disorder is in reality a fever, beginning with constitutional disturbance, which is followed by this peculiar inflammation of parts of the surface of the body.

In popular language, the disorder is known under the name of *St. Anthony's Fire;* and when the skin presents a light red hue, tinged with yellow, it is sometimes called the *rose.*

No inflammation, except that of mumps, gout, or rheumatism, is so subject to change its place suddenly as erysipelas. Neither is there any inflammation in which the sudden resolution of inflammation, to which the French pathologists apply the term delitescence, is so frequently and so dangerously exemplified.

Of all cases of erysipelas, that of the head and face is most liable to delitescence, preceded or followed by inflammation of the brain or its membranes, and coma or delirium. If any parts suppurate, they are generally the eyelids. The disorder may arise, not only from fever, but local injuries — especially wounds, pricks, or contusions of the scalp. The skin of the face and head, indeed, are particularly liable to erysipelas from very slight injuries.

Erysipelas is generally defined to be a peculiar inflammation of the skin, characterised by a propensity to extend with great rapidity, though one form of it certainly affects the cellular tissue in a greater degree than the cutis, and, according to Baron Dupuytren, really commences in it. John Hunter believed that erysipelas, when viewed as an inflammation, marked by a great propensity to spread over an extensive surface, denoted the existence of a peculiar state of the constitution, without which the patient would have experienced from any local irritation, not erysipelas, but common inflammation. He also thought that the seat of erysipelas was not necessarily restricted to the cutaneous texture, but that when that peculiar state of the constitution prevailed to which I have alluded, all inflammation, wheresoever situated, might partake of an erysipelatous character, and have a tendency to spread in a greater degree, and with more rapidity, than ordinary inflammation. But, although practitioners occasionally speak of erysipelatous sore throat, and erysipelatous inflammation of the conjunctiva, and although the extension of erysipelas from the face to the interior of the mouth, the nassal fossæ, the pharynx, and even the cavity of the tympanum, is a fact recorded by Dupuytren and others*, the view entertained by Hunter on this point, is far from being generally entertained. Perhaps, the mere circumstance of an inflammation having a remarkably great disposition to spread, — to run along a surface, as it

* Dr. Macartney, I observe, recognises mucous membrane as a texture liable to erysipelas. Op. cit. p. 137.

were, — is not an unequivocal proof of its character partaking of an erysipelatous nature connected with peculiarity of constitution, because sometimes the kind of texture affected communicates to the inflammation that kind of disposition, as is well illustrated in the inflammation of every serous membrane.

When the skin is merely affected with redness, is not perceptibly swelled, has no vesications upon it, and is of its usual softness, the case is termed *erythema*, which may or may not be the first degree of erysipelas, according to the general state of the system, on which the latter essentially depends. When the slight redness of the skin, called erythema, is produced in a healthy subject from any stimulation of that texture, by friction, heat, &c. it cannot be regarded, according to the foregoing doctrines, as a stage or degree of erysipelas.

Erysipelas is divided into *simple* or *superficial*, *phlegmonous*, and *œdematous*.

Some distinctions, occasionally specified, do not imply any peculiar varieties of the disorder, and in this respect are superfluous: thus *malignant*, or *gangrenous erysipelas*, is only a stage of phlegmonous erysipelas, and *erysipelas erraticum* is merely a term applied to the disease when it continues to spread from one part of the skin to another, to an unusual extent, and for a longer period than common, thus visiting sometimes nearly the whole surface of the trunk, limbs, &c., in succession.

In *simple* or *superficial erysipelas*, the skin is of a bright red colour, smooth, and shining, the redness being in general more or less bounded by a definite line, and not gradually fading away at the circumference of the part affected, like the redness of phlegmonous inflammation. When the part is pressed upon with the end of the finger, the redness disappears in the place which has been touched, leaving a white spot visible for a short time, but which is quickly obliterated again by the return of the red colour. In simple erysipelas, the circulation is not impeded, and hence the pressure of the finger on the skin removes the red colour, which immediately returns when the pressure is discontinued. The same fact accounts also for the bright red colour, the arterial blood being readily transmitted into the capillary veins. Probably, as Dr. M. Hall observes, it is by the stagnation of the blood in the capillaries, that common inflammation differs from mere blushing, from eruptions, and, in some degree from erysipelas.* There is no throbbing like what attends phlegmonous inflammation; and, if the skin alone be affected, hardly any perceptible swelling, and no tension. Still, when the finger is passed along the part, a trivial degree of stiffness, and a different feel from that of the rest of the skin, are manifest. Except in slight cases, however, there is always some fluid effused in the cellular tissue, and consequently a softish swelling. The inflamed part is hot and painful, the sensation at first experienced by the patient being that of an itching or pricking, but this soon becomes a burning kind of pain, and, when the parts are handled, extremely acute. The disease is frequently, but not always, attended with vesications, a thin serous fluid being effused under the cuticle, and raising it into small vesicles, or large *bullæ* or blebs, like those produced by a blister. Generally they contain a yellowish fluid, but sometimes a gelatinous substance, and now and then a bloody liquid, or pus. At length they burst, and incrustations, or scabs, are formed,

* Principles of Medicine, p. 17.

which, in a few days, fall off, leaving the skin under them mostly sound, but occasionally eroded by superficial ulcerations.

Simple erysipelas most commonly terminates in resolution, with desquamation, or a peeling off of the cuticle, though, if the disorder be slight, there may be no desquamation at all. When the inflammation is more severe at some points than others, limited suppurations in the cellular tissue may take place; but these only happen where the inflammation extends more deeply than usual, and affects the cellular tissue in certain situations with greater severity than in others. It is the nature of simple erysipelas to extend rapidly, and hence it will frequently pass over a large portion of the surface of the body in a short time. Another feature of the complaint is, its disposition to get well on one side, while it is spreading in another direction. Hence it frequently presents itself in all its different stages in one and the same person at the same period. In one place, that which was first attacked, there is perhaps desquamation; in the part last invaded, there is redness and swelling; at other points vesications; in other situations again, incrustations, or scabs; and, in a few places, if the disease has been severe, possibly a degree of suppuration. As the inflammation declines, the redness fades, the part then frequently exhibiting a yellowish tinge. One striking difference between phlegmonous and erysipelatous inflammation is, that the former is circumscribed, whereas the latter has no precise limit; for though the redness is terminated by a more or less abrupt line, the swelling from the effusion of serum in the cellular tissue is diffused, without any definite boundary. In fact, erysipelas is attended with little or no adhesive inflammation around it, and hence, partly, its uncircumscribed character, and the extensive disorganisation of the cellular tissue, when suppuration takes place in the worst, or phlegmonous variety of the disease. Simple erysipelas is attended with restlessness, acceleration of the pulse, headach, thirst, dryness of the skin, and other febrile symptoms. The most dangerous example of it is that which attacks the head and face, preceded by shiverings, headach, loss of appetite, and perhaps vomiting, and afterwards accompanied not only by a frequent pulse and most of the common symptoms of fever, but often by a lethargic drowsiness, or a tendency to coma, or delirium. When the latter symptom comes on early, the disorder is frequently fatal. The indisposition does not subside on the breaking out of the cutaneous redness on the second or third day, but continues till the local inflammation itself abates, which generally happens, under successful treatment, about the tenth or eleventh day, followed by copious evacuations from the skin and kidneys. If any parts suppurate, they are usually the eyelids, the cellular texture of which is abundant and loose. When erysipelas attacks the face, the swelling of the eyelids, and indeed of every part of the countenance, is such as to prevent the patient from being recognised by his most intimate acquaintance; the disfigurement is indeed prodigious. The loose cellular tissue of the eyelids is vastly distended, and, as it were, œdematous; the eyes are closed and watery; the nose swollen; the nostrils dry; the lips puffed up; the ears red and shining; the saliva often flows out in profusion; and the mouth is opened with difficulty. Erysipelas, in all its forms, is a species of inflammation, the blood being cupped and buffy.

*Phlegmonous erysipelas* differs from simple erysipelas in the higher degree and deeper extent of the inflammation, which not only affects the skin and cellular tissue, but has a tendency, when severe, and especially when situated in the lower extremities, to produce in the latter texture sup-

puration and extensive gangrenous mischief. The skin itself, being more highly organised, resists the effects of the disease longer, and when it does slough, does not perish to the same extent as the cellular tissue. Baron Dupuytren believes, that phlegmonous erysipelas does not affect the skin originally, but the cellular tissue, the cutaneous texture being attacked secondarily. This observation is true at all events, I believe, with reference to that modification of phlegmonous erysipelas described by Drs. Duncan, Scott, and others, under the name of *diffuse inflammation of the cellular membrane.* A few years ago, it was a common notion, that phlegmonous erysipelas sometimes began in the fasciæ; but this is never the case. Although, in severe instances, the fasciæ may be destroyed, they are attacked subsequently to the skin and cellular tissue, and, in many *post mortem* examinations, they are found not to be at all involved.

In phlegmonous erysipelas, the skin becomes more raised, and the swelling harder, deeper, and of a darker colour, than in simple erysipelas. At first, indeed, the part may be of a pale rose tint, with a smooth shining appearance of the skin; but, after a little while, the redness becomes darker, sometimes assuming a brownish or deep, almost a livid tinge. In many instances, the discolouration is irregular, the skin exhibiting a mottled or marbled appearance. At first a sensation of pricking and heat is experienced, which soon changes into a severe burning pain, and the swelling becomes such that the limb is frequently of twice its natural thickness. In the beginning, the swelling yields to the pressure of the finger, or pits, in consequence of the copious effusion of serous fluid in the cellular tissue, but afterwards the part becomes so firm, that if pressure be made on it, no pitting is occasioned, because the cellular tissue has now become hardened and thickened. In phlegmonous erysipelas, the white spot, caused in the part when it is pressed with the end of the finger, is not so quickly obliterated again as in simple erysipelas, neither does the skin rise up so promptly to its former level, after it has been made to pit.

As the disease advances, vesicles generally form, varying in size from that of a pin's head to that of a bean, and very often they are still larger. Their contents, which are at first a clear serum, frequently assume in a little while the appearance of a purulent fluid, or of a reddish or turbid serosity. If the case proceed favourably, the vesicles burst, incrustation takes place, and the case ends in the separation of the scabs, and desquamation. If the disease attain a more severe degree, the subcutaneous cellular tissue sloughs, and, often about the fifth or sixth day, the skin itself assumes a purple colour, loses its sensibility, softens, and becomes covered with phlyctenæ. There is now some sloughing of the skin, but a great deal more of the subjacent cellular tissue, in which purulent matter is extensively diffused. In fortunate cases, the sloughs separate, the gangrenous cellular tissue comes out, and the ulcers heal; but more frequently, and especially without the aid of surgery, the patient falls a victim to the constitutional disturbance.

The suppurative stage is not attended with additional swelling, elevation, and pointing, as in the suppuration that arises from common inflammation, but rather with a diminution of tension, a feel of softness, and a trivial subsidence of the part. Hence, when the disease has arrived at this stage, it may appear for three or four days as if it were stationary, or even inclined to recede; and an inexperienced surgeon may be induced to defer the only measure likely to prevent gangrenous mischief.

In severe forms of phlegmonous erysipelas, there is always an exten-

sive separation of the skin from the subjacent fascia, and of the muscles from one another; often attended with the formation of numerous sinuses and sloughing of the fasciæ and tendons themselves. In very bad cases, inflammation, ulceration, or even gangrene of the synovial membranes, the formation of matter in the joints, ulceration of cartilages, and sometimes caries and necrosis, are the effects of this alarming disease. The constitutional disturbance is often exceedingly severe. In the early stages of the disorder, the pulse is frequent, strong, and full; afterwards it increases in number, but its strength and fulness decline. The urinary and other secretions are suppressed, the alvine evacuations stopped, the patient has no sleep, there is excessive agitation of the nervous system, and frequently delirium. In the suppurative and gangrenous stage, the tongue becomes brown or sometimes black; at first it is moist, but afterwards dry, with great foulness of the gums and teeth, and fetor of the breath. The pulse is very quick (140) and small, and it is not uncommon for it to be irregular. If the disease assume a still more aggravated form, a bilious vomiting, or a diarrhœa, with involuntary discharge of very fetid dark-coloured matter from the bowels may ensue, followed by coma or delirium, subsultus tendinum, and death.

In many cases, arising from local injuries, the febrile disturbance at first closely resembles common inflammatory fever; but afterwards, if the disease lead to suppuration and gangrene of the cellular tissue, or threaten those consequences, the pulse becomes very quick, weak, and even irregular, with great derangement of the nervous system, and imminent danger. In many instances, the fatal termination is preceded by inflammation of the pleura, peritonæum, or mucous membrane of the bowels, or lungs.

Too often, when the patient recovers, after long and profuse discharge, and the slow detachment of numerous deep-seated sloughs of cellular tissue and other textures, the structure of the limb is so impaired, and the skin, fascia, muscles, tendons, and bones, all so agglutinated together by irregular adhesions, that the functions of the part are permanently injured.

Phlegmonous erysipelas is sometimes the consequence of fever, but more frequently of accidental injuries, especially of punctured or contused wounds, compound fractures, burns, neglected or irritable ulcers, the bites of venomous snakes, or punctures and cuts received in dissection. Sometimes it follows the prick of the lancet in venesection; and Dupuytren enters a caution against confounding phlegmonous erysipelas from venesection with phlebitis; for sometimes it is accompanied by inflammation of the vein, and sometimes not. Phlegmonous erysipelas is often attended with inflammation of the absorbent glands, and with streaks of painful thickened inflamed lymphatics running up to them, as is frequently exemplified in phlegmonous erysipelas of the leg and forearm. The two affections, however, are very distinct, and not essentially connected with one another. Phlegmonous erysipelas of the legs has a greater tendency to terminate in suppuration and a gangrenous destruction of the subcutaneous cellular tissue, than the same disease in most other parts of the body. There the cellular tissue of the limb suppurates as readily as that of the eyelids or the scrotum, and the pus is not collected in one cavity, but diffused. The cellular tissue indeed is soon converted into extensive sloughs, several inches in length. Then the skin, thinned and deprived of its due supply of blood, turns of a livid colour and also sloughs, more from defect of nutrition than from inflam-

mation. This consecutive mortification of the skin is remarkably common in the lower extremity, especially the leg, where the nutrient arteries, the anterior and posterior tibial, and the peronæal are very deeply placed, and only communicate with the cutaneous texture by small ramifications, almost all of which are involved in the destruction affecting the cellular tissue. On the contrary, phlegmonous erysipelas of the head rarely brings on sloughing of the scalp or skin, because here the arrangement of the arteries is very different; the temporal, frontal, and occipital branches being situated directly under the skin, between it and the aponeurosis of the occipito-frontalis, so that when the cellular tissue under the latter part becomes gangrenous, the supply of blood to the scalp is little interfered with; the integuments do not mortify; and if the pericranium escape destruction, and the membranes of the brain remain unaffected, the patient often survies. Dupuytren never saw but one instance of sloughing of the skin in phlegmonous erysipelas of the head.

*Œdematous erysipelas.* Nothing is more common than to observe œdema of the subcutaneous cellular tissue in the latter stages of simple erysipelas, and in the first stages of phlegmonous erysipelas. It is indeed a constant attendant on erysipelas of the eyelids and scrotum. But, by the term *œdematous erysipelas* is particularly implied the case, in which the swelling of the skin and subcutaneous cellular tissue comes on slowly and progressively, communicating the feeling of œdema, instead of the firm resistance of phlegmonous erysipelas. The skin, which is smooth and glossy, *pits* when pressed upon, and the hollow thus produced is very slowly effaced. Vesicles on the skin are less common in this, than the other varieties of erysipelas. If they occur at all, it is usually between the third and fifth day; they are small, and on breaking are followed by thin diminutive incrustations. The labia pudendi, the scrotum, the legs of dropsical persons, on which scarifications have been practised, are frequently the seats of œdematous erysipelas, often followed by sloughing of the integuments, a feeble, quick, irregular pulse, vomiting, typhoid symptoms, low delirium, and death. Œdematous erysipelas is of a yellowish brown, or dark red colour. It occurs chiefly in the parts specified, or, if in others, only in broken anasarcous constitutions.

With respect to the *causes of erysipelas*, why should any local irritation produce in one person this form of inflammation, and in another person common inflammation? Certainly, the fact is difficult of explanation, unless we admit the existence of some peculiar condition of the constitution, as a predisposing cause of the disease. Erysipelas is sometimes prevalent in particular seasons of the year, and states of the atmosphere, and occasionally endemic in certain districts and hospitals, where temporary or local circumstances may be presumed to be exercising a pernicious influence on the system. Intemperance and errors of diet appear to be frequently concerned in giving a tendency to erysipelas. Dr. Wells's doctrine of erysipelas being now and then contagious, is one not settled even at the present time. Fever, cold, and various accidental injuries, and local irritations, are the usual exciting causes of erysipelas, where the predisposition to it exists. It is not simple inflammation of the skin.

*Simple erysipelas*, not of great extent, and unattended with coma or delirium, generally has a favourable termination in about ten days. I have attended worse cases, which lasted six or eight weeks, leaving after their termination a tendency to inflammatory affections of the mucous membrane of the bowels, or lungs, or to the formation of large boils, and very fetid abscesses in various parts of the body. One young woman,

whom I attended, died soon after a severe attack of erysipelas, in consequence of a large and suddenly formed abscess of the hip.

Erysipelas of the head, phlegmonous erysipelas of the leg, or affecting the armpit and breast, and œdematous erysipelas in a broken or dropsical constitution, are the most dangerous examples of the disease.

Mild cases of *simple erysipelas* yield to saline purgative medicines, diaphoretics, and low diet. Dissolve one ounce of sulphate of magnesia in five and a half ounces of mint water, and add to the mixture half an ounce of antimonial wine. Two table spoonfuls of this may be given every four hours; or five grains of blue pill, or three of the submuriate of mercury, may be administered every night, or every other night, or calomel with James's powder, followed by a solution of sulphate of magnesia in the common saline or effervescing saline mixture, which should be repeated at intervals.

More severe cases require venesection, and the free application of leeches. This practice is particularly necessary where the patient is young and plethoric, the pulse strong, hard, and frequent, and, in all cases, where the head is the seat of the disease.

When simple erysipelas is accompanied by uneasiness about the stomach, a foul tongue, headach, and fetid breath, an emetic, followed up by a brisk calomel purgative, should be given. The old doctrine of erysipelas being essentially dependent on debility is now much on the decline. This is fortunate, because it led to the neglect of depletion in the early stage, the period offering the best opportunity of keeping down the disease. The idea also, respecting the specific power of bark, over erysipelas, influences but few practitioners of the present day; bark, the sulphate of quinine, sulphuric acid, and other tonics being only useful after the disease has been checked by bleeding and other antiphlogistic measures. After this has been done, indeed, not only bark and quinine, but cordials, wine, ammonia, and a light nutritious diet, may become highly beneficial. Ventilation and cleanliness are of vast importance in all stages of erysipelas.

When the disorder suddenly recedes, and internal organs are attacked with inflammation, the part originally affected should be immediately covered with a blister. When erysipelas is spreading up a limb, or from the chest or arm towards the neck, its extension in such direction has sometimes been effectually prevented by making a black line on the skin with nitrate of silver, a little beyond the part affected. With regard to local applications, fomenting the inflamed surface with decoction of poppy heads, or simple warm water, or moistening it lightly with a feather dipped in mucilage of quince seeds, are plans frequently adopted. When simple erysipelas arises from a wound, or other local injury, cold evaporating lotions are the best in the early stage of the disorder. Powdered starch, flour, chalk, or calamine, applied for the purpose of absorbing the fluid discharged from the vesicles, is not so frequently used at the present day as formerly. The application of mercurial ointment is sometimes commended, as having a specific power in stopping erysipelas; Professor Gibson speaks very highly of the plan*; but, in this metropolis, it does not retain many advocates. Rubbing the nitrate of silver on the inflamed skin, and beyond it, or blackening the part with a strong solution of the same caustic, I believe, with Dr. Macartney, to be more useful than either

* Institutes and Practice of Surgery, vol. i. p. 41. ed. 5.

mercurial ointment, or blisters; though not to be trusted for the relief of phlegmonous erysipelas in a severe form.

In *phlegmonous erysipelas* more rigorous antiphlogistic treatment is necessary than in simple erysipelas, and especially general and local bleeding, and the administration of calomel, followed by saline purgatives and tartarised antimony. In the very beginning, cold evaporating lotions often prove more effectual than warm applications; I have found this to be the case, and Dupuytren's experience is in favour of the practice. We are to persist in depletion, and employ cold or warm applications so long as there is any chance of resolution. But immediately it is manifest that, notwithstanding our utmost exertions, the cellular tissue is becoming more and more gorged with fluid, and that suppuration and gangrene of that texture would be likely to follow the continuance of such treatment, then the indication, requiring prompt attention, is to make a sufficient number of punctures or incisions, so as to discharge from the cellular tissue the great quantity of fluid which distends it, and has a principal share in bringing on mortification of it.

When matter has formed, or sloughs have occurred, all surgeons have long concurred in the necessity of making free incisions; but, in an earlier stage, where fomentations, or cold sedative lotions, applied freely and constantly, and rigorous antiphlogistic means, fail to check the disease, punctures or incisions are now universally acknowledged to be the most likely means of preventing gangrene of the cellular tissue, by discharging the serous fluid with which it is gorged. For this improvement we are indebted to Mr. Copland Hutchison.

The poultices or dressings are to be often changed, and the discharge carefully sponged away. Out of the openings we are to remove all loose portions of disorganised cellular tissue, but to avoid pulling them away before they are loose.

The lodgment of matter is to be carefully prevented by incisions, and its re-accumulation by compresses and a bandage, as soon as the parts are quiet enough to bear them. After a time, indeed, bandages become of great service for removing the œdema and swelling.

Baron Dupuytren, in his mode of dressing abscesses and ulcers occasioned by phlegmonous erysipelas, takes particular care not to let the dressings confine the matter. After the discontinuance of the poultices, he puts slips of old linen, spread with a mild astringent ointment over the edges of the ulcers, and then lays over their centre a piece of soft old linen, which has numerous apertures cut in it, and spread with the same ointment. In order to expedite the healing, we may occasionally employ a weak solution of nitrate of silver.

The tedious length of time which some of these cases occupy, the protracted irritation, the profuse discharge, the number and extent of textures injured, must be productive of dangerous degrees of weakness and hectic fever. Hence tonics, wine, pure air, and light nourishing articles of food, are frequently of great importance in enabling the constitution to continue the struggle. But, sometimes nothing will give a chance of saving life but amputation.

With respect to erysipelas of the scalp resisting venesection, leeches, tartarised antimony, calomel, and other means of depletion, surgeons have been many years in the habit of treating it by making a crucial incision through the skin, cellular tissue, and aponeurosis of the occipito-frontalis, so as to free the parts from tension. In twenty-four hours, the

patient is frequently relieved by such treatment, and the delirium and other bad symptoms stopped.

Whenever erysipelas seems connected with gastro-intestinal inflammation, leeches may be applied to the epigastrium.

In the *treatment of œdematous erysipelas,* the constitution will not bear loss of blood. Here aperient and tonic medicines, and sometimes iodine, may be prescribed with advantage. The part may be fomented with decoction of camomile flowers, to which may be added a proportion of camphorated spirit. If sloughing occur, we are to use poultices. In this form of erysipelas, the parts will not bear incisions without risk of gangrene. The quantity of fluid, however, sometimes renders punctures indispensable, but they should be small, and made with the fine point of a lancet. In the decline of the disease, a bandage is of great service.

*Diffuse inflammation of the cellular texture* differs from phlegmonous erysipelas in the cutaneous inflammation itself being absent or trivial. The skin, instead of being hot, as in phlegmonous erysipelas, is colder than natural. In some cases, the inflammation runs its course, and terminates in extensive suppuration and sloughing, without any redness; and, in all true cases, the inflammation of the skin, when it does occur, is secondary.

The disease arises from external injury, sometimes from punctures received in opening bodies, sometimes from the bites of venomous reptiles, and frequently from fever. It often occupies the cellular tissue of a whole limb, and proves fatal. In the cases related by Dr. Duncan, when the cause of the disease had been applied to any part of the hand or arm, the seat of the secondary inflammation was chiefly in the axilla, extending towards the sternum, up the neck and down the side, as far as the os ilium; and, in Professor Dease's case, even to the thigh of the affected side. The disorder sometimes shifts its place from one side of the body to the other. It is mostly accompanied with excessive constitutional irritation, fever of a typhoid character, extreme muscular debility, and mental depression.

In the *treatment of diffuse inflammation of the cellular tissue,* the plan will depend upon the nature of the exciting cause. Thus, the bites of venomous reptiles, and of wounds received in dissection, may require constitutional remedies not called for in other cases. For the most part, leeches and cold applications are to be preferred in the early stage, but afterwards fomentations. Blisters are beneficial by producing a copious discharge of serum; but, when much fluid is effused in the cellular tissue, the best practice is to make free incisions for its discharge. Notwithstanding the affection of the skin be only secondary, and that of the cellular tissue primary, I see in this disorder a great resemblance to phlegmonous erysipelas, of which, perhaps, it may be only a variety.

## FURUNCULAR, CARBUNCULAR, AND OTHER GANGRENOUS FORMS OF INFLAMMATION.

1. *Furuncular inflammation* is exemplified in the complaints called *boils* and *styes.* If the investigations of Baron Dupuytren have been conducted with accuracy, there are conical elongations of the subcutaneous cellular tissue extending into the texture of the cutis, as coverings of the vessels and nerves proceeding to its surface. Now, it is alleged, that it

is the inflammation of one of these elongations of the cellular tissue which constitutes a boil, just as a simultaneous and confluent inflammation of several of these processes of cellular tissue takes place in carbuncle. Of course, it is not meant that the inflammation is confined to the cellular tissue; for, the skin always participates in it. Whether the foregoing statements be true or not, a boil may be described as a circumscribed, prominent, hard, very painful tumour, of a conical shape, with a portion of dead cellular tissue in it, its apex being above the level of the surrounding skin, and its base below it. Its colour is a dusky red, often inclining to purple. Between the fourth and the eighth day, the apex turns white, softens, and bursts, giving issue to a small quantity of thin bloody matter, and at the bottom of the little opening a part of the mortified cellular tissue, termed the core, is perceptible. The generality of boils do not become larger than a marble or walnut, though some few attain the size of a pigeon's egg.

The conical prominent shape of a boil exposes it very much to friction of the clothes and external injury; and considerable pain and annoyance are common consequences of such a tumour. Between the tenth and twelfth day, the *core* becomes loose, and, on its evacuation, a cylindrical gaping cavity is left, reaching from the apex to the base of the swelling. After this the pain ceases, the skin gradually resumes its proper level, and the cavity granulates and heals.

Boils are most frequent in children and young plethoric individuals. They are also common after acute febrile diseases, typhus, measles, small-pox, attacks of erysipelas preceded by fever, and in persons who drink ardent spirits.

Although Dr. Macartney believes, that if the water-dressing be resorted to in the beginning, boils will seldom exceed the size of peas, and produce no pain; and although certain experiments made by Dumeril and Bretonneau, and the observations of Mr. Higginbottom, on the use of nitrate of silver, prove, that boils may sometimes be completely stopped and repressed by touching them slightly with caustic at their very commencement, the ordinary practice is to cover them with warm emollient applications. The core having formed and become loose, its evacuation is the chief indication. For this purpose, the boil, when sufficientiy mature, should be opened. Should the patient be very timid, and the boil only small, it may be covered with a piece of adhesive plaster, which will expedite the ulceration of its apex, and promote the discharge of the little mass of disorganised cellular tissue. Few boils are severe enough to require local bleeding; but, if a boil occur in the perinæum, between the scrotum and anus, it may bring on a difficulty of expelling the urine. Here, or wherever a boil causes inflammation of the lymphatic glands, or is of a large size, or there is more than one such tumour, antiphlogistic treatment should not be neglected. In particular, when boils follow one another for a long time in succession, a course of aperient and alterative medicines is indicated. After a boil has been opened, a poultice may be applied for a day or two, and then stimulating dressings.

### ANTHRAX OR CARBUNCLE.

The term *anthrax* is sometimes not used synonymously with *carbuncle*, or what the French call *charbon*, which Dupuytren, Rayer, and others, restrict to a gangrenous swelling that occurs as a symptom of the plague. This is often named the *pestilential carbuncle*, in order to denote its difference from anthrax, or common carbuncle.

*Anthrax*, or *carbuncle*, is a broad, flat, distinctly circumscribed, hard, painful, inflammatory swelling, of a dark red, livid, or dull brown colour, beginning in the subcutaneous cellular tissue, a considerable mass of which is in a mortified state, while a bloody sanious matter occupies the interior and base of the swelling. A carbuncle differs from a boil in the greater flatness of its surface, the more violent nature of the inflammation, the deeper and more extensive sloughing under the skin, the greater breadth of the disease at its base, the more severe character of the constitutional disturbance, and the kind of individuals in whom the disease presents itself. It differs also from a boil in its greater size, in its being almost always a single solitary tumour, which at length bursts, not by one small opening, like that on the summit of a boil, but frequently by several apertures, which give the skin a sievelike appearance. Like a boil, however, the common carbuncle generally occurs on parts of the body where the skin is thickest, and where the cells of the cellular tissue are most fully developed, as in the nape of the neck, over or between the scapulæ, on the back, the sides of the chest, or about the nates. I have seen several instances of carbuncle on the occiput, and although the disease is rare on the limbs, John Hunter mentions having seen it so placed. When it occurs on a limb, the thigh is the part mostly affected. I had a patient in University College Hospital, who had a large carbuncle on the left side of the neck. While boils are never larger than a pigeon's egg, carbuncles sometimes attain the diameter of a common dinner-plate; and they may become of this size in the course of a week or ten days. A carbuncle begins as a little swelling, not more than a few lines in breadth, with some resemblance, in this stage of it, to a boil, but sometimes presenting upon its centre a little vesicle filled with bloody serosity. Occasionally, however, a larger surface is affected in the very beginning. In proportion as a carbuncle increases in size, it becomes more prominent, but extends in a still greater degree in depth. At every point the swelling retains a singular degree of hardness, a hardness often compared to that of brawn, until the cellular tissue begins to slough; then its circumference continues hard, and its base to spread, while its centre presents an obscure fluctuation. The deep purple colour of the skin does not disappear under pressure; and the sensation of heat, which is from the first of a burning kind, only diminishes after one or several apertures have been formed. The disease is also well known to be attended with a sense of stiffness, tension, and weight in the part. If the disease be suffered to go on, the skin, after assuming a deep purple, or dull brown red colour, becomes thinned and softened, and at length bursts at one or more points, from which flows a bloody discharge, mixed with whitish flakes of mortified cellular tissue. Then additional perforations of the skin follow, out of which may be extracted a white core, or gangrenous mass, all at once or piecemeal. The mortified cellular tissue in carbuncles is never black, like an ordinary slough. The smell of the discharge is exceedingly fetid, yet peculiar; quite different from that of putrid animal matter. The white flakes of cellular tissue, and the whiteness of all the sloughs, which come away with the matter, explain the reason of Sir Astley Cooper's statement, that the matter of carbuncles generally looks like a mixture of flour and water.

If nature herself prove adequate to the discharge of the mortified cellular tissue, she is only capable of doing so slowly, and by an ulcerative destruction of the skin, whereby all the sloughy cellular tissue is by degrees voided, and a very deep ulcer left, at the bottom of which one

may sometimes see the fascia, the tendons, the muscles, and in some instances even the denuded cervical vertebræ.

Carbuncles are chiefly seen in persons above the middle age, whose constitutions are broken and impaired. Hence the disturbance of the general health, accompanying the disease, is mostly severe, and not unfrequently the issue fatal. Intense headach, considerable disorder of the stomach, great anxiety, and despondence, are usual symptoms; and in the progress of the disease in its severe forms, rigours, clammy sweats, bilious vomiting, or diarrhœa, palpitations, faintings, extreme prostration of strength, white tongue, followed by a dry brown appearance of that organ, typhoid symptoms, coma, delirium, and death too often follow.

Carbuncles sometimes lead to phlebitis, and thus their fatal termination is accelerated, as I have had occasion to see.

With respect to the *prognosis*, if, together with a carbuncle of large size, there be great prostration of the vital power, a small, rapid, and irregular pulse, frequent vomiting, and a tendency to coma or delirium, the danger is urgent. The same is the case if matter form in the joints or other organs, as effects of the complication with phlebitis.

A carbuncle on the head or neck, *cæteris paribus*, is more perilous than in other situations.

As for the *treatment*, at the very commencement of the disease, leeches and other antiphlogistic means may be useful, in proportion to the strength of the patient and the intensity of the inflammation. In this country, the applications, mostly preferred at first, are fomentations and poultices; but, in France, sometimes cold lotions. The best means of stopping both the local and the constitutional disorder is to make one or two free incisions, in the form of a cross, and carried deep enough to pass completely through the dead cellular tissue. Some of this may now be pressed out, and if a poultice of oatmeal and port wine, or the fermenting cataplasm be used, the rest will soon follow piecemeal, leaving a deep ulcer, which, as soon as the sloughs have come out, should be dressed with a moderately stimulating ointment or a solution of the nitrate of silver. The ung. resinæ flavæ with red precipitate or turpentine, or Peruvian balsam, is also a dressing in great repute. Antiphlogistic measures can never be long continued. The prostration of strength, and the typhoid character of the constitutional disturbance, quickly call for a change of treatment. Then tonics become necessary, especially the Peruvian bark, the sulphate of quinine, sulphuric acid, together with opium or the muriate or acetate of morphia, to procure rest, and medicines for the regulation of the bowels.

In some parts of the continent, and also in the United States, the plan of destroying a portion of the skin over a carbuncle, with the potassa fusa, as soon as openings form in the tumour, is not uncommonly adopted.*

## MALIGNANT PUSTULE.

There are at least four diseases communicable from animals to man, viz. cow-pox, hydrophobia, glanders, and malignant pustule. This last, with the pestilential carbuncle, is treated of by Rayer under the head of gangrenous inflammations.

* Physick, in Philadelphia Journ. of the Med. and Physical Sciences, vol. ii. p. 172.

The malignant pustule is a contagious and gangrenous inflammation of the skin and cellular tissue, exhibiting on its surface, in the earliest stage of it, a vesicle not larger than a millet-seed, filled with a bloody serous fluid, under which is a small induration, that soon becomes surrounded by a redness like that of a flea-bite (*puce maligne*). The indurated point is next attacked with gangrene, which spreads rapidly from the central point towards the circumference, producing extensive and fatal ravages.

In cases tending to a fatal termination, the pulse soon becomes small and concentrated, with extreme restlessness, frequent syncopes, dry brown tongue, cadaverous countenance, dryness of the skin, dull glassy look of the cornea, great despondency, pain about the præcordia, and low delirium, the forerunner of death.

The malignant pustule, instead of proceeding from internal causes, like a carbuncle, usually arises from an external one, namely the direct application of a specific contagion to the skin, produced in horned cattle, which labour under or die of epidemic gangrenous diseases. Hence the disorder is rarely seen except in butchers, slaughtermen, shepherds, tanners, &c. It scarcely ever occurs in this country, and seldom at Paris; though it is not uncommon in Burgundy and some other parts of the South of France, and in Italy.

Bayle and Rayer are authorities in favour of the possibility of its occasional sporadic commencement in the human subject, a circumstance not generally admitted. The eating of the flesh of cattle, killed when affected with epidemic gangrenous diseases, is described by Larrey and others as an exciting cause. Whether the disease can be communicated from one human being to another is an unsettled point. Chelius believes, that such transmission has never been proved.*

In the *treatment*, deep incisions, and the application of the most powerful caustics, as the liquid muriate of antimony, or caustic potassa, are recommended. Even the excision of the pustule, while it is small, has sometimes been performed, and repeated when the gangrenous mischief did not stop, followed by dressings of stimulating ointments or lotions, caustic applications, or even the actual cautery. Tonics and stimulants, bark, sulphate of quinine, the diluted sulphuric acid, wine, æther, ammonia, opium, with aperients, and, if the stomach be much oppressed, an emetic; are the best internal means. Antiphlogistic msasures are universally disapproved of by those surgeons, who have had opportunities of seeing this form of disease.

## OF CHEMICAL AND MECHANICAL INJURIES.

The former comprise *burns* and *scalds*, and certain *ill consequences arising from the exposure of the body*, or *parts of it, to very low temperatures*. The latter comprehend *wounds*, *fractures*, *dislocations*, *sprains*, and *contusions*.

* Handbuch der Chirurgie, b. i. p. 22. Leipzig, 1826.

## BURNS AND SCALDS.

A *burn* is the effect of the action of concentrated heat upon the living tissues; an injury combining in its nature inflammation, a lesion of textures, and sometimes disorganisation of them. A moderate degree of radiating heat thickens the cuticle, hardens the skin, blunts its sensibility, and imparts to it a more or less deep brown colour. Such are its effects upon persons, who are habitually exposed to the solar rays, or to the heat radiating from powerful fires. Blacksmiths with their rough horny palms and fingers can touch and hold with impunity pieces of iron which are nearly red-hot.

A greater degree of radiating heat produces irregular marbled discolourations of the skin, and chaps or cracks in the cuticle, not unfrequently followed by ulceration. Such effects are commonly seen on the forepart of the legs of aged individuals, who sit almost continually close to the fire. In a still higher degree, radiating heat will bring on redness, vesication, and all the consequences usually noticed in the first and second species of burn presently to be described.

A *scald* signifies an injury arising from the application of a hot, or boiling fluid to the skin, or a mucous texture. The effect of the momentary application of very hot water to the surface of the body is to produce pain and redness, followed by a degree of swelling. When the scald is somewhat more severe, the cuticle is raised from the cutis in the form of transparent vesicles, filled with a serous fluid. Here the same change takes place, as follows the application of a blistering plaster, and this with such quickness, that it has been proposed in some urgent disease to employ hot water as an expeditious mode of forming a blister.

As water boils at 212° of Fahrenheit's thermometer, the degree of heat, and consequently, so far as this is concerned, the severity of the injury itself, attending a common scald, are kept within a certain limitation. The mischief is therefore generally more superficial, than that resulting from burns. But, even in this respect, something will depend *upon the length of time the hot or boiling fluid is applied*, and *the kind of fluid itself;* because oil, greasy soups, and some other liquids, with which these accidents are frequently occasioned, not only take a higher temperature than that of boiling water, but adhere longer to the parts.

Perhaps, the worst scalds happen to workmen, who fall into coppers of boiling wort, or to firemen from the descent of boiling water from a building in flames upon their thick clothes, from which they cannot quickly extricate themselves. I have attended several children who were most severely scalded in nurseries, by falling into tubs of hot water carelessly left in their way; and I have known many children die from the accidental spilling of a basin of hot tea or coffee over their breasts and bodies.

In most of these examples, the injury, though necessarily severe on account of its extent, is much and dangerously aggravated by the protracted duration of the contact of the hot fluid with the surface of the body. Hence, there is not only an extensive scald, but one, which, if the patient live long enough, will proceed to ulceration and even sloughing. But, although scalds are mostly injuries of a more superficial kind than burns, they are frequently perilous on another account—namely *their great extent*, arising from the quantity of the hot fluid applied, and the rapidity with which it diffuses itself over the integuments.

One case of scald is of a particular kind, inasmuch as it does not arise from the application of any hot fluid to the skin, but to internal parts; and it involves questions respecting the treatment, which do not present themselves in other examples. Poor persons sometimes let their children drink out of the spouts of kettles and teapots. Now this is often the cause of fatal accidents; for when such children are left by themselves, they are disposed to drink out of the same vessels, which may now contain a hot or boiling fluid. The consequences are not always, as might be supposed, *à priori*, the symptoms of inflammation of the œsophagus and stomach, but of inflammation of the glottis and larynx, resembling those of croup, and, under such circumstances, tracheotomy may become indispensable to save the patient from impending suffocation. Dr. Marshal Hall, who first drew attention to this subject, suspected, that the hot or boiling fluid did not actually reach the stomach, or even the œsophagus, but, that its course was arrested by a spasmodic action of the muscles of the pharynx. By passing to the fauces, he supposed that it only scalded the epiglottis and glottis, which became more and more swollen, until at length the rima glottidis was completely obstructed. This view is partly correct, that is to say, the larynx inflames from the injury which it receives; but a case, and the *post mortem* examination of it, recorded by Mr. Gillman, prove, that the hot fluid sometimes passes much further than the foregoing account represents, the whole interior of the mouth, fauces, pharynx, and œsophagus, nearly down to the cardiac orifice of the stomach, presenting the usual appearances of a scald. The lining of the trachea, however, was found considerably inflamed, with a layer of coagulating lymph adhering to it. In another case, published by Mr. Stanley, the mucous membrane of the pharynx, and upper part of the larynx, above the rima glottidis, were slightly reddened, but that opening itself was pervious. The child died twelve hours after the accident.

A *burn* denotes the inflammation and other consequences resulting from the application of high degrees of heat to the body, in every other manner than through the medium of water, or other fluids, which do not admit of a temperature much above 212°. When solid substances undergo rapid combustion, like phosphorus, sulphur, and resinous bodies, in general they occasion deep burns; but, in the contrary case, the intensity of their effects is in a ratio to their degree of heat, the duration of their application, and the tenderness of the parts. *Cæteris paribus*, a burn of parts, habitually exposed to the external air, occasions an injury of less depth than when it occurs on parts usually covered, and where, consequently, the cuticle is thin and incapable of affording equal protection to the cutis. Many individuals are severely burnt by the direct application of the ignited substances themselves, or of the flames issuing from them, to the uncovered parts of the body, as is exemplified in those who escape out of buildings in which the flames already occupy a considerable part of the interior. In other examples, the burn is caused by the clothes taking fire, when the ascending flames often severely scorch the breast, neck, and face. In consequence of the light combustible materials of female dress, women more frequently receive bad and fatal burns in this particular way than men. On the other hand, various employments, exclusively followed by the male sex, as those of firemen and labourers in brewhouses, gunpowder-mills, distilleries, laboratories, founderies, and mines, particularly expose such classes to severe burns produced in other manners. I have seen many instances, in which men employed to extin-

guish fires, were not only dreadfully scalded by the fall of boiling water upon them from the heated bricks, but severely and fatally injured either by the descent of melted lead upon them from the gutters and pipes, or by their falling into the midst of the flames, in consequence of their having ventured upon walls or floors which gave way with them. Burns in such persons are sometimes conjoined with fractures, and other bad mechanical injuries.

Burns are divided into several kinds, the differences of which chiefly depend upon the intensity and duration of the heat applied to the parts. When the heat has not exceeded a certain degree, and its application has been very transient, the skin may be only a little reddened and tender; it may present merely an erythema, an efflorescence, or a superficial phlogosis of the skin, unaccompanied by vesicles. Such is the *first* or *slightest degree of burn*. In a few days, sometimes in a few hours, the redness, heat, and pain go off, and the inflammation terminates with desquamation. But however slight the burn may be, if it be extensive, the pulse will become accelerated, the tongue red, and sympathetic irritation of the mucous membrane of the alimentary canal may be excited. When the head is the seat of injury, the irritation is liable to be propagated to the brain, occasioning restlessness, delirium, convulsive twitches, coma, and even death.

In the *second degree of burn*, serous fluid is effused under the cuticle, and vesicles are formed, sometimes immediately, but more commonly after a few hours.

In the *third degree of burn* more or less of the surface of the cutis is destroyed; a kind of mischief, indicated by grey, yellowish, or brownish discolourations, the parts so changed being thin, supple, and not painful, unless roughly pressed upon. The vesicles, which frequently take place over the points disorganised in this degree, are usually filled with a brownish or milky fluid, or a red serosity. In this description of burn, the pain, which usually subsides at the end of twenty-four or forty-eight hours, soon returns again with severity, and inflammation comes on around the eschars, which at length becoming detached, the sore heals, and a pale cicatrix remains. Although the pain of all burns is acute, it is much more severe when only the surface of the cutis is injured, than when it is more deeply destroyed; a fact, which Dupuytren justly regards as important with reference to the prognosis.

In the *fourth degree of burn*, there is a total destruction of the whole thickness of the cutis, together with a portion of the subcutaneous cellular tissue. The parts are converted into a deep eschar, of a yellowish or blackish colour, dry, insensible, and harder and tenser, in proportion as its colour is darker. The sound skin around the eschar is wrinkled and pinched up, as it were, the folds showing the degree in which the burnt parts have shrunk and curled themselves up. At the end of three or four days, the pain begins to be severe; an inflammatory circle forms round the eschar, which generally becomes detached about the fifteenth or twentieth day; the bottom of the sore then consists of the subcutaneous cellular tissue; a copious suppuration ensues, but granulations soon spring up with vigour.

Following Baron Dupuytren's classification, I may next observe, that *burns of the fifth degree* only differ from the fourth, inasmuch as they extend to parts more deeply situated. The eschars, composed of muscles, fasciæ, tendons, &c., sometimes include vessels and nerves which are not yet completely destroyed. The eschars are *black* and *brittle*, and require

a longer time to be detached than those of a more superficial description. When they are produced by boiling liquids, however, they are soft, greyish, and so insensible, that on being touched no pain is experienced. The suppuration which ensues is profuse, and the subsequent cicatrix is full of irregularities, the motions of the part being irreparably lost in consequence of the locomotive organs being involved.

In the *sixth degree of burn*, implicating the whole thickness of a limb, the surface of the part is completely charred, hard, insensible, and brittle. Sanson refers to a young man, who put his foot into a gutter, just at the moment when some fused iron was about to run along it; the foot and ankle were annihilated in a moment.

Each of the different degrees of burns, according as a small or great extent of parts happens to be injured, may either be merely a local affection, as it were, or the cause of such constitutional disturbance as will endanger life. This general indisposition may be the immediate effect of the irritation of the burn, the shock of the injury, or the secondary effect of the stages of inflammatory reaction, of suppuration, or of hectic exhaustion, sometimes induced in the later stages of bad and extensive burns. A burn may occasion immediate death; but I believe this is not altogether from the severity of the pain, as stated by Dupuytren. In fact, he has himself noticed, that, in such examples, there is generally extreme congestion of the viscera, and effusion in almost all the large cavities. This quick fatality of burns, however, is more frequent in children and nervous females than in adults or old persons. If the patient be not killed in this sudden way, he may be seized with excessive agitation, restlessness, spasms, or convulsions, and his pulse may become small, quick, and irregular. In other instances, a state of stupor and prostration, or collapse, takes place, with a small hardly perceptible pulse, cold pale skin, slow difficult respiration, and shiverings, the limbs being motionless and relinquished to their own weight, and the patient either giving no answers to questions put to him, or answering them reluctantly and imperfectly. This condition will soon end in death, or be followed by a general reaction; a fever, which, when the burn is superficial, but somewhat extensive, will resemble that febrile disturbance which accompanies erysipelas, the pulse being frequent, the skin hot, the digestive organs disordered, and the tongue dry and red.

In many cases of deep burns, no particular constitutional disturbance occurs in the interval between the receipt of the burn, and the beginning of the detachment of the eschars. But, at this period, which (according to Dupuytren) is usually about the fourth day, *inflammation comes on*, attended with a great deal of severe pain. If extensive surfaces be burnt, either considerable gastric irritation will be noticed, or great oppression and difficulty of respiration, connected with determination of blood to the bronchial membrane and lungs. But should the patient be fortunate enough to get through all these dangers, he will yet have others to encounter, namely, such as depend upon the extensive ulcers left after the separation of the eschars, and upon the hectic symptoms brought on by profuse suppuration.

Amongst the worst complications of burns are tetanus, and phlegmonous erysipelas, which latter sometimes creates a necessity for amputation. Another complication of burns of the sixth degree is necrosis, or the death of bone.

Dupuytren enumerates four periods of danger, as arising from burns:

1. The stage of irritation, as it is termed by him, or, as we should say, of the first shock of the injury on the system.

2. The stage of inflammation.
3. The stage of suppuration.
4. The stage of debility and hectic exhaustion.

The same distinguished surgeon has the merit of having first well explained, not only the complications of burns, but the *post mortem* appearances in fatal cases.

When persons perish in the flames, or soon after being removed from them, inflammation has not had time to invade the digestive canal, yet marks of great congestion are noticed. Not only does the mucous membrane exhibit red spots of greater or less extent, not only is it gorged with blood, but the cavity of the intestine contains a copious quantity of blood effused within it. The vessels of the brain are also fully injected with blood; the serosity in the ventricles has a red tint, which is likewise noticed in the fluid in the cavities of the pleura, pericardium, and peritonæum. The bronchi also contain a bloody mucous secretion, and their lining exhibits at various points a bright red colour, and different degrees of capillary turgescence.

If the patients die between the third and eighth day, and are afterwards opened, traces of inflammation are noticed in the alimentary canal, brain, and lungs. If they die in the suppurative stage, ulceration of the bowels and enlargement of the mesenteric glands may be observed.

In many burns, the parts are so violently injured, that though they are not killed or decomposed at once, they undergo such inflammation as soon terminates in their conversion into *sloughs* or *eschars*, as they are here generally termed. When the eschars are deep or extensive, the derangement of the whole system will be great, there will be collapse, with pallid face, cold extremities, shiverings, vomiting, and frequently hiccough.

The mortification from burns differs from that called *traumatic*, or such as arises from mechanical injuries, in not having a disposition to spread beyond the extent of the injury; a fact of importance to be remembered in the prognosis.

From the foregoing account of the division of burns and scalds into several degrees, it must not be inferred, that each variety of them always corresponds at every point to one of those degrees: frequently it is not universally either a mere redness or efflorescence, or redness with vesication, or a burn with ulceration, or with the formation of eschars. In bad burns and scalds, sometimes all these diversities of injury are exemplified in different parts of the burnt or scalded surface, according to the intensity or duration of the heat, or the disposition of the parts to be acted upon more or less quickly by it.

With regard to the *prognosis:*—1. The degree of danger materially depends upon the extent of the injured surface. A scald or burn of considerable extent often proves fatal immediately, or in a few hours, without the patient ever having rallied from the collapse. 2. The depth of the injury is another consideration influencing the prognosis. The deeper the effects of the burn extend, the greater the peril. 3. The situation of burns is also to be taken into the account; those of the head, neck, chest, and abdomen, *cæteris paribus*, being more dangerous than such as affect only the extremities. Scalds of the pharynx and larynx are remarkable for their fatality. 4. The age of the patient makes also a vast difference; infants being often carried off by convulsions, and very nervous persons sinking apparently from want of power in the system to bear the shock inflicted upon it; and delicate individuals, and others who lead irregular lives, or are of a gross corpulent habit, being far less capable of bearing

the consequences of severe burns, than strong healthy individuals more careful in their mode of living. 5. In estimating the danger of burns, however, a judgment is not to be formed abstractedly either from the extent of a burn, or from its probable depth, but with reference to its extent and depth together, joined with other circumstances already specified. In fact, a burn of the worst or sloughing kind, if it be of little extent, and the patient's constitution good, may be attended with no severe indisposition whatsoever, while the most superficial scald, if extensive, may prove fatal; and the risk of this termination will be greater in proportion as the patient's age, or previous state of health and mode of living, may render him an unfavourable subject for the accident. 6. In delivering a judgment respecting the degree of danger from a burn, we are not to hold out too favourable a view on first inspection of the case, because, when the eschars and sloughs come away, the mischief may be deeper and more extensive, than first appearances might lead us to expect. 7. In the process by which suppurating wounds and ulcers heal, there is a principle in the animal economy exemplified, by which the contraction and absorption of granulations are brought about during and for some time after cicatrisation. It is in consequence of this contraction of granulations, that the circumference of the ulcer is powerfully drawn towards the centre, and the degree and force with which this happens are perhaps greater in the sores produced by burns, than in those resulting from any other cause. Hence the healing of ulcerated burns is liable to be followed by hideous disfigurement and contraction of parts, and even by a complete and permanent interruption of their functions. Thus, when the forehead or eyebrow is burnt, the eyelids are likely to become everted, *ectropium* may take place, and the eyeball, being deprived of its natural screen, may have its functions considerably impaired, or even destroyed, by repeated attacks of chronic inflammation, terminating in opacity of the cornea. In burns of the neck, if the patient live, the contraction of the granulations frequently brings on a wry neck, and, in worse cases, the chin is absolutely pulled down to the sternum, and fixed in this position. When this happens, the integuments are thrown into irregular folds, which, like so many cords or bands, seem to hold the chin downwards. Sometimes the head is thus pulled towards the shoulder. I have seen deformity of this kind carried to such a degree, that even the lips were involved in it, and the mouth was horribly disfigured.

Sometimes the contractions, following burns, will fix a joint in a perfectly useless position, drawing the thumb or fingers quite back against the bones of the carpus, or holding the knee in a complete state of flexion, or the whole hand may be bent and fixed against the forearm, or the foot so twisted and deformed, as to be only a misshapen useless mass attached to the leg. The lower eyelid is sometimes drawn down, and adherent to the upper lip, or the lower lip is adherent to the chin. But, in order to convey an idea of the force, with which the contraction of the cicatrix takes place, I may quote a case recorded by Cruveilhier, where a burn of the forearm occasioned such a contraction of the skin, that the carpus was gradually dislocated from the radius. Dupuytren had a case, in which the penis became drawn up and fixed to the skin covering the linea alba; and another, in which the thigh was fixed in the bent position, the skin of the upper part of it being attached to that of the abdomen. The patient had a hernia, and when an attempt was made to extend the limb, thick longitudinal folds of the cicatrised parts projected, so as to prevent the truss from being applied.

These disfigurements and useless conditions of parts from burns are not usually noticed after burns on the posterior parts of the trunk, because the movements of flexion, which are the most natural, oppose the contraction of the cicatrix; and the same observation is generally applicable to burns on the posterior surface of the limbs.

Now, although surgery has resources for the prevention and relief of some of these severe disfigurements and mutilations, the risk of their occurrence cannot be prudently overlooked in the prognosis.

Besides these ill consequences, frequently arising from the power with which the granulations contract during and after the cicatrisation of burns, serious deformities, and the loss of the use of parts, are often produced on another principle; namely, by the growth and adhesion of burnt parts to one another. Thus the eyelids sometimes grow together, and the same thing may happen to the toes or fingers, or the ears may be rendered adherent to the scalp. Sometimes the lachrymal puncta and canals are obliterated; sometimes the nostrils. Deep burns of the fifth degree usually lead to very serious consequences. From the destruction of the muscles and tendons, the use of the limb often becomes permanently lost; from the copiousness of the suppuration, the patient is rendered hectic, and likely to sink; from the denudation of the bones, and their long exposure to the air, they are in danger of being attacked with necrosis; from the synovial membranes being frequently injured, the joints are likely to inflame; and, when the large joints are thus involved, the only chances of recovery are either by anchylosis or amputation.

Burns of the sixth degree on the limbs necessarily require amputation.

In burns, according to Baron Dupuytren's investigations, the patient's recovery is frequently retarded for a long while by ulceration of the mucous coat of the intestines.

With respect to the *treatment of scalds or burns*, when the injury is superficial, the indication is to keep down the inflammation, and thus prevent or limit the formation of vesicles; but, if the latter purpose cannot be accomplished, we are to endeavour to prevent such vesicles from becoming troublesome painful ulcers. For slight burns and scalds, cold applications are frequently preferred. The injured part may be immersed in very cold or iced water, or covered with linen wet with an evaporating lotion, such as vinegar and water, the liquor plumbi acetatis dilutus, with a small quantity of camphorated spirit in it; or rose water, with a drachm or two of diluted acetic acid, and two grains of the acetate of lead to each ounce of it, or the diluted liq. ammon. acetatis. All these applications, in common use amongst surgeons, and some others in favour with the vulgar, like scraped potatoes, prove serviceable on the principle of reducing the temperature of the burnt parts, and thus diminishing and keeping off inflammation. In particular, they tend to check the effusion of serum under the cuticle, and the formation of vesicles; but, for this purpose, they must be put on the part very soon, and, if possible, immediately after the accident; because vesicles sometimes make their appearance almost directly after the receipt of the injury, and others follow with more or less quickness. When there is a disposition to shiverings, the pulse is feeble, the skin pale and cold, the patient faint, and the burn extensive or situated on the trunk, cold applications are improper. In such cases, we may either imitate Dupuytren, who applies fomentations, or put the patient, if a child, into a warm bath, or use what Sir Astley Cooper recommends, namely, spirit of turpentine, or a

liniment of turpentine, linseed oil, and lime water, in equal parts *, afterwards resorting, however, on the reaction taking place, to antiphlogistic treatment, that is to say, after the pulse has risen, the patient has rallied, and a tendency to fever and inflammation has begun. Of late, the practice of dressing superficial burns with *raw cotton*, has been introduced into this country from America.† The cotton is thinly spread out, or carded and laid directly over the burn. This practice was at first proposed chiefly for scalds and superficial burns; but Dr. Anderson, of Glasgow, represents it as advantageous for all kinds of burns, whether superficial or deep, vesicated or sphacelated. One great principle insisted upon by him, is that of not removing the cotton, unless compelled by circumstances, until the cuticle is formed, and the parts are enabled to bear exposure. The raw cotton is sometimes covered with a moderately tight roller.

With respect to the suggestion of allowing the cotton to continue long unchanged, it seems inconsistent with due attention to cleanliness, for the discharge would in many instances convert the cotton into a fetid mass of putridity, and, in hot weather, maggots would soon be deposited in it.

Another application to burns is *common flour*, plentifully sprinkled on the injured surface with a flour dredger. This practice has gained reputation, and been introduced into the London hospitals. No doubt, the exclusion of the air, the absorption of the discharge, and the idea of protecting the burnt surface with a remarkably soft application, were the considerations which first suggested this treatment. In its adoption, nearly the same rules are followed as in the use of cotton, the parts being kept constantly covered, and allowed to heal under the coating of flour formed over them. For the purpose of loosening the masses of flour, when they require to be taken away, poultices are applied.

The *second class of burns*, or *those attended with vesication*, may be treated with refrigerant evaporating lotions, or with the lime water and linseed oil liniment, or with carded cotton, or common flour.

But the question here occurs, what are we to do with the vesicles? Should we discharge the fluid from them, or leave it undisturbed? Whatever be done, we cannot always prevent ulceration of the cutis from taking place under them. I believe, the occurrence is not much affected by the presence or discharge of the fluid from them, but depends rather upon the degree of injury, which the surface of the skin has sustained from the burn itself. In my own practice, when the vesicles are large, I generally let out the fluid by making a fine puncture with the point of a needle or lancet, a plan sanctioned also by the authority of Dupuytren. When the cutis is exposed, we may apply the unguentum creasoti, or liquor plumbi acetatis dilutus, with two grains of the sulphate of zinc to each ounce of the lotion, as an application that seems to promote the quick production of new cuticle.

The *third and fourth degrees of burns*, or *those in which the parts are so injured that eschars and ulceration are unavoidable*, may also be treated with the lime water and linseed oil liniment, emollient poultices, and fomentations, flour, or the turpentine liniment, which is sometimes preferred as the dressing for every kind of burns.

* In superficial burns of the face, M. Velpeau is in favour of this common application; the parts being smeared with it four or five times daily with a feather. In five or six days, large burns of the first, and some of the second degrees, have been cured by it.

† Dallam, in Potter's "Medical Lyceum," p. 22.

According to M. Velpeau, in a burn of the first degree, a compressing bandage prevents the development of inflammation; in one of the second degree, it hinders the occurrence of blisters, or, if not employed early enough to do this, causes the absorption of the effused serum. In a burn of the third degree, it cannot prevent an eschar, but it lessens the pain. M. Velpeau * generally prefers straps of diachylon plaster, or, in other words, the plan adopted by Baynton for ulcers. He states, that the first degree is constantly checked by surrounding the burn in such a manner, that the strap may remain seven or eight days. In the second and third degrees, the cuticle must be first removed, the surface cleaned, and the strapping renewed every third, fourth, fifth, or sixth day. In the fourth degree, it represses the surrounding inflammation, does not hinder the separation of the sloughs, and, as they become detached, it promotes cicatrisation. If suppuration be profuse, the straps are to be changed every other day; but, in ordinary cases, every third or fourth day. In the fourth degree, before the eschars are detached, M. Velpeau lets the straps remain five or six days. Very large burns are excepted from this treatment, which of course is only adapted to those of the limbs.

Suppuration is not the invariable consequence of vesicles, though it frequently follows them. Sometimes purulent matter is formed from the surface of the cutis, without any appearance of ulceration, and is at last stopped by the production of new cuticle. In other instances, small ulcerations occur on the surface or edges of the burn, and spread with more or less rapidity into extensive sores.

Immediately the ulcers begin to secrete healthy pus, and to form granulations, the applications above specified should be discontinued, and a mildly astringent ointment made use of, such as the calamine cerate, ung. creasoti (L. P.), blended with an equal quantity of lard, or the zinc and spermaceti ointments, mixed together in equal proportions.

Of all the sores which surgeons have to deal with, none are more disposed than those of burns to produce high fungous granulations, which seriously retard the healing process, and, if not repressed by suitable treatment, often terminate in the formation of an ugly, protuberant, dense, almost cartilaginous cicatrix. In Mr. Higginbottom's treatise on the nitrate of silver, cases of this kind are reported, in which it was necessary to apply this substance for the dispersion of the extraordinary mass of projecting new matter collected in the place of the cicatrix.

For the prevention of this description of deformity, the best method is to keep down the granulations by sprinkling them occasionally with powder of myrrh and calamine in equal parts, or by touching them from time to time with the nitrate of silver; or, if the situation of the burn will admit of the plan, by applying straps of adhesive plaster, or a bandage.

With regard to the *treatment of burns*, where the parts are reduced to an *eschar* at the time of the accident, or are so injured that they afterwards slough, we may either pursue the same practice which is applicable to mortification in general, that is, we may either employ emollient applications, poultices, and fomentations, or use such local means as are believed to have a specific virtue in the relief of sloughing burns. Amongst the latter applications, the turpentine liniment deserves to be particularly mentioned. Dr. Kentish, who first brought it into use, adopts the principle, that the increased action in the parts near the eschars

* See Révue Méd. Juin et Juillet, 1835.

should not be suddenly reduced, but supported until suppuration takes place. With this view, he first bathes them with warm camphorated spirit, or oil of turpentine, and then covers them with the turpentine liniment, consisting of ung. resinæ flavæ, diluted and softened with turpentine, and spread upon rag. When the secretion of pus commences, he discontinues the turpentine liniment, and applies milder dressings, such as the ceratum calaminæ, or ceratum plumbi acetatis. For repressing exuberant granulations, and absorbing the discharge, he uses powdered chalk, which he also introduces into the cavities of separated eschars, and into the furrows between sloughs, a pledget being then put on, and, in tedious cases, a poultice.

With respect to the dressing of burns in general, all surgeons concur respecting the advantages of keeping the injured parts well covered, and not exposed to the air, which has a decidedly bad effect upon them. They also coincide in the usefulness of dressing a burn much less frequently than was the practice in former days; indeed, many practitioners now make it a rule not to remove the first dressings until suppuration is established. On the same principle, when cold applications are used, we should not frequently take off the rags, but merely sprinkle them with the lotion as often as may be requisite to keep them wet. For the purpose, also, of not keeping the burnt surface long uncovered, we should not, when the burn is extensive, take off all the dressings at once, but only a part of them. No doubt, it is partly on the principle of keeping the burnt surface effectually excluded from the air, and partly on the principle of avoiding the pain and irritation of the frequent removal of dressings, that carded cotton, flour, and various liniments of turpentine, linseed oil, and lime water, produce their beneficial effects. A gentleman, who lately attended my lectures, informed me that, in the part of the country which he came from, burns were successfully treated by applying to them with a fine brush a solution of elastic gum in ether, which formed a kind of varnish or coating upon them, preventing the ill effects of their exposure to the air.

With regard to the *internal treatment*, when a scald or burn is of a severe description, *the first stage of danger*, the danger from the shock on the system, the period of irritation, as Dupuytren terms it, immediately presents itself, sometimes accompanied by violent agitation of the nervous system, but still more frequently by shiverings, paleness, stupor, coldness, weak pulse, and collapse. Now opium, brandy, ammonia, or ether may be given. Cold applications are to be avoided, bottles of hot water may be put to the feet and epigastrium, and the patient kept covered. The warm bath for children is in this stage particularly recommended by Dupuytren. When the collapse goes off, and fever and inflammation come on, we are to adopt antiphlogistic treatment, bleed young robust subjects, and administer opium.

The second period of great suffering and danger is when the eschars and sloughs are beginning to loosen: the *stage of elimination*, as it is named by French surgeons. The constitutional disturbance now runs high, and, when the patient is strong and young, bleeding may be necessary, together with leeches, and opium. According to M. Velpeau, the application of leeches around eschars prevents or lessens inflammation and erysipelas.

The third stage of danger is that of suppuration, when the profuse discharge may be such as the patient cannot safely bear: purgatives and astringent lotions are now proper to check it, followed by bark, dil. sulph.

acid, a moderate quantity of wine, and opium. For the diarrhœa, to which burnt patients are subject in the suppurative stage, Dupuytren prefers giving half a grain of opium, and one of sulphate of zinc, three or four times a day.

The fourth stage of danger is when hectic symptoms have been induced by the long duration of the effects of the injury, the irritation, pain, discharge, &c. Here we must act according to the principles explained in the article on hectic fever, support the strength, give opium, &c. The occasional complication of burns with phlegmonous erysipelas, tetanus, or the determination of blood to internal organs, will of course demand particular remedies.

### OF DEFORMITIES BROUGHT ON BY BURNS.

Burns of the head and face are particularly liable to occasion more or less deformity by the contraction of the cicatrix, because the tissues of the face are remarkably moveable and extensible, and no position of the head has any effect in counteracting the influence of such contraction. Bandages, splints, and other mechanical contrivances, are here, also, totally inapplicable and useless. Some trivial good may result, however, from keeping the skin drawn in the opposite direction to that in which its contraction would be disadvantageous, by means of straps of adhesive plaster. We may also make free use of nitrate of silver to repress the high granulations. When, however, the burn is on the neck or limbs, a great deal may be effected by mechanical means, adapted to maintain the head or limb in the opposite direction to that in which the contraction of the cicatrix would otherwise draw the part. Thus, supposing the skin of the front of the arm to be in a state of ulceration from a burn, if we maintain the limb extended, the cicatrix cannot diminish in the long axis, but transversely, so that a permanent flexion of the arm will be prevented. The plan is to be continued for at least two months after the healing is complete, for, without such precaution, deformity will still follow; but passive motion should be begun sooner. Fabricius Hildanus notices the practice of cutting away the horny scars and indurated substances left by burns; a method revived by the late Mr. Earle, who found that merely dividing the cicatrix and frœna would not suffice. His plan consists in cutting away the whole of the indurated substance of the cicatrix, and in then bringing the sides of the wound together transversely by means of adhesive plaster. The aid of machinery and splints is not to be neglected. On the other hand, Baron Dupuytren deems this practice unnecessary, and declares, that the simple but complete division of the cicatrix and its frœna at several points will answer every purpose, if, by so doing, we can bring the limb or part again into its right position, and the injury has not been such as to involve the muscles, or to have caused anchylosis.

The limb is then to be kept extended by machinery, splints, or bandages. When the part cannot be put into its proper position directly after the division of the indurated cicatrix and frœna, a slow and gradual extension is to be kept up: for this purpose, splints made with a screw, by which they can be bent to any convenient angle, are of great service. After the division of the cicatrix at several points, and the restoration of the part to the desirable position, the treatment is to be conducted on the same principles as are applicable to a burn, on the separation of the eschars and the commencement of the granulations. If new frœna begin to form again, they must be cut through without hesitation. When parts

are merely adherent to one another, the following rules of practice are laid down by Dupuytren: — 1. We are to divide them freely, and somewhat beyond their origin. 2. We are then to keep the divided surfaces apart. 3. Next, we are to make methodical and constant pressure on the point whence cicatrisation must proceed, viz. the angle of union.

When any natural opening is *contracted* or *obliterated* in consequence of a burn, we are either to enlarge the contracted aperture, or to restore the obliterated one by a perforation; then a tent or ivory tube, of considerably greater diameter than the natural opening, is to be inserted, and worn, not only during the healing process, but for a long while after it.

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## EFFECTS OF COLD.

Of the general exciting or stimulant power of heat there can be no doubt; and, with regard to cold, the disputes concerning its operation have been perpetuated only by logical illusion. In common language, we are accustomed to speak of cold as a positive and active energy, while philosophy can acknowledge it only as the expression of a relative decrease of temperature; for any degree of temperature designated by the appellation of cold is still heat.* The very same temperature may be called hot or cold, according as it is compared with a colder or a hotter temperature. If we warm one of our hands at a fire, while we cool the other by means of ice, and then plunge both of them into water of the common temperature of the atmosphere, the water will feel cold to the hand which has been heated, and warm to the other which has been cooled.

In a physical sense, every temperature of the air, or other surrounding medium, below 98°, might be denominated cold, because this is the common heat of the human body; but, with regard to the feelings and the health, a degree much lower, namely, from 60° to 65°, is the most grateful and invigorating. The external medium, at the temperature of about 62°, appears to abstract the heat of the body in the same proportion in which it is generated, without any extraordinary exertion, of the system; and, therefore, neither contributes to exhaust its powers, nor to excite uneasy sensations. Hence, also, the denominations of temperate, warm, hot, cool, and cold, are given to particular degrees of the thermometric scale. The sensations of different men vary, however, according to the power which their respective constitutions possess of evolving heat. This depends much upon the original vigour of the system, especially of the heart and arterial system. It is also much influenced by habit, or by a person's being seasoned to the cold. Hence, people who, from vigour of constitution or from habit, readily evolve a considerable quantity of heat, especially during moderate exercise, can bear with pleasure and benefit to their health the very same degree of cold, which to the weak and unhabituated is a source of painful chilliness.

The first effect of certain degrees of cold, applied to the human body, is to weaken the circulation through the small cutaneous vessels, more especially those which are situated in extreme parts, like the hands and feet;

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* Kellie, in Edinb. Med. and Surg. Journ. vol. i. p. 305. The latter part of the above remark may be said to be generally true, with respect to any degree of cold of which we ever speak, though rules for calculating the zero of heat have been given. See Essays on Subjects chiefly Chemical, by W. Irvine, M. D. 8vo. Lond. 1809.

or, in projecting parts, as the ears, nose, scrotum, &c. which expose a larger surface to the atmosphere, or medium, by which their caloric is abstracted. Hence the skin becomes pale, and, contracting round the miliary glands and roots of the hair, exhibits a roughness which is compared to the skin of an unfeathered goose, and is technically named the *cutis anserina.* The action of the heart and arteries in general becomes weakened; and the blood being partially delayed in its course through some of the cutaneous vessels, and not undergoing the change of colour which the circulation through the lungs produces, it gives a bluish or livid colour to the fingers, ears, and other projecting parts. If the cold be intense, or the exposure long continued, the circulation in the extreme parts becomes altogether interrupted, and, the power of evolving heat being completely destroyed, mortification is the consequence. Parts killed in this manner are said to be *frost-bitten.*

From the languor and weakness of the arterial system, produced by the application of cold, other effects on the constitution necessarily accrue. A free circulation of well-oxygenated blood seems essential to the perfect execution of the functions of the brain and nervous system, and to the support of sensibility. If the circulation is suspended for a few moments, as in syncope, the sensibility is also suspended; and, on the other hand, when there is more than an ordinary supply of blood to any part, as in inflammation, the sensibility is highly augmented. Hence, another immediate effect of the agency of cold on the human body is a diminution of the sensibility of parts. This is universally felt in the numbness of the hands and fingers, which, under the impression of cold, are altogether incapable of accurate discrimination of touch; and the whole of the surface of the skin partakes of the imperfect feeling. The tongue is also incapable of distinguishing the peculiar flavour of sapid bodies, if they be extremely cold; and the sense of smell is considerably enfeebled by cold. If the cold be intense, or its application long continued, the powers of the whole nervous system yield; a torpor of the animal functions ensues; the action of the muscles becomes feeble, and scarcely obedient to the will; an unconquerable languor and indisposition to motion succeed; and drowsiness comes on, ending in sleep, from which the person, if not speedily roused, frequently awakes no more.*

The strong propensity to sleep, following the anxiety and lassitude experienced at an earlier period, is noticed by most writers as the precursor of imminent danger†; and it is certainly a symptom of usual occurrence. But, as an intelligent author remarks, it is doubtful how far the state of sleep is the necessary consequence of simple exposure to cold; or, at least, what other circumstances besides cold are necessary for its production, since this exposure may be made to an intense degree of cold, for a considerable length of time, without sleep being induced.‡ The case of Elizabeth Woodcock §, who lay buried under snow more than a week without sleeping a great deal, and those of some shipwrecked sailors, who were more or less immersed in water, in severe weather, for twenty-

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* See a description of the effects of the cold at Terra del Fuego, on the persons who landed there with Dr. Solander and Sir J. Banks, as detailed in Captain Cook's first voyage.

† Richter, Anfangsgr. der Wundarzn. b. 1. p. 117. Larrey, Mém. de Chir. Mil. t. iv. p. 106. Callisen, Syst. Chir. Hod. pars i. p. 308.

‡ Thomson's Lect. on Inflammation, p. 624.

§ Reeve's Essay on Torpidity, p. 109.

three hours, without being seized with drowsiness, are proofs that an irresistible propensity to sleep is not constant.*

In describing the manner in which the French soldiers perished from the severity of the cold in Russia, Larrey remarks that their death was preceded by a paleness of the countenance, by a sort of idiotism, difficulty of speech, weakness of sight, and even a total loss of these faculties. In this state, some of the men continued to march, for a greater or lesser time, led by their comrades. The action of the muscles gradually grew weaker; the men reeled about as if they were drunk; and their debility increased until they fell down — a certain sign of the total extinction of life. The incessant and rapid march of the troops in close masses obliged those, who could not bear it, to quit the centre to walk along the side of the road. Separated from this compact column, and left to themselves, they soon lost their equilibrium, and fell into the ditches of snow, from which it was hardly possible for them to get out. Here they were immediately seized with a painful numbness, followed by lethargic drowsiness, and in a few minutes their miserable existence terminated. Frequently, before death, there was an involuntary emission of urine, and sometimes hemorrhage from the nose. Almost all the men who perished in this manner were found lying with their faces downwards. The skin was without alteration of colour, or any appearance of gangrene. In general, death took place more or less rapidly, according as the subject had been fasting a longer or shorter time. †

It has been a question, whether the human body, after being frozen, can ever be restored to life. Richter asserts the possibility of recovery, *when the blood in the heart itself is not turned into ice; when this organ and large bloodvessels still retain a degree of vitality; and there is no extravasation in the brain* to render the thing impracticable. And he declares that persons, who have lain in a frozen state as long as four and six days, have been restored to life. ‡ After a full consideration of this subject, I think there can be no doubt that Richter is in error; and that the cases of recovery to which he adverts were only instances of restoration from a state in which suspension of sensation, voluntary motion, &c. had been induced by cold, and not examples in which the whole body, or even the greater part of it, had been frozen. In order to ascertain the truth or falsity of an assertion, that some animals, especially serpents and fish, can recover their vitality after being frozen, Mr. John Hunter instituted a number of interesting experiments on the power of different animals in resisting the agency of cold. Two carps were gradually frozen, with the aid of a freezing mixture, and did not recover. It was with great difficulty that he succeeded in freezing a dormouse, such were its powers of evolving heat, and the non-conducting quality of its integuments; and it was not till the hair had been wetted that life was destroyed. This animal, also, did not recover. When a toad was exposed to a similar cold mixture, the water froze round the animal so as to enclose it, but without destroying life: yet, though not frozen, it hardly ever recovered the use of its limbs. The conclusion drawn from these experiments was,

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* Phil. Trans. 1792; and Currie's Med. Reports on the Effects of Water, vol. i. chap. 15.

† Larrey, Mémoires de Chir. Militaire, t. iv. pp. 127—129. His description, however, is rather that of people dying from the combined effects of cold, hunger, and fatigue, than from cold alone.

‡ Richter, b. i. p. 119.

*that an animal must be deprived of life before it can be frozen.** On the other hand, Hearne says, that spiders, frozen so hard as to bound from the floor like a pea, were revived by being brought to the fire. Leeches, snails, grubs, and frogs, have been frozen to a certain degree by artificial cold, and revived. Other experiments have also proved, that frogs would revive even if the heart was frozen, but not if the brain congealed, after which they could not be affected by the galvanic action.† Captain Franklin, in his northern expedition, repeatedly saw fish, especially carp, recover after having been congealed by cold into a solid mass of ice; and one carp recovered so far as to leap about with much vigour after it had been frozen for thirty-six hours.‡ We learn from Professor Thomson, however, that, in the year 1785, a variety of experiments were made at the Royal Medical Society of Edinburgh, in order to discover some of the effects which exposure to intense degrees of cold produces upon warm-blooded animals. In these experiments it was uniformly observed, that death took place long before the irritability of the heart and other internal parts was destroyed, and at a time when the temperature of the blood, circulating in the heart and larger blood-vessels, was but little, if at all, reduced below 60° of Fahrenheit.§ How far these various facts can be reconciled by the different effects of artificial and natural freezing, or by the less pernicious operation of severe cold upon similar classes of animals in the polar regions than in milder climates, I cannot presume to conjecture; but I have no doubt that, in whatever manner this physiological question may be hereafter settled, with respect to the lower animals, the truth of Mr. Hunter's inference, with regard to the human subject, will remain unshaken. Whoever will advert to any of the most remarkable examples on record, where persons have recovered after being exposed for a length of time to extraordinary cold, will find that the particulars by no means justify the conclusion, that such cases were instances in which the whole body, or the greater part of it, had been frozen. We may be sure that this did not happen in the case of Elizabeth Woodcock, who lay buried six feet under the snow, and without food, from Saturday, Feb. 2d to Sunday, Feb. 10th, 1799; for it is expressly related that she was sensible the whole time ||; a state, which cannot be supposed to be compatible with a general congelation of the blood and other fluids in the system. The French peasant Boutillat was lost in a snow storm on the Black Mountains, which separate France from Spain, and lay asleep under the snow four days; but on the fifth morning he awoke with a sensation of thirst. How could this return of sense and intellect have happened, had the whole mass of the blood been in a frozen state? Or, if it be thought that the fluid was in a state of congelation only while the man lay asleep and senseless, by what alteration of circumstances is the thawing of the blood to be accounted for, since he awoke buried under the snow, breathing through a hollow cone, which, as in the instance of Elizabeth Woodcock, extended from his body to the surface of the snow?¶ Nor could the circulating fluids have been frozen to a great extent in three other individuals, whose remarkable case is upon record, since, in such con-

* See Philosoph. Trans. vols. lxv. and lxviii.; and Hunter on certain Parts of the Animal Œconomy, pp. 100, 101.

† Quarterly Review, No. lvi. p. 382.

‡ Franklin's Journey to the Shores of the Polar Sea, p. 248., 4to. 1823.

§ Thomson's Lect. on Inflammation, p. 642.

|| Reeve's Essay on Torpidity, p. 109.

¶ Pilhes, in Journ. de Médécine. Paris, 1767, tom. xxvii.

dition, they would not have been in constant dread of being starved.* The very existence of sensation and intelligence proves that, in none of these cases, a completely frozen state of the body or of the blood could have taken place. Had this last state been induced, no doubt recovery would have been out of all possibility, notwithstanding the contrary sentiments which have been published on this point by Fabricius, Hildanus, Richter, &c.†

### TREATMENT OF PERSONS IN A STATE OF TORPOR OR SUSPENDED ANIMATION FROM COLD.

One great principle, insisted upon by practical writers, is to let caloric be communicated to the body in the most gradual manner.‡ From observations and experiments (says Mr. Hunter), it appears to be a law of nature, in animal bodies, that the degree of external heat should bear a proportion to the quantity of life. When life is weakened, this proportion must be adjusted with great accuracy; but, when the powers of life are considerable, a greater latitude is allowable. "I was led (he observes) to make these observations by attending to persons who are frost-bitten, the effect of cold in such cases being that of lessening the living principle. The powers of action remain as perfect as ever, but weakened, and heat is the only thing wanting to put these powers into action; yet that heat must at first be gradually applied, and proportioned to the quantity of the living principle, which increasing, the degree of heat may likewise be increased. If this method is not observed, and too great a degree of heat is at first applied, the person, or part, loses entirely the living principle, and mortification ensues. Such a process invariably takes place with regard to men; and the same thing, I am convinced, happens to other animals. For, if an eel is exposed to a degree of cold, sufficiently intense to benumb it till the remains of life are scarcely perceptible, and still retained in a cold of about 40°, this small proportion of living principle will continue for a considerable time, without diminution or increase; but, if the animal is afterwards placed in a heat about 60°, after showing strong signs of returning life, it will die in a few minutes. Nor is this circumstance peculiar to the diminution of life by cold. The same phenomena take place in animals which have been very much reduced by hunger. If a lizard or snake, when it goes to its autumnal hiding-place, is not sufficiently fat, the living powers are, before the season admits it to come out, very considerably weakened, perhaps so much, as not to permit of the animal being again restored. If animals in a torpid state are exposed to the sun's rays, or placed in any situation which by its warmth would give vigour to those of the same kind, possessed of a larger share of life, they will immediately show signs of increased life, but quickly sink under the experiment, and die; while others reduced to the same degree of weakness, as far as appearances can discover, will live for many weeks, if kept in a degree of cold proportioned to the quantity of life they possess. "I observed, many years ago (says Mr. Hunter), in some of the colder parts of this island, that, when intense cold had forced blackbirds or thrushes to take shelter in

* Narrative of three women saved, who were buried thirty-seven days under the snow, in a stable at Bergemoletto, in Italy, by F. Soumis. 12mo. 1739.

† For many judicious observations on this topic, consult Thomson's Lect. on Inflammation, pp. 642—644.

‡ Richter, Anfangsgr. b. i. p. 123. Callisen, Syst. Chir. Hodiern. t. i. p. 309.

outhouses, such of them as had been caught, and were, from an ill-judged compassion, exposed to a considerable degree of warmth, died very soon."*

I have deemed it advisable to cite these sentiments of Mr. Hunter, with some of the facts upon which they are founded, in consequence of my having read, in some modern works of high repute and extensive circulation, that, in cases of suspended animation, or torpor from cold, the patient may be safely brought into a warm but well ventilated room, chafed with warm flannels, and his feet and legs immersed in warm water.† Dr. Kellie does not think the same caution and reserve necessary in the application of heat to a case of general torpor, as to benumbed and frost-bitten limbs. In the latter occurrence, he admits, heat should be very gradually communicated; but (says he) surely we would not commence the treatment of a case of general torpor, nearly approaching to death, by applying snow to the body. He argues, that there does not appear to be the same danger of violent reaction, or of destroying by premature stimulation, an accumulated excitability in general torpor, where the sensorial functions have been all along suspended, as in a partial affection, where, notwithstanding the injury done to the part, the general powers of the system have remained excitable. Notwithstanding the ingenuity of the reasoning which Dr. Kellie has adopted, I am far from thinking the practical principles, to which the observations of Mr. Hunter tend, are at all erroneous. The case, related by Dr. Kellie, was not an example in which the vital powers were reduced altogether by cold. The temperature, to which the individual had been exposed, was not, indeed, depressed to a degree generally incompatible with activity and life; but he was reduced by fatigue and fasting, and the effects of the atmospheric cold were increased by the drizzling rain which fell. The blood which flowed from the arm was judged to be of its natural temperature. This was, therefore, a case in which the temperature of the patient could hardly have been low enough to afford any criterion of the safety or danger of suddenly exposing a person to much warmth, who has been subjected to the effects of intense cold. If the facts mentioned by Hunter had left this matter doubtful, we might still be convinced of the truth of his observations by other events upon record. The limbs of the peasant Boutillat, whose case I have already noticed, were covered with warm linen, dipped in aromatic liquors: his feet mortified, and he lost his life. These consequences, Dr. Pilhes thinks, might have been avoided by the use of cold applications.‡ The ample experience of Larrey, who was an eye-witness of all the disasters of Napoleon's campaign in Russia, appears also to confirm the truth of the principle inculcated by Hunter, Richter, Callisen, &c. In describing the sufferings of the French army from the rigour of the climate, Larrey exclaims, "Woe to the man benumbed with cold, whose animal functions were nearly exhausted, and especially whose external sensibility was destroyed, if he entered too suddenly into a warm room, or came too near the fire of a bivouac! The prominent parts benumbed or frozen, at a distance from the centre of the circulation, were seized with gangrene,

* Observations on certain Parts of the Animal Œconomy, by J. Hunter. 4to. p. 137. 2d edit. Lond. 1792.

† Kellie, in Edin. Med. and Surgical Journ. vol. i. p. 312. Rees's Cyclopædia, art. *Cold.*

‡ Journ. de Médecine, tom. xxvii.

which made its appearance at the very instant, and spread with such rapidity, that its advances were perceptible by the eye, or the individual was suddenly suffocated with a kind of turgescence, which appeared to affect the brain and lungs: he perished as in asphyxia. Thus died the chief apothecary of the guards. He had arrived at Kowno without any accident, but his strength was much reduced by cold and abstinence. An asylum was offered him in a warm apartment in the pharmacy of the hospital. He had scarcely been a few hours in this atmosphere, so new to him, when his limbs, in which he had lost all feeling, became considerably swelled; and he expired soon afterwards, in the arms of his son and one of his colleagues, incapable of uttering a single word. We saw some individuals fall down stiff-dead in the fires of the bivouacs," &c.*

In describing the treatment of a person in a state of torpor, or suspended animation, from cold, Callisen and Richter rigorously adhere to the principle, that caloric should be very gradually communicated to the body. The former recommends long-continued frictions with snow, or cloths wet with very cold water. This is to be done in a cold room; and he advises the surgeon not to let his endeavours cease too soon, as patients, after lying without signs of life for several days, have yet been snatched from the jaws of death. On the return of sense, motion, and warmth, aromatic spirituous applications may be used; the temperature in which the body is placed may be raised, and cordials administered.† When signs of vitality return, Richter directs strong volatiles and sternutatories to be applied to the nostrils, air to be blown into the lungs, and the fauces to be tickled with a feather. He also recommends the introduction of tobacco-fumes up the rectum; a practice, however, the propriety of which is questionable in all cases of suspended animation, on account of the debilitating, and even deleterious, effects of that plant. It might be better to throw warm wine into the large intestines, or inject it by means of a hollow bougie down the œsophagus. When the signs of returning animation increase, the body is to rubbed with brandy, and conveyed into a warmer situation. A diaphoretic drink is then to be given; and, as soon as the patient has been well dried, he is to be put to bed, and remain there till he begins to sweat.‡

Possibly, these eminent surgeons may have extended the principle too far, in directing the body to be at first covered or rubbed with snow. But, there is every reason to believe, that their method of allowing the heat to be communicated only by degrees, is the most likely to be conducive to recovery.

### TREATMENT OF FROZEN PARTS.

As, in all the experiments which Mr. Hunter made upon the freezing of whole animals, he had never seen life return by thawing, he was desirous of ascertaining how far parts were similar to the whole in this respect. He froze the ears of rabbits, and the combs and wattles of cocks, till the parts were so stiff and hard that, when cut, they flew from the blades of the scissors like a chip, and no pain nor bleeding ensued. After being thawed, they inflamed considerably; but, in the end, perfectly recovered. There was thus a material difference in the result of his experiments, on the whole of some of the more perfect animals, and

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* Mém. de Chir. Mil. tom. iv. pp. 134, 135.
† Callisen, t. i. p. 309.
‡ Richter's Anfangsgr. b. i. p. 123.

on parts of them. But, though it was thus fully proved, that parts of such animals might be frozen, and restored to their natural state, it was not known whether this would happen in the more imperfect animals. Mr. Hunter, therefore, froze the tails of a tench and two gold fishes, and endeavoured to restore the vitality of the parts, by putting the fish into cold water; but the tails, when thawed, did not resume their original appearance: the fish were suspended with their heads perpendicularly downwards, and ultimately died. All his other trials to restore the life of other cold-blooded animals, or of parts of them, after they had been frozen, also entirely failed.* Spallanzani also found, that the irritability of the muscles of frogs, toads, and lizards was not destroyed by keeping these animals a good while in snow; but that, if the cold was increased, so as to freeze any part of them, the frozen part was invariably killed, and rendered insensible to stimuli.†

The experiments, however, on warm-blooded animals corroborate what has long been believed, that when a part of the human body is simply frozen, without any impairment of its organisation, it may often be recovered by the *gradual* communication of caloric to it. What parts of the human body admit of being frozen, without the destruction of life, and how long they may remain in this state with impunity (as Dr. Thomson remarks), are points, which observation does not hitherto appear accurately to have determined: but we know, that portions of the cheeks, ears, and nose, have often been frozen by exposure to cold, and yet that, by a proper management, the vital functions of these parts have been restored. It seems probable, therefore, that a small part of the cutaneous texture may be frozen for a short period, without the necessary destruction of its vitality. But Dr. Thomson considers the restoration of a frozen limb a matter of impossibility; and, in the course of his reading, he has not met with a single unequivocal instance of such an event.‡ On this point he differs from Callisen and Richter, quite as much as upon the other question of the possibility of reviving the whole body, after it has been frozen. Whatever doubts may have been suggested, concerning the propriety of keeping patients out of a warm temperature, who are in a state of torpor and insensibility from cold, none exist with respect to the prudence of extending this principle to the treatment of very cold or actually frozen parts of the human body. If a limb, that is not indeed frozen but excessively cold, be suddenly warmed, chilblains, frost-bite, and other more extensive forms of inflammation, are the result. The part swells, turns livid, and becomes affected with insupportable darting pain. And, when a part actually frozen is thus quickly warmed, the same symptoms arise, but in an aggravated degree, and rapidly end in mortification.§

I have already cited some facts ||, strongly illustrative of the danger of exposing very cold or frozen parts to the fire; but, perhaps, on no occasion has the thing been more forcibly proved, than in the campaign of the French army, about the period of the battle of Eylau. During

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* Obs. on certain Parts of the Animal Œconomy, pp. 124, 125.

† Opuscules de Physique, t. i. p. 118.

‡ Lectures on Inflammation, pp. 628. 642. "The fingers, toes, and nose may be frozen and perfectly recovered, if judicious means be employed; whereas, if the whole limb be frozen, it dies; and none of the higher animals can have the body congealed, and escape death."— Macartney on Inflammation, p. 99.

§ Richter, Anfangsgr. der Wundarzneykunst, b. i. p. 120.

|| From Larrey's Mém. de Chir. Mil. t. 4.

the three or four severely cold days previous to this action, the mercury had fallen to ten, eleven, twelve, thirteen, fourteen, and fifteen degrees below the zero of Reaumur's thermometer, and yet, until the second day after the battle, not a single soldier complained of any accident from the effect of the cold. "We had, however," says Larrey, "passed these days, and a great part of the nights of the 5th, 6th, 7th, 8th, and 9th of February, in the snow, exposed to the most inclement frost." In the night, however, between the 9th and 10th, the temperature suddenly rose to three, four, and five degrees above zero, accompanied with sleet. A thaw then commenced; and, from this moment, numerous soldiers began to complain of acute pain in their feet, numbness, sense of heaviness, and annoying pricking pains in their limbs. The parts were but little swelled, and of a dark red colour. In some individuals, a slight redness was observed at the base of the toes, and upon the instep; while, in others, the toes had lost all power of motion, all sensation and warmth, and become black and dried. These patients, without exception, declared that they had felt no uneasiness while the severe cold lasted, and that their complaints first began at the commencement of the thaw. From these facts Larrey argues, that cold is not an exciting, but only a predisposing, cause of inflammation and gangrene *; a truth, which Richter appears to have been well aware of, when he observes, that cold alone, even the most intense, will never produce chilblains. †

In order to thaw a frozen part gradually, it is best to rub it with snow, or ice and cold water, until sensibility and motion return. If the ear or tip of the nose be the part concerned, care must be taken to avoid breaking it. As soon as marks of sense and motion are discerned, the friction may be made with brandy or camphorated spirit of wine. The patient may then have some gently diaphoretic drink, such as a little mulled wine, a basin of tea, &c. and be put to bed in a chamber where there is a fire. Here he is to remain until he begins to perspire, when a perfect recovery of whatever sensibility may have been lost generally succeeds.

When a part is almost in the state of gangrene, in consequence of improper exposure to sudden heat, sometimes its recovery may still be accomplished by immersing it in water of a temperature nearly as low as the freezing point. The part must be kept immersed until the swelling, pain, and marks of discolouration begin to diminish, when frictions with brandy, &c. may commence, and the warmth be gradually increased.

### CHILBLAINS.

The inflammation attending chilblains is of a peculiar nature, irritable, yet languid; and, from the state of the circulation in the parts affected, the reparative power is low, and requires stimulation.‡

A chilblain, in its mildest form, is attended with redness, heat, and itching of the parts affected, which are generally either the toes, heels, or fingers, though sometimes the extremity of the nose, or ear, or parts about the metacarpus. In the next degree of severity, the parts are more swelled, redder, and so painful that the patient is deprived of the use of them; and, when the instep or back of the hand is the seat of the disease,

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* Mémoire sur la Gangrène sèche causée par le Froid, &c. in op. cit. t. ii. p. 60.
† Richter, b. i. p. 124.
‡ See Macartney on Inflammation, p. 99.

the subcutaneous cellular tissue is swelled to twice or thrice its natural thickness, and the integuments are of a bluish or livid colour. In a still more severe form chilblains produce vesication, or a rising of the cuticle, in consequence of the accumulation of a dark bloody serum under it. Beneath such vesications the surface of the cutis frequently ulcerates, and the sores thus occasioned usually discharge a thin ichorous matter, penetrate deeply, are excessively painful, and frequently very difficult to heal. Their bottom presents a grayish and often a fungous appearance. In the worst cases the inflammation ends in mortification, which is often preceded by the formation of bloody vesicles.

The sudden warming of a cold part, and the sudden cooling of a heated part, seem particularly conducive to chilblains: hence, parts most exposed to the vicissitudes of heat and cold are most subject to the complaint; as, for instance, the toes, fingers, nose, ears, and lips. When a part is exposed to sudden cold, while it is in a state of perspiration, it is more likely to be affected with chilblains, than when thus exposed while simply warm. The most intense cold alone cannot produce true chilblains, though analogous complaints do remain in limbs which have been frozen. The more irritable and tender the skin is, the more readily the complaint arises. Children, especially those subject to scrofula, young persons, females, and all who are brought up tenderly, who keep themselves warm, and unexposed to the air, and who perspire much in the feet, are particularly liable to chilblains. Chilblains, as Dr. Macartney justly states, occur with remarkable frequency in constitutions where the circulation is languid in the extreme parts, with a predominance of venous blood, indicated by a purple complexion, and the same colour in the skin of the extremities appearing on exposure to cold.

One of the best applications to chilblains of the first and second sort is ice-cold water: the part affected is to be immersed in it a few minutes, two or three times a day, and then well dried and covered with a leather sock. Ice-water, or snow, is not, however, eligible for patients disposed to phthisis, or gout, nor for delicate females.* Astringent and stimulating applications are in more common use; such as the liquor plumbi acet., spir. vini. camph., tinct. myrrhæ, spirit of turpentine mixed with balsam copaivæ, linimentum camphoræ, linimentum ammoniæ, one part of tincture of cantharides diluted with six parts of soap liniment, or a mixture of two parts of spir. vini. camph. and one part of liquor plumbi acet.

Ulcerated chilblains require stimulating dressings, as lint dipped in a solution of the nitrate of silver, Peruvian balsam, a mixture of liquor plumbi acet. and liquor calcis, or a lotion of the chloride of lime, as recommended by Lisfranc. A salve, containing the superacetate of copper, or the hydrarg. nitrico-oxydum, or touching the ulcers with the nitrate of siver, is often beneficial. If a poultice be necessary in the first instance, it may be made of oatmeal, with some port wine, or a proportion of the solution of chloride of soda in it.

Gangrenous chilblains should be treated according to rules explained in the remarks on mortification.

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* See Gibson's Institutes, vol. i. p. 46. ed. 5.

## WOUNDS.

By a wound, surgeons imply a recent suddenly formed breach in the continuity of the soft parts, attended at first with hemorrhage, and generally produced by an external mechanical cause.

In a few instances, however, breaches of continuity, both in the soft and hard parts, are suddenly caused by the violent action of the muscles, which either tear themselves asunder, break the bones, or rupture the tendons, with which they are connected. Sometimes, also, the sharp point of a broken bone wounds the integuments, and changes the case into a compound fracture. Here we see, that the cause is mechanical, but not of an external kind, as in ordinary examples.

Wounds are divided into several kinds, the distinctions being founded either upon the sort of weapon with which the injury is inflicted, or upon the circumstance of a venomous matter having been inserted in the part, or, lastly, upon the particular situation of the wound, and the nature of the wounded parts themselves. Thus, the first class of wounds, consisting of *cuts, incisions,* or *incised wounds,* is produced by sharp-edged instruments, and generally free from all contusion and laceration. The fibres and texture of the wounded part have suffered no injury but their mere division; and there is, consequently, less tendency to inflammation, suppuration, gangrene, and other bad consequences, than in the generality of other wounds. Incised wounds, also, may usually be healed with greater quickness and facility than others which are more or less contused or lacerated: the surgeon has only to prevent the solution of continuity from gaping, or, in other words, he has simply to bring the opposite sides of the wound into contact, and to keep them in this state a few hours, and they will grow together.

Another class of wounds is *stabs,* or *punctured wounds,* caused by the thrust of pointed weapons, like bayonets, lances, swords, daggers, &c., and also by the accidental and forcible introduction of considerable thorns, large nails, &c. into the flesh. These wounds frequently penetrate to a great depth, so as to injure blood-vessels, nerves, viscera, and other organs of importance; and, as they are generally inflicted with much force and violence, the parts suffer infinitely more injury than what would result from their simple division. It should also be noticed, that a great number of the weapons or instruments with which stabs are inflicted increase materially in diameter from the point towards the other extremity; and, consequently, when they penetrate far, they act like a wedge in forcing the fibres asunder, and thus cause a serious degree of stretching and contusion. It is on this account that bayonet wounds of the ordinary soft parts are very often followed by violent inflammation, extensive swelling, large abscesses, fever, delirium, and other unfavourable symptoms. The opening, which the point of such a weapon makes, is quite inadequate for the passage of the thicker part of it, which can only enter by forcibly dilating, stretching, and otherwise injuring the fibres.

A third description of wounds is *contused* and *lacerated* ones, which strictly comprehend, together with a variety of cases produced by the violent application of hard, blunt, obtuse bodies to the soft parts, all those interesting and common injuries denominated *gunshot wounds.* Many bites also rank as contused lacerated wounds. In short, every solution of continuity, which is suddenly produced in the soft parts by a blunt in-

strument or weapon, that does not operate by means of a sharp edge or point, must be a contused or lacerated wound.

*Poisoned wounds* are complicated with the introduction of a venomous matter or fluid into the part. Thus the stings and bites of a variety of insects afford us examples of poisoned wounds. But a more serious and dangerous instance, which we meet with in this climate, is seen in the cuts accidentally received in the dissection of dead bodies, or in handling instruments infected with any irritating or venomous matter, as sometimes happens to the surgeon in the performance of operations on gangrenous limbs, and in dressing venereal and other infectious ulcers. The most dangerous, however, of all the poisoned wounds which ever occur in this kingdom, are those caused by the bite of the viper, and by that of several rabid animals, especially the dog and cat.

Wounds are farther divided by surgical writers into those of particular regions or parts of the body: thus, we have *wounds of the head, face, throat, chest, abdomen, limbs, arteries, veins, nerves, lungs, liver, &c. &c.*

Wounds may likewise be universally referred to two other general classes, viz. *simple* and *complicated.* A wound is called *simple* when it occurs in a healthy subject, has been produced by a clean sharp-edged instrument, is unattended with any serious symptoms, and the only indication is to re-unite the fresh-cut surfaces. A wound, on the contrary, is said to be *complicated,* whenever the state of the whole system, or of the wounded part, or wound itself, is such as to make it necessary for the surgeon to deviate from the plan of treatment requisite for a common simple wound. The differences of complicated wounds, therefore, must be numerous, as they depend upon many incidental circumstances, the principal of which, however, are hemorrhage, nervous symptoms, excessive pain, tetanus, a great degree of contusion, the discharge or extravasation of certain fluids, indicating the injury of particular bowels or vessels, the presence of foreign bodies, or of a poison or irritating matter in the part, loss of substance, an attack of hospital gangrene, phlegmonous erysipelas, &c.

All large or deep wounds are followed by more or less symptomatic fever, which usually comes on at a period varying from sixteen to thirty-six hours after the receipt of the injury, but sometimes much earlier. Its occurrence is indicated by a greater warmth of the skin; by an increase in the frequency, and generally, also, in the strength, of the action of the heart and arteries; by anxiety, thirst, and a suppression of the powers of digestion. The symptomatic fever from wounds is usually of the inflammatory character; and it even sometimes happens that a very high degree of it takes place in debilitated constitutions, and in persons who have lost a considerable quantity of blood. In these latter cases, however, the frequency of the pulse is more remarkable than its strength, and the fever puts on more of the asthenic than the truly inflammatory type. It is of great consequence to attend to the character of this fever; for the loss of blood, which may be required and sustained with impunity in one species of fever, may prove highly injurious, if not fatal, in the other.*

The danger of wounds is proportioned to their size; the degree of violence done to the fibres in addition to their mere division; the little power which the part has of repairing its injuries; its great importance to the constitution; the size of the injured bloodvessels and nerves, and the age of the patient, and the state of his constitution.

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* See Thomson's Lect. on Inflammation, p. 292.

1. The removal of a large adipose tumour is often accomplished without injuring any part of importance, and yet the magnitude of the wound may occasion death.

2. A man cannot bear a large incised and lacerated wound equally well; because, in the latter case, the textures are not only divided, but stretched, and otherwise injured. I have seen the integuments covering the anterior surface of the tibia torn in a straight direction, from the upper head of that bone nearly to the foot: a rapid mortification of the limb took place, and the man died. Had this been a simple incision, such fatal consequences would not, probably, have happened, since the wound of amputation, even when a bulky thigh is removed, is not frequently the cause of death. All contused and gunshot wounds are, for this reason, more perilous than if they were simple breaches of continuity.

3. Joints seem to possess only an inferior power of repairing their accidental injuries, which often induce a state of irremediable disease in the part, or so violent a disturbance of the whole system, that the patient loses his life. I here more especially allude to wounds of the large joints; for the smaller articulations generally bear severe injuries as well as most other parts. Some organs are prevented from readily healing, owing to the continual or frequent passage of fluids through them. This is the case with all the ducts and outlets of secreting organs, the intestinal canal, the arteries, &c.

4. The slightest wound of a part, the functions of which are intimately connected with life, is often fatal: the brain, the cerebellum, the spinal cord, stomach, the bowels, &c.

5. When large arteries are injured, the hemorrhage, if not immediately stopped, will destroy life in a few seconds; and, when the main artery and nerve of a part are both divided, there is generally a considerable risk of mortification, in addition to the first danger from the bleeding.

6. Wounds in young, strong, healthy subjects generally heal more quickly and favourably, than in persons of advanced age, and impaired constitutions.

### INCISED WOUNDS.

An effusion of blood from the divided vessels, pain arising from the division and exposure of nerves, and a gaping of the wound, or separation of its edges from each other, are the immediate effects of a wound of the skin, or flesh, with a sharp cutting instrument.

Almost every part of the body is furnished with a vast number of bloodvessels, which, indeed, exist in such myriads that it is impossible to prick the skin with the point of the finest needle, without opening one or more ramifications of vessels containing blood, which instantly oozes out. But this effect always happens in a greater and more remarkable degree when there is an extensive cut in the skin or flesh; and if any of the wounded vessels be above a certain magnitude, the hemorrhage may be profuse, and even immediately fatal.

The same experiment, which demonstrates the presence of bloodvessels in every situation, namely, the pricking of any part of the body with a needle, proves, also, that filaments of nerves exist every where, and at every point; for, the slightest prick of the skin occasions pain; and pain cannot happen except where there are nerves. The pain of wounds is observed to be more or less acute, according to the kind of instrument with which they are inflicted; the extent of the division;

and, especially, according as the individual happens or not to be in expectation of the receipt of the injury. A patient, on whom an operation is to be performed, turns his whole attention to the effect which the use of the knife will produce upon his feelings, and he suffers a great deal: but if an incision be made when not expected, or when the mind is intent on other things, the agony is more moderate. Thus, a soldier may be wounded in the heat of battle, and not feel the hurt till the bleeding attracts his notice.

When the skin or flesh is divided with a cutting instrument, the edges of the wound separate from one another, and the injury presents a gaping appearance. The instrument itself, acting like a wedge, must unavoidably separate the parts between which it enters; but, if this were the only cause, the gaping would be very inconsiderable. We find, however, that the opposite surfaces of many wounds are drawn away from one another several inches; and the principal causes, to which the phenomenon is to be ascribed, are the natural elasticity of the skin, cellular tissue, fasciæ, &c., and the power of contraction inherent in the muscles.

The quality of elasticity which belongs to most animal substances, and is inherent in them even after they have been deprived of life, does not prevail in an equal degree in every texture. Hence, the degree of separation, produced by this cause, varies considerably, according to the nature of the wounded parts. The edges of an incision in the skin become widely drawn asunder, because the integuments are endued with great elasticity. The cellular tissue, when cut, gapes very little, because it is less elastic. The extremities of a divided artery recede far from one another; the retraction being far greater than what happens in divided veins, which possess a much smaller share of elasticity. The muscles, also, are not remarkably elastic; yet, the sides of these wounds, especially those of the transverse kind, are always considerably separated from one another; but, this is not altogether owing to elasticity, but chiefly to a vital power of contraction inherent in muscular fibres.

The separation of the edges of a wound is also not always in proportion to the elasticity of the parts, but depends in some measure upon the degree of tension in which they happen to be at the moment of the injury. A simple experiment proves the truth of this observation. If the skin covering the knee be divided transversely in a dead subject, while the leg is bent upon the thigh, and another similar incision be made in the knee, while the leg is extended, the separation, which happens between the lips of these wounds, will be found to be much greater in the first than the second example.

The prognosis of incised wounds varies according to the extent and depth of the division, the nature of the injured parts, and several circumstances which rank as complications. Deep large wounds are more dangerous and difficult to cure, than those which only interest the skin. Wounds, accompanied with injury of large bloodvessels, or nerves, are more or less dangerous, according to the magnitude and importance of those vessels and nerves, and the possibility or impossibility of obtaining speedy surgical assistance. Simple cuts, in which the only indication is to bring the divided parts together, are the most favourable cases of all. On the other hand, complicated incised wounds are more or less serious and hazardous, according to the particular nature of the complication, whether this be a wounded artery, a vein, or nerve of magnitude and importance, a wounded excretory duct, a wounded bowel, a wounded trachea, œsophagus, &c. The complications, also, of bad health, and very

advanced age, are other considerations which should influence the prognosis. Generally speaking, the most dangerous examples of incised wounds are those of the throat, made by persons who attempt to destroy themselves. Here there are so many large blood-vessels, nerves, and other organs of importance, that deep incised wounds too often prove fatal, either immediately, or in a short time. Sometimes the patient opens the carotid artery, and perishes of hemorrhage on the spot, before any assistance can be rendered. In other instances, he divides some of the principal branches of the external carotid, and, after losing a great deal of blood, faints, in which state the hemorrhage may cease for a little while. The fainting, indeed, is often the very thing which saves his life, by checking the effusion of blood until the surgeon arrives, who ties the vessels as soon as they begin to bleed again. Incised wounds of the extremities, when such arteries as the femoral and brachial are injured, may also suddenly destroy the patient, by the great quantity of blood sometimes lost before the arrival of surgical assistance.

In the treatment of incised wounds, there is frequently nothing to be remedied, except the simple breach of continuity, the cut fibres not having been stretched, contused, nor lacerated. When no artery of importance is divided, and no extraneous bodies are lodged in the wound, the duty of the surgeon consists in promoting the re-union of the divided surfaces without delay. It often happens, however, that considerable vessels are injured, and then the bleeding demands primary attention.

## HEMORRHAGE.

According to the correct definition of it, laid down by Dr. Carswell, hemorrhage consists in the extravasation of blood, or the escape of this fluid during life, from the vessels in which it is contained and circulated, into the substance or on the surface of organs, whether it be retained in these situations, or conveyed to the external surface of the body. It may take place from the heart, arteries, veins, and capillaries, as the immediate consequence of a solution of continuity occasioned by incised wounds, puncture, laceration, ulceration, and mortification; or the sanguineous discharge may proceed from the capillaries, which present either no perceptible lesion of structure, or merely an increase of capacity, whereby the red globules are enabled to pass along these vessels, with the other constituents of this fluid, which is poured out after the manner of extravasation.* Hemorrhage may be *arterial* or *venous; primary* or *secondary; active* or *passive.* One of the best classifications of the several forms of it is that adopted by Dr. Carswell, namely, —

1. *Hemorrhages from Physical Lesions*, comprising, 1st, those from wounds, ulceration, and mortification; 2dly, others, from a mechanical obstacle to the circulation, situated in the heart, or the blood-vessels.

2. *Hemorrhages from Vital Lesions*, comprehending, 1st, those from a modification of function of the capillaries, as exemplified in vicarious hemorrhage, and that from erectile tissue; 2dly, bleeding from a diseased state of the blood, as illustrated in scorbutus, some forms of purpura, and some of typhoid fever; 3dly, hemorrhage from debility.

In every wound, the bleeding demands the earliest attention, because, if loss of blood be not prevented without delay, the patient will frequently die in the course of a few seconds or minutes. Every other consideration may be deferred; but, when large vessels are injured, they must be imme-

* See Dr. Carswell's Elementary Forms of Disease; fasciculus on Hemorrhage.

diately secured, or else the sudden death of the patient will leave the surgeon no opportunity of exhibiting his skill and usefulness in other matters connected with the treatment.

Previously to considering what surgical means are best calculated for stopping hemorrhage, it seems right that I should advert to the nature of the process by which the bleeding from wounded arteries is permanently suppressed. As arteries are supplied, not only with small arteries and veins (the vasa vasorum), but also with absorbents and nerves, and have, in these respects, a similar organisation to the other soft parts of the body, they must be susceptible of every change to which living parts are subject in common; and hence, when they are injured, they inflame, and pour out coagulating lymph, by which the injury is sometimes repaired, or the tube permanently closed.* In short, the coats of arteries inflame, and pass through all the stages of adhesion, suppuration, or gangrene, in the same manner as the skin, a gland, or a muscle.†

Surgeons formerly entertained various theories, concerning the process by which the hemorrhage from divided arteries was suppressed; but, as none of these seemed altogether satisfactory, the late Dr. Jones was led to undertake a series of interesting experiments, the results of which enabled him to give a more correct view of the subject; and from these investigations it appears that, when an artery of considerable size is *entirely divided*, the bleeding is stopped in the following manner:—An impetuous flow of blood, a sudden and forcible retraction of the artery within its sheath‡, and a slight contraction of its extremity, are the immediate and almost simultaneous effects of its division. The natural impulse, however, with which the blood is driven on, in some measure counteracts the retraction, and resists the contraction of the artery. The blood is effused in the cellular tissue, between the artery and its sheath, and, passing through that canal of the sheath which has been formed by the retraction of the artery, flows freely outward, or is extravasated in the surrounding cellular tissue, in proportion to the open or confined state of the external wound. The retracting artery leaves the internal surface of the sheath uneven, by lacerating or stretching the cellular fibres which connected them. These fibres entangle the blood as it flows; and thus the foundation is laid for the formation of a coagulum at the mouth of the artery, which is completed by the blood gradually adhering and coagulating around its internal surface, till it completely fills it up from the circumference to the centre.

The hemorrhage is checked by the effusion of blood into the surrounding cellular tissue, and between the artery and its sheath; but, particularly, by the diminished velocity of the circulation, occasioned by the bleeding, and by the quick manner in which the blood always coagulates, when the action of the vascular system is much diminished.

Thus a clot over the mouth of the artery, within its sheath, called by

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* See Jones on the Process employed by Nature in suppressing the Hemorrhage from Divided and Punctured Arteries; and on the Use of the Ligature; with Obs. on Secondary Hemorrhage, p. 5. 8vo. Lond. 1805.

† Hodgson on the Diseases of Arteries and Veins, p. 1. 8vo. Lond. 1815.

‡ Arteries of the fourth and fifth orders, like those of the forearm and leg, are not furnished with a distinct sheath, their external coat being immediately connected with the surrounding cellular tissue. This accounts for the greater difficulty, invariably experienced, in separating a small artery from its attachments than a large one. See P. J. Manec, Traité Théorique et Pratique de la Ligature des Artères, p. 3. fol. Paris, 1832.

Dr. Jones the *external coagulum*, presents the first complete barrier to the effusion of blood.

The mouth of the artery being no longer pervious, and having no collateral branch very near it, the blood, just within it, is at rest, coagulates, and forms, in general, a slender conical coagulum, which neither fills up the canal of the artery, nor adheres to its sides, except by a small portion of the circumference of its base, which lies near the extremity of the vessel. This coagulum is distinct from the former, and is named by Dr. Jones the *internal coagulum*.

In the meantime, the cut extremity of the artery inflames, and the vasa vasorum pour out fibrine, which is prevented from escaping by the external coagulum. This fibrine fills up the extremity of the artery, is situated between the internal and external coagula of blood, is somewhat intermingled with them, or adherent to them, and is firmly united all round to the internal coat of the artery.

The permanent suppression of the hemorrhage chiefly depends on this coagulum of fibrine; but, while it is forming within, the extremity of the artery is further secured by a gradual contraction, which it undergoes, and by an effusion of fibrine between its tunics, and in the cellular tissue surrounding it. Thus, these parts become thickened, and so completely incorporated with each other, that one cannot be distinguished from the other; the canal and mouth of the artery becoming obliterated, and blended with surrounding parts.

When the wound in the skin is not healed by the first intention, an exudation of coagulating lymph, or fibrine, gives a covering to the end of the vessel, and separates it from the cavity of the wound.

In the inferior portion of the divided artery, the orifice of the vessel is generally more contracted, and the external coagulum is much smaller.*

The extremity of the artery, up to the first collateral branch, afterwards gradually contracts, till at length its cavity is completely obliterated, and its tunics assume a ligamentous appearance.

The external coagulum, which stopped the hemorrhage in the first instance, is absorbed in a few days, and the thickening of the parts, from the extravasation of fibrine, gradually diminishes.

If the end of the artery be examined, at a still later period, it will be found to be reduced to a mere filamentous state, as high up as the origin of its first branch, and the anastomosing branches are considerably enlarged.

Another fact made out by Dr. Jones is, that, when the division of an artery has happened near a collateral branch, no internal coagulum is formed.

When an artery is *punctured* or only *partially divided*, the blood is effused in the cellular tissue, between the artery and its sheath, for some distance both below and above the wounded part. On examination, a short time after the hemorrhage has stopped, a stratum of coagulated blood is found between the artery and its sheath, extending from a few inches below the wounded part, to two or three inches above it, and is somewhat thicker, or more prominent, just over the wounded part, than elsewhere. In consequence of the space between the artery and sheath becoming filled with blood, and the latter part distended, the relative

* Mr. Guthrie differs from Dr. Jones, in believing the retraction and contraction of the lower end of a divided artery not to be so complete, nor so permanent, as in the upper. He states, also, that the internal coagulum is less perfectly formed. On the Diseases, &c. of Arteries, p. 24 9.

situations of the punctures in it and the artery are altered, and thus a coagulum of blood becomes confined by the sheath over the puncture in the vessel, and stops the hemorrhage. But this is only a temporary barrier; and the permanent stoppage of the bleeding is here also effected by a process of reparation or obliteration.

If an artery be wounded only to a moderate extent, it is capable of re-uniting, and of healing so completely, that, after a certain time, the cicatrisation cannot be discovered, either on its internal or external surface; and even oblique and transverse wounds (which are attended with more gaping than longitudinal ones), when they do not open the artery to a greater extent than one fourth of its circumference, are also healed, so as to occasion little or no obstruction in the canal of the artery. But, as Petit observed, this can hardly ever happen, except when the aperture in the vessel is of moderate size *; and, as Professor Béclard's experiments tend to prove, it can scarcely take place in an artery above a certain magnitude, without the support afforded to the vessel by its sheath. In larger wounds, the artery is rendered impervious by the effusion and organisation of fibrine; and, when the division is still more extensive, the partially divided part of the vessel becomes either torn or ulcerated through.†

### SURGICAL MEANS FOR THE STOPPAGE OF BLEEDING.

The *tourniquet* consists of a band and buckle, a pad, and two brass frames, the upper one of which is furnished with two small rollers, and the lower with four, over all of which the band plays, so as to facilitate the action of the screw. When the handle of this is turned to the right or left, the band is tightened, or relaxed, in the exact degree which the surgeon wishes. The piece of leather under the lower brass frame hinders the skin from being hurt at this point by the pressure of the edges of the hard metal. The buckle is prevented from having this effect by its being commonly fastened over the pad. The band is first buckled round the limb in such a manner, that the pad, which is attached to the band, is placed exactly over the artery. The two brass frames, with their respective rollers, over which the band proceeds, are then made to separate from each other to the requisite distance by turning the screw, and thus the due degree of pressure is produced.

The advantages of this instrument are considerable: the pressure may be regulated with the utmost exactness, and it operates with the chief force on the point where the pad is placed, and under which the main artery lies; it does not require the aid of an assistant to keep it tense; it completely commands the flow of blood into a limb; it may be relaxed or tightened in a moment; and, when there is reason to fear a sudden renewal of bleeding, it may be left slackly round a limb, and, in case of need, made tense in an instant.

Its operation, however, is limited to the limbs; and, as the pressure, necessary to impede the flow of blood through the principal artery, completely prevents the return of blood through the veins, its application cannot be made long without inducing gangrene. Hence, it is only a temporary expedient for the stoppage of bleeding, always discontinued immediately the surgeon has had time to adopt other means of a more permanent nature.

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* Mém. de l'Acad. Royale des Sciences, an. 1735.

† Jones, op. cit. chap. i. sect. 3. and chap. ii.

The tourniquet is unquestionably a meritorious invention, by which the lives of wounded persons are frequently preserved, and a degree of security given to several of the most important operations in surgery, sometimes difficultly attainable without its assistance. Thus, when surgeons are about to amputate a limb, they commonly apply the tourniquet, in order that the patient may not lose a dangerous quantity of blood during the time requisite for the division of the soft parts and the sawing of the bone. These proceedings having been completed, the principal artery or arteries are looked for, the situations of which are made known by anatomy. For instance, in the stump of an amputated thigh, the operator searches for the open mouth of the divided femoral artery near the sartorius muscle: he takes hold of it with a pair of arterial forceps, and the assistant ties it. But, after having taken up the main artery and such others as have determinate situations, and are large and open-mouthed, so as to be readily perceived, the surgeon would not be able to detect others of less size, requiring ligature, if the tourniquet were not loosened for an instant, when the gush of blood from particular points denotes where they lie. Directly the surgeon has gained this information, he tightens the tourniquet again, seizes the end of one of the bleeding vessels with a tenaculum, and the ligature is applied.

Supposing a person were to meet with a wound of one of the principal arteries of the upper or lower extremity, followed by profuse hemorrhage, here the surgeon would immediately put on the tourniquet, and stop further loss of blood, until he had had time to adopt the requisite measures for securing the wounded artery.

Important as the tourniquet certainly is, it is only applicable to the limbs; and even there its office may be partly executed by a steady assistant making pressure on the main artery with his hand, or some other compressing instrument. In University College Hospital, the tourniquet is not usually employed in amputation; the current of blood through the main artery of the limb being commanded by pressure made with the fingers of a trusty assistant. The objection made to the instrument in such operation is, that it renders all the veins of the limb exceedingly turgid, and that more blood is lost than when the pressure is made on the artery alone with the fingers. The tourniquet is also, as I have stated, only a temporary expedient, because its application beyond a certain time would bring on mortification. Hence, it is absolutely necessary to employ other means as soon as possible.

*Ligature.* With all the knowledge which we now possess about the right principles of treating wounded arteries, and advantageous as the tourniquet sometimes is, we could more conveniently dispense with its assistance than with that of the means which I am next going to consider; namely, the *ligature*. A modern surgeon, possessing coolness and anatomical knowledge, would know how to prevent the patient from being lost by hemorrhage from any part of the body, to which that instrument is applicable, even were he not provided with it. He would know how and where to make pressure on the arterial trunk; and, if the wound were so ample as to let the orifice of the bleeding artery be seen, he would then have recourse to the simple and effectual plan of placing his finger over it, until he could get out his case of instruments and tie it. I have known practitioners so confused as to let patients lose a fatal quantity of blood in their presence, from the neglect of this obvious and simple proceeding.

It is not doubted at the present day, that the most important of the means for the permanent stoppage of bleeding is the *ligature*, by which

the most alarming bleedings may be restrained. With this the mouths of the divided arteries are tied, and thus, not only an instantaneous stop is put to further hemorrhage, but, long before the ligature becomes loose, the opposite sides of the vessel have grown together, and all danger of the renewal of the bleeding is over.

Several of the conclusions, drawn from Dr. Jones's experiments upon the subject of hemorrhage, are of the highest importance in relation to the practic of surgery, and, were they all of them universally admitted, little doubt would remain about the most advantageous manner of making and applying ligatures. That a ligature, especially a small one, when applied round an artery with a certain degree of tightness, completely divides the inner and middle coats of the vessel, is a fact well known to all surgeons; but, whether we should employ such ligatures as are expressly calculated to produce this effect, and whether we should aim at it as a beneficial and useful, not to say an essential, object, are questions on which there have been, and perhaps still are, differences of opinion. From a variety of experiments Dr. Jones was led to infer, that the division of the membranous and muscular coats of a tied artery by the ligature had a principal share in bringing on the effusion of fibrine within the vessel, or, in other words, the process of adhesive inflammation, by which the permanent closure of the vessel was effected. He observes that, when a ligature is properly applied, it cuts through the internal and middle coats of the artery, keeps their cut surfaces in contact, and affords them an opportunity of uniting and cicatrising, as other cut surfaces do, by the adhesive inflammation. Nay, he extended the doctrine further, by representing the division of internal coats of the vessel by the ligature, not merely as advantageous, but as absolutely indispensable; for he remarks that, if the ligature does not completely cut through the internal and middle coats all round the artery, adhesion cannot take place between its internal surfaces, and, therefore, secondary hemorrhage will take place, as soon as the ligature has ulcerated through any part of the artery.*

That Dr. Jones erred, in describing the division of the inner coats of the vessel as a thing without which the vessel could not be closed by the process of adhesive inflammation, remains no longer questionable. The assertion, as Sir Philip Crampton† has observed, rested upon no other foundation than several experiments made on the arteries of quadrupeds, in *all of which* the internal and middle coats were ruptured by the application of the ligature. No comparative experiments are related, in order to show, that this operation of the ligature is essential to the process of union, and that, under these circumstances only, the obliteration of the artery can take place. Numerous instances are recorded of arteries being obliterated by the pressure of tumours. The subclavian and carotid have been found obliterated by the pressure of an aneurism of the arch of the aorta.‡ In Mr. Freer's experiments, the pressure of a tourniquet for four days was sufficient to effect the obliteration of the radial artery in horses. § Mr. Hunter found, that the mere exposure of the tibial artery of a dog to the air, for about an hour, excited such a degree of inflammation and thickening of its coats as completely obstructed the canal. ||

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* On Hemorrhage, pp. 166. and 170.

† Medico-Chir. Trans. vol. vii. p. 343.

‡ Hodgson on the Diseases of Arteries and Veins, p. 110. A. Cooper, in Med. Chir. Trans. vol. i. p. 12.

§ Obs. on Aneurism, p. 14. || On the Blood, &c.

All the great arteries, the aorta inclusive, have been found obliterated, in consequence of the effusion of fibrine from their internal coat, and this independently of any injury which could produce the rupture of that membrane. The cure of aneurism by compression (whether mediate or immediate) affords an example of the obliteration of an artery without any rupture of its internal coats.*

In the course of the interesting experiments undertaken by Dr. Jones, he observed, that when a ligature had been tightly applied round a large unwounded artery in a quadruped, so as to cut through the internal coats, and it was immediately afterwards removed, the adhesive inflammation took place at the part of the vessel embraced by the ligature, and the canal of the artery became permanently obliterated for some extent. This consequence happened, however, with increased certainty, when two or more ligatures were thus applied near one another, and then taken off.†

The promulgation of these observations at first excited hopes, that the leaving of a ligature on arteries, tied for the cure of aneurisms, might be dispensed with; and what Dr. Jones had himself succeeded in accomplishing did not fail to convince him, still more firmly, that the division of the inner coats of the artery was the main exciting cause of the adhesive inflammation by which the canal of the vessel was permanently closed; and that the obliteration could not happen unless those coats were cut through by the ligature. But, as Mr. Travers has justly stated, the result of these experiments neither warranted the conclusion that the complete division of the internal coat was necessary to union, nor that union was a necessary consequence of it. The history of the broad tape or riband ligature proves, that contact without wound will sometimes produce adhesion, and the frequent repetition of Dr. Jones's experiment has proved that wound without contact will sometimes fail to produce it. Mr. Dalrymple, of Norwich, repeated the second experiment, in Dr. Jones's third chapter, not less than seven times on horses, and three times on sheep, and, in every instance, failed in obtaining the same results. Not only was no coagulum formed, but, even when the animal had been suffered to live until the thirteenth, fifteenth, or eighteenth day after the operation, the canal of the artery was not found obliterated. Its calibre was indeed contracted; but the tube remained in some degree pervious, and capable of transmitting a lessened column of blood.‡ The evidence of another eminent writer also coincides precisely with that of Mr. Dalrymple.§

Dr. Jones's idea, that the division of the internal and middle coats was essential to the production of the requisite degree of adhesive inflammation for the obliteration of the cavity of the artery, is completely refuted, not only by the facts adverted to by the preceding authors, but by a variety of other considerations. A ligature was put round the carotid of a dog without being drawn. It lay in contact with the artery, but did not press upon it, nor interrupt the flow of blood through it. The result was an obliteration of that part of the vessel which was irritated by the presence of the ligature. The same experiment was made on the carotid of an ass with a similar consequence.‖ Here, then, are further proofs, as unequi-

* Crampton, in Med. Chir. Trans. vol. vii. p. 345.
† Jones on Hemorrhage, p. 126, &c.
‡ Travers, in Med. Chir. Trans. vol. iv. p. 442.
§ Hodgson on Diseases of Arteries, &c. p. 128.
‖ C. Bell, Surgical Obs. vol. i. p. 261.

vocal as any of those previously cited from Sir Philip Crampton's valuable paper, that the internal coat of an artery will effuse fibrine when any cause of sufficient irritation exists on the outside of the vessel, and that the division of its inner coats by a ligature is by no means essential to the excitement of the adhesive inflammation within it.*

All serous membranes, including the inner coat of the arteries, when kept in close contact, in sufficiently vigorous subjects, generally assume, with surprising quickness, the adhesive inflammation in the seat of the compression and around it, evincing a singular propensity to effuse fibrine, and, though such membranes are inflamed, they remain free from ulceration or breach of continuity. This is daily seen between the lungs and pleura, between the peritoneum and the viscera of the abdomen, and between the tunica vaginalis and the testicle. And, in order to assure ourselves that the same phenomenon also happens betwixt the two opposite sides of an artery, which are simply held in close contact with each other, without any previous ulceration or rupture of them, we need not have recourse to analogy in what takes place under the same circumstances in other similar parts of the body, since there are numerous instances of the quick union and perfect closure of an artery, by means of the adhesive inflammation, under simple compression alone, practised upon the artery while all its parts remain entire. Dubois † effected this prompt adhesion by means of the serrenœud of Desault; Assalini ‡ by compressing the artery with his forceps; and Crampton with a presse-artére resembling that of Deschamps. To these facts we are to add numerous others of the closure of the artery, in consequence of pressure made on the vessel by a neighbouring tumour, or an aneurismal sac. If the ligature be preferable to compression in the treatment of external aneurism, still it is certain that, by means of pressure applied above the seat of the disease, several cures have been accomplished; and if the compressing apparatus does not always produce such good effects, it is often because we have not the opportunity of making the pressure with sufficient steadiness and force to obliterate the artery. Compression (says Scarpa) generally answers very well when made upon an exposed artery, behind which there is a point of resistance. Formy §, in a wound of the brachial artery, laid bare the vessel, placed a cylinder of linen upon it, and over this some graduated compresses, supported by means of a suitable bandage; and thus he effected the closure of the artery. ‖ Guattani exposed the femoral artery as it passes under Poupart's ligament, compressed it against the ramus of the os pubis with graduated little bolsters and a bandage, and the vessel was speedily closed. Flajani ¶, in similar cases, found the same method answer. Buzani** also succeeded, with graduated compresses, in healing a wound of the brachial artery after bleeding; and so did Garneri in two additional examples of the

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* See, also, Crampton's experiments with a flat ligature, and piece of metal, on the carotids of sheep, in Med. Chir. Trans. vol. vii. p. 346., and other experiments detailed by Scarpa in his Memoria sulla Legatura delle principali Arterie degli Arti, &c. Fol. Pavia, 1817. p. 34. et seq.

† Leveillé, Nouvelle Doctrine Chir. t. iv. pp. 247—280.

‡ Manuale di Chirurgia.

§ Traité Chir. des Bandes Larges Emplatrês, &c. Montpelier, 1652.

‖ De Aneurysmate, Historia 15.

¶ Collezione d'Osservasioni e Riflessioni di Chirurgia, t. ii. p. 47, &c.

** Opere di Bertrandi. Trattato del Operaz. t. iii. p. 207. Gli editori.

same nature. Scarpa corroborates the purport of these observations by a relation of some experiments, in which the arteries of sheep and other quadrupeds were tied with a simple ligature, and also with a ligature between which and the vessels a roll of waxed linen was placed, in order to prevent the inner coats from being cut through. The main result was, that in all these cases, the artery closed, but the ulceration advanced more quickly in the instances where the simple ligature was used.* Four cases are likewise recorded, in which Scarpa's mode of applying the ligature was successfully practised in operations for aneurism.

The preceding facts cannot allow us to hesitate a moment about the rejection of Dr. Jones's assertion, that a ligature will never be followed by an efficient degree of adhesive inflammation within a tied artery, unless the inner coats of the vessel be divided by the cord. Instead of so sweeping an inference, this talented observer should merely have concluded, that such inflammation may take place after the ligature has had the effect described, and not that it cannot happen under any other circumstances. The determination of this question, however, is not at all a decision of the other point, viz. whether such division of the inner coats of an artery by the ligature be useful or detrimental in its effects upon the process by which the vessel is to be obliterated. Dr. Jones, who considered it as the best means of promoting the effusion of coagulating lymph, or fibrine, within the vessel, and as the surest and most prompt mode of bringing about the union and closure of the tied part of the arterial canal, gave a decided preference to small ligatures, which always cut through the inner coats of the vessel with the greatest certainty. He thinks that ligatures should be round and very firm; and he declares, that there is no danger of their making the external coat of the artery ulcerate, by their tightness, before the internal ones have adhered; for the union of the latter is found to be soon completed. He reprobates broad flat ligatures, because they cannot be tied smoothly round the artery, which must become puckered, and, consequently, have an irregular bruised wound made in its middle and internal coats. By covering a considerable part of the external surface of the artery, they may also destroy the very vessels which pass on it in their way to the cut surfaces of the internal and middle coats, and thereby render these surfaces incapable of inflaming. But, says he, admitting that such a ligature makes a proper wound, and that the wound unites, still it may cover that part of the external coat which is directly over the newly united part, and, consequently, as soon as it has occasioned ulceration through the external coat, it will produce the same effect on the newly united parts, and, of course, secondary hemorrhage. A ligature of an irregular form will not cut through the inner coats of the artery equally at every point, which Dr. Jones endeavours to prove ought to be done, for the purpose of occasioning an effusion of fibrine and adhesion. The first good explanation was likewise given by him of the advantages of applying ligatures in as circular a manner as possible, not higher on one side of the vessel than the other. Any deviation from a circle must be unfavourable to a steady apposition of the cut surfaces of the artery, and be conducive to secondary hemorrhage.

Sir Philip Crampton, however, is far from admitting the utility of cutting through the internal coats of the artery with the ligature, and is of

* Memoria sulla Legatura, &c. pp. 27. 34., &c.

opinion that, in man, the division of these coats not unfrequently prevents the obliteration of the artery, and gives rise to secondary hemorrhage; two assertions which appear to me not to be very well proved. If it be meant to draw a weighty argument from the weakening of the artery by this effect of the ligature, and an apprehension of the vessel bursting, or becoming dilated, how can we give such importance to this mode of reasoning, when such inability of the remaining external coat to resist the impetus of the circulation must be very rare? Although the two middle coats are divided by the ligature, in securing the vessels in the common way after every operation, I have never seen an artery give way or become dilated from this sort of cause. I have known the ligature slip from not having been skilfully applied, or accidentally pulled off by a jerk of the hand, and hemorrhage take place. An artery may also be in so diseased a state as to give way at once under the application of the ligature; or, if it should not burst immediately, yet, from being incapable of the adhesive inflammation, it may afterwards pour out its blood as soon as the ligature has produced ulceration through the external coat. But, in this circumstance, it is evident, as Scarpa himself allows*, that no mode of tying the vessel will answer. As we are not sufficiently acquainted with the actual state of the vessels, the kind of ligatures employed, and some other essential particulars, in the few cases cited by Sir Philip Crampton, with the view of proving the risk of arteries giving way from their inner coats being cut through by the cord, we cannot pronounce whether these were really examples of this injurious operation of the ligature, or whether they might not rather be specimens of some uncommon diseased state of the arteries. For my own part, I cannot suppose any instance in which the brachial artery, after being tied in amputation, would three times form an aneurismal tumour above the ligatures†, if it were not in some unusual state of disease, because I have seen many hundreds of amputations, but have never witnessed such an occurrence. Besides, if this particular case prove any thing, it proves, at all events, that the largish ligatures used in Warner's time, which ligatures probably never fairly divided the inner coats of a sound artery, could not prevent the vessel in question from giving way. Without extending these criticisms, however, I may safely assert, that the advocates for the utility of cutting through the inner coats of the vessel, and the employment of small fine ligatures, will come off triumphantly, if they only encounter such objections as are founded upon the danger of the artery at once giving way, or forming an aneurismal tumour. It avails little to talk, as Scarpa has done, of the arteries of some individuals being of preternaturally weak texture from birth‡; or to urge, with Sir Charles Bell, that, if a dead artery be tied too tightly, it will burst at the tied part when distended with anatomical injection. § The question can never be decided by such statements; and when we admit, with these writers, that an artery with three unbroken coats is physically stronger than when two of these coats are broken or torn, we still maintain, that the remaining external coat is strong enough to resist the impetus of the circulation, so far as we can judge from the

* Memoria sulla Legatura delle Principali Arterie, p. 7.

† See Warner's Cases in Surgery, p. 138. Probably the inner coats of the artery were in this case not divided, because the vessel was secured with a needle and ligature, and of course an intervening portion of flesh included. Mr. Warner himself entitles the case "An *Extraordinary* Disease of the Humeral Artery."

‡ Memoria sulla Legatura delle Principali Arterie degli Arti, p. 25.

§ Surgical Obs. vol. i. p. 260.

general result of the practice, in which it is the surgeon's particular aim to cut through the inner coats of arteries in applying the ligature. It matters not what happens in the injection of dead bodies; what happens in aneurismal and diseased arteries before the ligature is employed; what may have happened in very unusual cases, showing that ligatures may sometimes fail: it must yet be proved, that the tying of arteries, on the principles recommended by Dr. Jones, is generally less successful than other plans.

Amongst the most distinguished surgeons who opposed the doctrines and practice recommended by Dr. Jones, and so extensively approved of in this country, was Scarpa, whose valuable observations on many parts of anatomy and surgery rendered him the pride of the modern Italian school. After briefly describing the process of obliteration, according to Dr. Jones's account, and mentioning a few other things, to which I have already adverted, he argues that, as cutting through the internal coats of an artery must render the vessel weaker than when its coats are left undivided, and we can never estimate the density of such a vessel in the living subject, it is, cæteris paribus, better to tie the vessel in such a way as will leave all its three coats uninjured. When the internal coat is ulcerated from internal causes, and the adhesive inflammation does not supervene quickly enough, he says, the blood is invariably effused through the layers of the middle tunic, and extravasated on the outside of it, first in the form of ecchymosis, and afterwards in that of an aneurismal swelling. Now, if this can happen when only the inner coat is ulcerated, it must still more easily take place when the middle coat is also divided, and any cause retards the adhesive inflammation. He admits that, even in this second case, if, directly after the division of the two internal coats, the artery is affected with the requisite degree of adhesive inflammation, as fortunately mostly happens, the union and closure of the vessel follow as speedily and favourably as if the two inner coats had not been divided. But he declares, that this fortunate issue is not constant, especially in man, in whom the adhesive inflammation is not, as it is in brutes, sufficiently quick to produce on the coats of the artery its beneficial effects immediately after the application of a tight ligature. Yet, while the adhesive inflammation is thus retarded, the ulcerative process, occasioned by the pressure of the small ligature, rapidly attacks the external cellular coat of the artery, eats more and more deeply into it, and penetrates into the cavity of the vessel before this has been rendered impervious, and certainly with greater celerity than if it had to make its way through all the three tunics of which the artery is composed. The slow access of the adhesive inflammation, whether from the general debility of the patient, or from the particular state of the artery itself, is not followed by a proportionate retardation of ulceration, which incessantly proceeds till it gives rise to the worst effects. Besides, it is contended that, in feeble subjects, the coagulating lymph effused in the cavity of the artery, as well as the coagulum itself, sometimes does not acquire with equal celerity the degree of consistence necessary for firmly connecting together the opposite sides of the artery, which are held in accurate contact. These dangers, says Scarpa, are unquestionably avoided by keeping all the three coats of the artery from being injured by the pressure of the ligature.*

But, after all this reasoning, we must return to experience; and, if Sir Philip Crampton and Professor Scarpa have produced cases, exemplifying

* Memoria sulla Legatura delle Principali Arterie, pp. 26—28.

the possibility of effecting the obliteration of arteries without a division of the inner coats of the vessels, as I admit has been fully proved, they cannot subvert the fact, acknowledged by all the most experienced surgeons in this metropolis, that since Dr. Jones's principles have been acted upon in practice, and small ligatures been employed, secondary hemorrhage has become much less common. Those principles dictate the use of a fine ligature, as first tried on the human subject by Dr. Veitch, in the Naval Hospital at Plymouth, and prohibit all unnecessary disturbance and irritation of the artery; all needless separation of it from its surrounding connections; and, in particular, forbid the introduction of a larger quantity of extraneous substances into the wound than the indications positively require. If the increased success, to which I have alluded, be the truth, it is an answer to every argument used by the opponents of Dr. Jones's doctrines. With respect to the danger of the external coat being ulcerated through more quickly by a ligature, which divides the other two coats, as this occurrence will enable the surgeon to remove the extraneous substance sooner, it must be a great advantage, if it be also a fact, as experience proves, that such division of the inner coats expedites the adhesive inflammation, and insures the closure of the vessel, before the ulceration has penetrated through the external tunic.

Dr. Jones refutes the idea of ligatures being forced off the vessels by the impulse of the circulation; a fear, which led to very hurtful practices, with the view of mechanically fixing the ligature; and he observes, that a candid inquirer into the cause of it will find a much more rational explanation, either in the clumsiness of the ligature, which prevented its lying compactly and securely round the artery; or in its not having been applied tight enough, lest it should cut through the coats of the artery too soon; or in its having that very insecure hold of the vessel, which the deviation from the circular application must necessarily occasion.

No other plan of preventing bleeding from large arteries is so safe as the ligature, because no other makes such direct pressure on them, nor acts with so little chance of being displaced. In the performance of operations, large arteries are often wounded in situations where the tourniquet cannot be applied. The scientific surgeon now knows, that he can tie such vessels immediately they are wounded, and then proceed with his incisions, without that confusion and danger which would result from the continuance of a profuse hemorrhage during the whole time requisite for the completion of the operation.

It is a maxim in surgery always to tie arteries as separately as possible, that is to say, without any nerve, vein, or portion of flesh being included in the noose of the ligature. The tying of the flesh should constantly be avoided when possible, because it produces immense pain, and causes a larger part of the wound to remain disunited. Ligatures, thus awkwardly applied, are likely to become loose, as soon as the substance between them and the arteries sloughs; or they may form a circular furrow in the textures surrounding the vessels, and remain, a tedious time, incapable of being removed. The intervention of any substance between the ligature and the artery must also have a great tendency to prevent the internal coats of the vessel from being cut through; that very event, on which the safety from secondary hemorrhage is found so much to depend.

Bloodvessels partake of the same organisation as other parts. Hence the healing of a wounded artery can only take place favourably, when

that part of the vessel which is immediately contiguous to the ligature continues to receive a due supply of blood through its vasa vasorum. As these vessels are derived from the surrounding ramifications, it is obvious that the application of a ligature to a divided artery at some distance from where it is encompassed by flesh, must be very disadvantageous and insecure. Thus, although it is quite improper to include much of the adjacent soft parts with the artery in the ligature, it is highly judicious to make the knot as closely as possible to that part of the vessel which lies undisturbed among its natural connections. These observations, however, only refer to vessels above a certain size; for others are not sufficiently visible to be tied in this manner.

The method of tying an artery is as follows:— The extremity of the vessel is first to be taken hold of by the surgeon with a tenaculum, or pair of artery forceps, which open by their own elasticity, and are sometimes so constructed as to admit of being kept closely shut with a double button, that slides along a slit in each branch of the instrument. When the vessel is large and obvious, the forceps should always be preferred. A round firm ligature, and by no means too thick, is then to be put by an assistant, in the form of a noose, round the artery, just below the end of the instrument. The same assistant then tightens the noose; and, in order that it may not rise above the mouth of the artery, he draws the ends of the ligature as horizontally as possible, which is most conveniently done with the thumbs. A knot is next made. Assalini's double spring tenaculum, which shuts in the manner of a pair of forceps, is now preferred, by many of the best hospital surgeons in the country, to the common tenaculum.

When the wounded artery is large, one ligature to the orifice nearest the heart will not suffice; for, as soon as this is tied, the blood finds its way, through anastomosing branches, into the lower continuation of the vessel, the further orifice of which from the heart then begins to bleed.

The lower or distal end of a divided artery is believed to be more prone to secondary hemorrhage, than the upper; and, according to Mr. Guthrie, this is so much the case that, if the bleeding has been arrested for four hours, and then returns, it is in all probability from the lower end. "This," says he, "may always be known from the darker colour of the blood, and from its flowing out in a continuous stream, in the same manner as water rises from a spring, and not with any arterial impulse."* When the anastomoses are very free, as in the lower part of the forearm, the blood issues from the lower end of the artery directly the upper one is secured; or, more properly speaking, it never ceases to pour out blood in small quantity, which is of a bright red, or vermillion colour. On the contrary, when the blood has to pervade the capillaries, ere it reaches the lower continuation of the artery, it flows out evenly, that is to say, not *per saltum*, and presents a dark colour, and the appearance of venous blood.† After a time, however, when the anastomosing communications between the upper and lower portions of the vessels have become more direct and free, the blood from the distal orifice, if secondary hemorrhage occurs, will exhibit the usual scarlet colour of arterial blood. In hemorrhage from individuals who are in a state approaching to asphyxia, the blood issuing even from the cardiac end of an artery will not retain its characteristic redness.

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* See Guthrie on the Diseases and Injuries of Arteries, p. 248.

† See L. J. Sanson des Hémorrhagies Traumatiques, p. 82. 8vo. Paris, 1836.

When a large artery is only punctured, and not completely cut through, the vessel is to be first exposed by an incision, and a double ligature put under it by means of an aneurism needle. One portion of the ligature is then to be applied above the wound in the artery; the other, below it. Thus, all danger of bleeding, from the passage of the blood by the anastomoses into the lower part of the vessel, is effectually removed.

Sometimes, when the punctured part of the artery cannot be prudently exposed by an incision, as in a bleeding from one of the deep-seated arteries of the leg in a compound fracture, or from a wound that is highly inflamed, and threatening gangrene, the surgeon should cut down to the vessel in a situation nearer the heart, and be content with the application of one ligature. On these principles it was, that in a gun-shot wound, injuring the popliteal artery, I took up the femoral artery in 1814, and in University College Hospital, in May 1835, I tied the popliteal artery, on account of several returns of bleeding from the arteries of the leg; and, in both these cases, the plan answered very effectually; yet the safest general rule is, undoubtedly, to expose the wounded part of an artery, and tie it above and below the aperture from which the blood issues.

Since ligatures act as extraneous substances, and only one half of each is necessary for withdrawing it when it becomes loose, the other half is always to be cut off near the knot.

With the view of diminishing still further the quantity of extraneous substance in the wound, the plan of cutting off both ends of the ligature close to the knot was proposed by Mr. Lawrence; but this method is not generally followed, in consequence of the small portions of ligature left in the part having sometimes occasioned a succession of troublesome abscesses.* When, however, the wound must suppurate, the practice is free from objection, and the best ligatures for this purpose are very fine ones, composed of dentists' silk.†

Ligatures usually separate, even from the largest arteries ever tied, in about a fortnight or three weeks, and from smaller ones in the course of five or six days. When they continue attached beyond the usual period, it is proper to draw or rather twist them gently every time the wound is dressed, so as to accelerate their separation.

*Compression.* When the blood does not issue from any distinct large vessels, but from numerous small ones, compression is preferable to the ligature, the employment of which would render it necessary to tie the whole surface of the wound. In order to make effectual compression, the opposite surfaces of the wound are to be brought into contact; compresses are then to be placed over it, and a roller applied with moderate tightness.

If compression can ever be safely adopted as a permanent plan for bleedings from large arteries, it is when these vessels run in the vicinity of a bone, against which they can be compressed; as in bleeding from the temporal artery. Compression is sometimes tried when the brachial artery has been wounded in phlebotomy. Here it is occasionally tried in preference to the ligature, because the latter cannot be employed

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* Guthrie on Gunshot Wounds of the Extremities, p. 93. See also Crosse's Obs. in Lond. Med. Repository, vol. vii. p. 363., and Gibson's Institutes, &c., of Surgery, vol. i. p. 72.

† Lawrence, in Medico-Chir. Trans. vol. viii. p. 490.

without an operation to expose the artery. It is absurd to adopt compression, in this instance, with an idea that it brings about the closure of the wound in the vessel without obliterating the arterial canal; and, consequently, with less chance of mortification from a deficiency of blood in the limb. Frequent dissections have proved that, whenever a large artery has been wounded and healed by pressure, the canal of the vessel rarely continues pervious; for, although Dr. Jones's experiments, as well as those of Béclard, tend to show, that an artery, very partially divided, may heal and remain pervious, the latter condition is not to be expected, when much compression is employed.

When an artery of magnitude has received a small wound, and lies favourably for the trial of pressure, either the ring-tourniquet or the following plan may be tried:—I suppose the brachial artery at the bend of the elbow to be the vessel. A tourniquet is to be applied, so as to command the flow of blood into the vessel. The edges of the external wound are next to be brought into contact. Then a compress, shaped like a blunt cone, and formed of a series of compresses gradually increasing in size, is to be placed with its apex exactly over the wound in the artery. This graduated compress, as it is termed, is then to be bound on the part with a roller. After relaxing the tourniquet, if no blood escape, the surgeon should feel the pulse at the wrist, in order to ascertain that the compression employed is not so powerful as entirely to prevent the circulation. The arm is to be kept perfectly quiet in a sling; and in forty-eight hours, if no bleeding take place, there will be great reason to expect that the case will end well. The plan would not, I think, be likely to succeed, if there were much blood already effused in the cellular tissue, because this would prevent the compress from acting efficiently on the wounded part of the artery.

In a wound of the superficial palmar arch, the ends of the artery may sometimes be tied at first without much difficulty, if the wound in the skin and fascia be properly enlarged. Were the attempt to fail, or were the wound itself a mere puncture, a graduated compress on the part, and cold applications, might be resorted to with success, as I have seen in several examples. Sir Astley Cooper informs me that, in some cases of puncture of the superficial palmar arch, dividing the artery completely through, so as to allow the ends to retract and contract, has effectually put a stop to the bleeding. I have never seen a case in which the ligature of the brachial artery was required for bleeding from the palmar arches; but, at least, half a dozen, where the radial or ulnar was taken up, and cold and a graduated compress also resorted to. In every instance, the effect of pressure on the radial and ulnar artery should be ascertained. When hemorrhage takes place from the palmar arches, in gunshot injuries of the hand, the bleeding orifices can rarely be secured by ligature. Here, graduated compresses on the radial and ulnar arteries at the wrist, and on the bleeding part itself, aided by a cold evaporating lotion, with which the hand and forearm should be covered, will generally answer. When the hemorrhage is secondary, and the hand in a state that will not bear any degree even of regulated and limited pressure, the effect of a ring tourniquet, in moderating or stopping the flow of blood through the brachial artery, should be tried. The operation of tying the brachial artery, or of mutilatingt he hand by removing one of the metarcarpal bones to search for the deep palmar arch, I consider unadvisable proceedings.

Compression can seldom be relied upon; for the compresses frequently slip off the artery, or the bandages become slack, so as to give room for

fatal hemorrhage. When the plan is employed, a slack tourniquet may be left on the limb, ready to be tightened in an instant by a vigilant attendant left for that purpose. If the external wound heal, while the aperture in the artery remains unclosed, an aneurism will be the consequence. This is likely to happen when the pressure is not powerful enough; and, when it is too great, there will be risk of mortification.

When the mouth of a large artery, divided in amputation, or other free and open wound, can be taken hold of with the finger and thumb, a slight degree of compression made with them will stop the hemorrhage from it, until some means of permanently suppressing it has been put in execution. Or if the orifice of the artery, which may not project sufficiently for this purpose, be yet close to the surface of the stump or wound, a very moderate pressure, made perpendicularly on it with the end of a finger, will prevent loss of blood, until the surgeon is ready to secure the vessel with a ligature.

Many secondary hemorrhages may be restrained by moderate pressure, and a ligature should only be had recourse to when pressure is inapplicable, or ineffectual.* Such pressure is sometimes required to be placed directly on the bleeding vessels, but occasionally on the trunk from which they originate, through the medium of a ring tourniquet, or compress skilfully applied. By means of such a tourniquet applied to the femoral artery, bleeding from the tibial arteries in compound fractures has often been successfully commanded; and the same instrument, as we learn from Mr. Tyrrell, has proved very effectual in several instances, at St. Thomas's Hospital, where the brachial artery had been wounded at the bend of the elbow.

*Sponge.* In profuse hemorrhages after operations about the rectum, or from the socket of a tooth, from the wound of lithotomy, or from the nose, sponge is sometimes employed for the purpose of checking the loss of blood. Its quality of expanding, when moistened, so as to distend and press upon the sides of any cavity in which it is placed, renders it eligible in these and a few other cases, where the bleeding vessels cannot be easily commanded by ligatures.

*Actual cautery.* The application of a heated iron to a bleeding vessel is one of the most ancient modes of suppressing hemorrhage; but, at present, almost in general disuse. It operates by producing a slough, which covers and closes the mouth of the artery. In order that it may not injure the circumjacent parts, it is applied through a cannula.

There are several objections to its employment: one is, that it does not regularly produce a permanent cessation of hemorrhage, as, when the eschar separates prematurely, the bleeding recurs.

In dangerous bleeding from the tongue†, and other parts within the mouth; and, perhaps, for the suppression of those profuse hemorrhages which sometimes arise from the bursting of varices, and aneurisms by anastomosis, the employment of the actual cautery may be warrantable. Dr. Elliotson recites a case, where the bleeding from the bites of leeches would have proved fatal, had they not been touched with the actual cautery. I should say, however, that nothing, but urgent necessity, can

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* See G. J. Guthrie on Diseases and Injuries of Arteries, p. 166.

† In Alibert's Nosologie Naturelle, tom. i., is described an amputation of the tongue, where the bleeding from three large arteries was instantly and effectually stopped by touching them with the cautery.

justify its use, and that, if the bleeding could be stopped by any other measures, they should be preferred.

*Torsion of arteries.* When limbs are torn off, or when wounds occur with much contusion and laceration, the middle and internal coats of the arteries are torn, and thrown into folds within the cellular tunic, which remains entire. Under these circumstances, large arteries frequently do not bleed, and then no ligatures are necessary. Probably, it was the recollection of this fact, which led MM. Amussat, Velpeau, and Thierry, three French surgeons, to try the experiment of stopping hemorrhage by twisting and stretching the extremities of the arteries, which they accomplished with forceps made expressly for the purpose.

Thierry simply twists the end of the artery with a pair of forceps, five or six times, if the vessel be small; and ten or twelve times, if it be large. Amussat first seizes the artery with one pair of forceps, and draws it out of the wound, with the view of separating it from the adjoining veins and nerves. Then, with another pair of forceps, he takes hold of the artery, below the grasp of the first forceps, pinching the vessel forcibly, so as to produce a solution of continuity in its internal and middle coats. Having done this, he holds the first pair of forceps firmly, and pushes the second ones, tightly closed, towards the undenuded part of the artery. This latter movement has the effect of pushing in that direction the inner coats, which are thrown into a fold, or duplicature, which makes a sort of barrier against the stream of blood. Then holding the second pair of forceps stationary, he twists the end of the artery, now consisting of only the cellular coat, five or six times round with the first pair of forceps.

The torsion of arteries has not yet gained many advocates in this country. If we look over the cases published by Amussat himself, and consider the experiments and reports on the subject collected by Manec, we shall find, that the plan is not a security against hemorrhage at all equal to the ligature, and that the accomplishment of it is more tedious and painful than simply tying an artery. These reasons alone would induce us to reject the practice, even if the wound sometimes healed more quickly in consequence of there being seemingly no extraneous substance in it. But, the fact is, what M. Manec has recorded, namely, the wound is generally longer in healing, and suppurates more copiously; and, as the artery often sloughs, there is in reality an extraneous substance present, namely, the slough itself. Hence, we cannot wonder, that Velpeau has already renounced the method.

*Potential cautery or caustic.* The most common formerly used, was a button of the sulphate of copper, of the size of a pea, rolled up in a piece of linen, and placed on the aperture of the bleeding vessel. The operation of strong caustics is similar to that of heated irons. Caustics are even worse than the actual cautery; for their action is more tedious, less effectual, and not confined to the vessel alone. In a case recorded by Pelletan, inflammation of the dura mater and death were produced by muriate of antimony applied to a bleeding tumour on the head.*

*Styptics* are alleged to have the property of producing a contraction of the vessels, and, as is sometimes erroneously supposed, a quick coagulation of the blood. Such are cold air, cold water, wine, brandy, tincture of myrrh, spirits in general, diluted mineral acids, solutions of alum, sulphate of copper, &c. These substances do, indeed, possess the

* Clinique Chirurgicale, tom. ii. p. 304.

power of stopping a few hemorrhages from small vessels; but, they ought never to be trusted, when large arteries are concerned. The method of applying fluid applications of this kind, is to dip lint in them, and place it on the bleeding surface. Compression is generally adopted at the same time. That cold air has a styptic effect, we have the most unequivocal proofs. We frequently tie, on the surface of a wound, every artery that betrays a disposition to bleed, so long as the wound continues exposed to the air. We bring the opposite sides of the wound into contact, and put the patient to bed. Not an hour elapses before the renewal of hemorrhage compels us to remove the dressings. The wound is again exposed to the air, and again the bleeding ceases. I have repeatedly seen this happen in the scrotum, after the removal of the testis. The proper conduct in such cases is not to open the wound unnecessarily, but to apply cold wet linen to the part, and keep up a continual evaporation from its surface, by which means its temperature will be reduced, and the bleeding suppressed.

All styptics create great irritation in recent wounds, in which cases, therefore, scientific surgeons never have recourse to them. They are, however, judiciously used to suppress bleedings, from many diseased surfaces, where the vessels seem to have lost their natural disposition to contract.

When an artery is partly cut through, it generally bleeds more profusely than when quite divided, because it can neither shrink under the surrounding substance, nor contract itself sufficiently to become impervious. Hence, when, in arteriotomy, the bleeding from the temporal artery cannot be readily stopped by pressure, the surgeon sometimes suppresses the hemorrhage by cutting the vessel completely through.

Sympathetic inflammatory fever, attended with an increase in the velocity of the circulating blood, and an augmented action of the heart and arteries, is the consequence of all considerable wounds. Hence, during its predominance, the patient is particularly exposed to the danger of fresh hemorrhage.

If the vessels be small, and the patient plethoric, venesection is sometimes recommended, the loss of venous blood being less prejudicial to the constitution than that of arterial. The flow of blood into the wounded limb is to be decreased by placing the part (if possible) in an elevated posture; and cold applications or compression tried. If, however, the arteries should be above a certain size, and the hemorrhage still continue, they must be exposed, and tied.

Hemorrhages from external injuries seldom require internal means, which, if they were needed, possess but questionable virtue. However, keeping the patient in a cool situation, not covered with too many clothes, enjoining him to avoid all motion and exertions, and allowing him only a very low diet, are, undoubtedly, means well calculated to lessen the chances of hemorrhage.

## TREATMENT OF WOUNDS.

### EXTRACTION OF FOREIGN BODIES FROM WOUNDS.

This is the second indication, the stoppage of hemorrhage being considered as the first. The removal of all extraneous substances from a wound, is universally allowed to be an object of vast importance, because,

if it be not fulfilled, the wound may be brought together as nicely, as accurately, and as skilfully as possible, and every thing look well at the beginning; yet, that desirable event, union by the first intention, will not follow, but, instead of it, a severe degree of pain, considerable swelling of the circumference of the injury, extensive redness, suppuration, large abscesses, and even the worst consequence, sloughing. All these aggravated effects frequently arise from the irritation of foreign bodies in wounds; and, as an incised wound can generally be examined, at first, with the utmost facility, and properly cleaned, without putting the patient to much pain, the neglect on the part of the surgeon becomes the more blameable. In other deep, narrow, or lacerated wounds, and in many gunshot injuries, it is often difficult at first to ascertain whether there are extraneous substances present, or not; or, when known to be there, their exact situation cannot always be determined; but, in open incised wounds, no such difficulty and obscurity prevail, and the surgeon who closes them, without having assured himself that they are perfectly free from all extraneous matter, betrays either supine negligence, or an utter ignorance of his professional duty. It is true, an incised wound, made with a clean sharp instrument, which has not broken, can have no foreign bodies in it; but very considerable and dangerous cuts are often produced by glass, china, &c., which break at the moment, and leave some of their fragments in the flesh. Sometimes, also, the weapon with which the wound is made is unclean; and sometimes, dirt, gravel, &c., get into the wound, in consequence of the patient falling upon the ground immediately he receives the injury. I shall merely repeat, that, as extraneous bodies create serious irritation in every kind of wound into which they happen to be introduced, the surgeon should always direct his attention to their removal as soon as the bleeding has been stopped.

Mr. Hunter believed that blood, retaining the living principle, and lying on the surface of a wound, was rather useful than otherwise, in promoting the reunion of the parts; and it was his particular opinion, that effused blood became hurtful to this process, only after being deprived of the living principle by long exposure, the effect of styptics, &c. Yet, this is a doctrine which is by no means sanctioned by the best modern surgeons, all of whom are perfectly convinced, that leaving any blood upon the surface of a recent wound, when its opposite surfaces are to be brought together, is highly disadvantageous, retarding the cure, and rendering union by the first intention less certain. The presence of blood must, indeed, have the effect of producing a greater or lesser separation of the opposite surfaces, which strictly ought to touch one another. Neither has it the tendency to become organised, when left on the surface of a recent wound, which Mr. Hunter's doctrines would lead us to suppose. We do not find organisation follow coagulation of the blood, as it does the effusion of plastic lymph. At all events, this is not usually the case with blood effused on wounds, or into cavities; for blood, under certain conditions, may be organised after coagulation in its natural cavities.*

* See Dr. G. Burrows on the Pathology of the Blood, in Med. Gaz. vol. xviii. The investigations of Andral, Carswell, and others, support the Hunterian doctrine of the possibility of effused coagulated blood becoming organised, forming adhesions, undergoing various morbid transformations, &c. Yet, that it has less tendency than coagulating lymph to become organised on the surface of a wound, and that its presence there is generally hurtful, are facts which no practical surgeons now entertain any doubt of.

### UNION BY THE FIRST INTENTION.

When the surgeon has stopped the bleeding, removed extraneous substances, and properly cleaned the wound, the next or third indication is to bring the opposite sides of the injury evenly together, and keep them quietly and steadily in this position, until they have united. Wounds may be healed by two processes*, viz. by one, in which pus is produced, and granulations and new skin are formed; and by another, in which, if it perfectly succeed at every point, no suppuration whatsoever takes place. Surgeons have termed this way of healing wounds *union by the first intention, or adhesion*, and Mr. Hunter named the process by which it, together with many other analogous effects, is accomplished in the animal body, the *adhesive inflammation*. This last expression, I know, was disapproved of by the late Mr. John Bell, and is objected to by Dr. Macartney, who believes, that some wounds are promptly healed without any heat, redness, tumour, pain, or disturbed vascular action. (P. 50.) But, though these effects may occasionally be very slight, it appears to me, that even a cut finger cannot rightly be said to be perfectly free from one or more of them, short as their continuance may be rendered by the quickness with which the union is sometimes completed. It is not because the process is hindered by too high a degree of inflammation, that a low degree cannot accompany it, and even be an essential part of it.

The great recommendations of union by the first intention are, celerity of cure; the hindrance of the pain and inflammation which would arise from the exposure of raw surfaces; freedom from the inconveniences of suppuration; the prevention of the deformity which would result from a large irregular cicatrix; and the greater permanency and soundness of the cure, as the part is covered by the old original skin, which is invariably stronger, and less disposed to ulceration, than what is new.

The strong tendency which divided parts of the animal body have to grow together, when kept a certain time in contact with each other, is an important fact, of which the moderns have taken much more advantage than the ancients. In the treatment of ordinary injuries, the latter seem to have availed themselves little, or not at all, of this readiness of raw living surfaces to grow together; and, as we may see by referring to Celsus, it was principally in making attempts to repair and improve the appearance of deformed and mutilated parts, that they applied their knowledge of the fact to practice. The moderns, however, (I speak more particularly of our countrymen,) have shown their high sense of the good purposes to which this tendency to adhesion in the animal body may be converted, by recommending and practising the immediate closure of every wound, for the keeping of which open there is not some very particular and specific reason. There are even circumstances on record, leaving no doubt of the fact, that it is not quite impossible for parts, entirely detached from the rest of the body, to become united again, if quickly replaced. One extraordinary case, generally quoted in confirm-

* Dr. Macartney describes four, adding to such as are usually admitted, and here specified, two others; viz. 1. Immediate union, without the intervention of blood, or lymph. 2. Reorganisation, without any medium of lymph, or granulations, the cavity of the wound becoming obliterated by a natural process of growth, which he terms the modelling process, and consists, according to his observations, in the growth of the surfaces of the wound to the level of the skin, instead of the interval being filled up by any new-formed substance. Op. cit. p. 48—64, &c.

ation of this statement, is that mentioned by Garengeot, where a soldier's nose was bit off, yet, on being immediately restored to its natural situation, it acquired there a permanent union.* Two other examples of the reunion of pieces of the nose, which were entirely cut off, are recorded by Fioraventi†, and Blegny‡; and well authenticated cases of similar facts, in relation to other parts, may be found in different publications. § The celebrated experiments of Duhamel and Mr. Hunter furnish, also, a mass of interesting evidence, completely displaying the possibility of reuniting some parts, which have been recently severed from the rest of the body. It was proved by Mr. Hunter, that the testicles of a cock, when introduced into the abdomen of a hen, contracted a vascular connection with the surface of the viscera, and lived; and that a sound tooth might be transplanted from its socket, and acquire an union in the alveolary process of another person. Lastly, he repeated Duhamel's experiment: he cut off the spurs of a young cock, and found that they might be made to unite to its comb, or that of another cock, and grow even to a larger size than natural, in such stiuations. The possibility of this species of union shows how strong the disposition of the surfaces of a fresh wound must be to grow together; particularly when it is reflected, that, in the foregoing instances, there can be, on one side, no assistance given to the union, as the separated part is hardly able to do more than preserve its own living principle, and (as Hunter expresses himself), accept of the union. ||

But, although this evidence is too strong to permit us to doubt the possibility of reuniting parts, which have been completely separated from the animal system, and in which the circulation of the blood has necessarily ceased for a time, it must not be dissembled, that attempts of this nature have generally failed. They are very successful, however, when the detached part still retains a partial and slight connection with the rest of the body, by means of only a few fibres, or a little bit of skin: a circumstance that makes a very material difference. As Dr. Thompson has said ¶, many cases are upon record, and many more have been observed, in which parts have been reunited which were completely detached, with the exception of a very small portion of cutis, a portion so small that it is not easy to conceive that any effectual circulation could be carried on through it; and he quotes from Arcæus an instance, in which the nose, and most of the upper jaw, were so extensively separated, as to hang down upon the chin, and yet were afterwards reunited. A remarkable example of the same kind was published by Larrey**, one of whose assistants was actually about to cut through the connection which was left, when he was interrupted by the Baron, who happened to be on the spot. The instances in which the fingers, toes, nose, and ears have been entirely cut off, with the exception of a small bit of skin, and afterwards saved by adhesion, are so generally known, and frequently

* Traité des Opérations, t. iii. p. 55.

† Secreti Medicinali, 12mo. Venet. 1561.

‡ Zodiacus Medico-Gallicus, Mars, 1680.

§ Bossu, in Journ. de Médecine, t. xxxiii.; Dr. W. Balfour's Obs. on Adhesion, with two Cases demonstrative of the Powers of Nature to reunite Parts which have been by Accident totally separated from the Animal System, 8vo. Edinb. 1814.

|| See Hunter on the Blood, &c. p. 208.; and Duhamel, in Mém. de l'Acad. des Sciences, 1746.

¶ Lectures on Inflammation, p. 243.

** Mém. de Chir. Militaire, t. iv. p. 20. 8vo. Paris, 1817.

exemplified in practice, that it would be useless prolixity to dwell upon them.

The knowledge of the preceding facts cannot but prove useful in relation to surgery: it raises our confidence in the powers of nature, under circumstances in which we should otherwise entirely despair; and, with the precedents before us, we shall be induced to attempt the union of parts, and sometimes succeed, when the project would appear hopeless and absurd to any one uninformed of what has already happened in other similar cases.

In promoting union by the first intention, surgery is merely to officiate as the handmaid of nature. There are only two indications: the first is, to bring the edges of the wound accurately together, and keep them so; the other is, to endeavour to keep off violent inflammation, by which the agglutination of the wound would certainly be prevented. The first object is accomplished by a proper position of the wounded part, and by the use of bandages, adhesive plaster, and sutures; the second is fulfilled by a strict observance of the antiphlogistic regimen, and particularly by avoiding every kind of motion and disturbance of the wound. The rest is the work of nature.

1. *Position of the part* is to be regulated on the principle of relaxing the wounded integuments and muscles. If the extensor muscles are injured, the joint which they move ought to be placed in an extended posture; if the flexor muscles are wounded, the limb is to be bent. When the integuments alone are cut, the same posture which relaxes the muscles, situated immediately beneath the wound, also serves, in general, to relax the skin. In transverse wounds of muscular fibres, it is astonishing what immense effect a proper posture has. This is never to be neglected, whatever may be the other means adopted.

2. *Bandages* may frequently contribute very essentially to keep the sides of the wounds duly in contact, as is strikingly illustrated in cases of harelip, where the opposite edges of the fissure may be brought forward so as to touch, and be maintained in this position by the simple use of compresses and a bandage. Such was the mode of treatment actually preferred by M. Louis; and, were it not for the greater convenience and certainty of the twisted suture, it is the plan to which surgeons would yet have recourse.

The common uniting bandage can only be applied to wounds which take a direction corresponding to the length of the body, or limbs, and which are situated where a bandage can be used with convenience and effect. It consists of a double-headed roller, with a slit between the two heads, large enough to allow one head of the roller to pass through it with facility. The proper dressings having been put on, the surgeon is to take one head of the roller in each hand, and apply the bandage first to that part of the limb which is opposite the wound. One head of the roller is then to be brought round, so as to bring the slit precisely over the breach of continuity. The other head is then to be brought round in the opposite direction, and passed through the fissure. The bandage is next to be drawn moderately tight, and, its two heads being carried round the limb again, the same artifice is to be repeated. A sufficient number of turns of the roller must be made to cover the whole length of the wound. When the wound is deep, small longitudinal compresses are sometimes put under the roller, at a little distance from the edge of the wound.

As the uniting bandage can only be made use of for longitudinal

wounds, which never have a considerable tendency to gape, nothing can be more absurd than the application of it with immoderate tightness. By this cruel and injudicious practice many limbs and lives have been lost; for, if the bandage be very tight on its first application, what a dangerous constriction of the limb or part must follow, when the swelling, necessarily arising from the wound, has come on. It is thus that insufferable pain and gangrenous mischief have frequently been induced, when, if the part had been simply dressed, and left unconfined, every thing would have gone on most favourably. It is right to state, however, that modern surgeons are not partial to the uniting bandage, and I have no hesitation in saying, that it is a means which may be advantageously banished from practice. If it be true that it brings the sides of deep wounds together better than adhesive plaster alone, and that it acts without the irritation arising from the application of resinous substances to the skin, it still has many inconveniences: its total concealment of the wound, its lying in irregular folds, so as to create an uneven cicatrix, the difficulty of undoing it, and some other serious objections, might be mentioned. These reasons have rendered its employment much less frequent than in former times, and, I may say, that its use in this country is now superseded by the preference universally and justly given, either to a common roller, or an eighteen-tailed bandage.

3. *Adhesive plaster* is generally applied in strips, between every two of which an interspace is recommended to be left, for the purpose of allowing the discharge to escape, in the event of any part of the wound not healing in the ready manner which is desirable. Therefore, to bring the edges of the wound effectually together, and, at the same time, to leave a little room for the exit of the discharge, are the leading objects to which we ought to attend in using adhesive plaster. Hence, when the strips are broad, it is not unfrequent to cut out an oval piece of each strip just where it crosses the wound. When the plaster is about to be applied to parts where hair grows, they should first be shaved; and, if wet, they should be made dry.

Adhesive plaster is of great use, even in many wounds in which it is impossible to bring their sides completely into contact; for, by bringing and retaining them nearer together than they would otherwise be, the strips lessen the size of the wound, and ultimately, when the gradual elongation of the old skin begins to take place, they succeed in bringing the separated parts perfectly together.

A pledget of simple cerate is often applied over the plasters: it is frequently preferable to dry lint, which sticks to them and the ligatures, and is more troublesome to remove. Instead of common adhesive plaster, Mr. Liston uses a solution of isinglass in brandy, smeared upon oil silk or riband, as an excellent and less irritating means of keeping the sides of wounds together. The application is sometimes not removed till the wound is cured; a plan which, when it can be followed, certainly saves the patient from all the pain usually experienced at every removal of the dressings.

4. *Sutures.* Of the numerous sutures used by the old surgeons, only two are now ever employed in this country, viz. the *interrupted* and the *twisted.* The latter will be spoken of in the observations upon harelip. The *interrupted suture* is applied as follows: — When the bleeding has been suppressed, and all extraneous substances have been removed, the surgeon is to place the limb in such a posture as shall enable him to bring the lips of the wound easily into contact. The needle, armed with a

ligature, and having a curvature that forms the segment of a circle, is then to be introduced into the right lip of the wound, at a small distance from its edge, and is to be directed across the wound, so as to come through the left lip from within outward. It is now to be cut off, and the ligature tied in a bow. These sutures should always be at least an inch from each other. At the same time, strips of adhesive plaster, and a bandage for the support of the part, are usually employed.

In the present schools of surgery, the use of sutures is less recommended than in former days. By the combined operation of position, adhesive plaster, and a bandage, the generality of wounds are capable of being united as expeditiously and well as they could be were sutures employed. In the treatment of harelip, wounds of the face, large wounds penetrating the abdomen, wounds after castration, and operations for hernia, we must, however, admit their utility. In wounds of the lips, the incessant and unavoidable motion of the parts, and in those of the abdomen, the distention arising from the viscera, and the danger of their being protruded, are reasons which, in these particular instances, may account for the advantages of sutures. But, in general, the promotion of union by the first intention cannot be set forth as a valid argument in favour of the practice. Inflammation, above a very moderate pitch, always destroys every prospect of this nature, and occasions the secretion of pus, instead of the exudation of coagulating lymph. Sutures have fallen into disrepute, principally because they tend to increase inflammation. The new wounds which they make, their irritation as extraneous bodies, the forcible manner in which they drag the living parts together, and their incapacity, in general, to accomplish any useful purpose, which position, adhesive plaster, and bandages cannot effect, are strong motives for reprobating their common application. Extensive erysipelatous redness, uncommon pain, and severe nervous symptoms, will often be found to originate from the irritation of sutures. I believe, that they are still too much resorted to by the mechanical class of surgeons.

Such are the principal means for keeping the opposite surfaces of wounds in contact, until union has taken place. The first plasters and dressings should continue on the part at least three or four days, unless any disagreeable symptoms, as excessive pain, hemorrhage, &c. indicate the contrary. The cause of the severity of the pain should always be duly considered, and, if possible, removed: sometimes it is owing to the sutures; sometimes to the immoderate tightness of the roller; and, occasionally, to extraneous substances yet lodged in the wound.

When too much inflammation is apprehended, the bandage should never be tight, and wetting it with cold water may be of use. Perfect quietude, and an antiphlogistic regimen, should be observed. The old plan of covering the dressings with thick woollen rollers, caps, and large masses of tow, is entirely rejected in this metropolis, as being inconsistent with those principles which are recognised by every scientific surgeon as best calculated to avert and lessen inflammation.

When the first dressings are removed, the surgeon often finds union by the first intention accomplished only at certain points of the injury; and the connexion even there still requiring further support. On the application of the second dressings, however, it is generally unnecessary to put on as many strips of adhesive plaster as were at first employed, and their number may be gradually lessened at each future dressing. The sutures, if there are any, should also be now withdrawn, as they can do no further good, and their continuance may excite irritation, and do harm. Through-

out the rest of the treatment, also, the dressings should be light, simple, and unirritating.

I shall conclude this part of the subject with a few useful rules in the dressing and examination of wounds.

The first is, never to give the patient more pain from our modes of procedure, or methods of dressing, than is absolutely necessary for his present good or future security. For instance, we ought never to probe a wound, where probing can be of no use; and we should be contented to remain ignorant of things, the knowledge of which would only gratify an idle curiosity.

The second is, that any requisite examination of a wound should be made as soon after the accident as possible; for, at this period, inflammation and swelling not having had time to come on, the patient suffers much less pain from the introduction of the probe, or finger, into the wound, and the surgeon more easily gains the information which he is in search of, than in a later stage.

Another good rule is to let all the fresh dressings be perfectly ready before the old ones are removed. A sponge and warm water, adhesive plaster, lint, ointments, lotions, nitrate of silver, bandages, &c. should all be at hand, and not left to be looked for at the very moment when they are wanted.

As in many instances the removal of the dressings, and the application of others, take up a considerable time, we ought carefully to reflect what position would be most easy to the patient, and, at the same time, most convenient to the surgeon.

When the bandage, adhesive plaster, and other dressings have become hard and dry, and glued together, and to the surrounding skin, by blood, or other discharge from the wound, the surgeon should soften and loosen the applications by wetting them a sufficient length of time with warm water, which is to be pressed out of a sponge upon them, a basin being held below the part for the reception of the water as it falls off the dressings. This duty is of much importance in saving the patient from a great deal of agony, which the abrupt removal of the adherent dressings would produce.

In removing the dressings which are under the bandage, we should be careful that the ligatures are not entangled, and forcibly pulled away, so as to give severe pain, and create a risk of hemorrhage.

The strips of adhesive plaster should be removed by taking hold of their ends, each of which is to be drawn towards the wound. Were the plasters pulled off in the contrary direction, the edges of the wound would be liable to be torn asunder again, and the process of reunion, at all events, disturbed; neither should the plasters be pulled up, as by this proceeding the edges of the wound would be torn from the subjacent parts.

In large wounds, only a single strip, or at most two, should be off at a time, and the part from which the plaster has been removed, having been carefully wiped with a sponge, and dried, is then to be supported with a fresh strip, before any more strips are taken off. As Dr. Thomson well observes, it is from inattention to this rule, that wounds are daily torn open again at each dressing, merely by the weight of the parts.

The sides of the wound, particularly if it be large and deep, should always be supported by an assistant at the time of changing the dressings.

When there are several wounds, only one is to be opened and dressed at a time, so that all unnecessary exposure of the parts may be avoided.

At each dressing, care must be taken to prevent lodgments of matter, by placing the compresses and strips of plaster in the manner best calculated to press upon and obliterate any cavity in which the pus has a tendency to accumulate.

The utmost attention should be paid to cleanliness, every thing filthy and offensive being removed from the ward as quickly as possible. Above all things, care must be taken not to let the matter touch the bedclothes. The custom of laying a piece of oilskin under suppurating wounded parts, in order to keep the bed clean, is highly praiseworthy; for cleanliness is essential to the general health of the patients, and the favourable progress of all wounds.

The frequency of dressing must be regulated by the quantity and quality of the discharge; by the situation of the injury; by the climate and season of the year; by the effect which the renewal of the dressing seems to produce; and by the feelings, and sometimes the wishes, of the patient.*

### PROCESS BY WHICH THE WOUND IS UNITED.

When the opposite sides of an incised wound are maintained in contact, they soon become permanently connected together. The vessels of the wounded surface cease bleeding, and their extremities become impervious to the blood itself, but not to the coagulating lymph, or fibrine, which forms the general bond of union between living parts. This uniting medium is the primitive and most simple connection that takes place between the two sides of a wound. In many cases, where the wound is closed before the hemorrhage has had time to cease, no doubt a quantity of blood must be interposed between the opposite surfaces of the injury; but such blood is now suspected, by many good pathologists, not to become itself the first bond of union; but, on coagulating lymph being effused, to be generally absorbed, as answering not only no useful purpose in the healing process, but if too abundant, proving an impediment to the cure without suppuration. Hence, the best practical surgeons always make the surface of the wound as free from blood as possible, before its opposite sides are brought together. I am quite sure, that union by the first intention more certainly follows this mode of proceeding. Yet we are not to defer bringing the sides of a wound together, until every little oozing of blood is at an end; for the long exposure of the wounded surface would be hurtful, and tend to defeat the grand object in view, direct adhesion, without suppuration. The doctrine of the occasional extension of vessels into a clot of blood is considered, however, by Professors Carswell, Macartney, and others, to admit sometimes of demonstration. Dr. Macartney states, that he has seen vessels passing for a short way into a clot of blood, covering the surface of an ulcer, &c. He also succeeded in making injection pass into the coagula, formed in the cavities of the heart after death, which injection presented the appearance of red elongated lines. (P. 54.) Clots of blood are often enveloped in fibrine, a substance into which vessels are prone to extend themselves from those of the nearest texture; and this has sometimes been suspected to be the case in certain preparations put up by John Hunter himself, to demonstrate the vascularity of clots of blood, and preserved in the museum of the Royal College of Surgeons, in London.

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* See Thomson on Inflammation, p. 294, &c.

We have examples of the union of textures without suppuration, and, in this respect, by a process similar to union by the first intention, in bones which have been fractured; in tendons which have been ruptured; and even sometimes in muscles, which have been wholly or partially torn asunder, without any division having been produced in the skin which covers such parts. In the sudden and violent division of these textures, blood is always effused between the divided parts, and into the surrounding cellular tissue. When this extravasated blood is not very considerable in quantity, and when the parts from which it has been effused are not too severely injured, it is observed to be gradually absorbed, in proportion as the process of union advances. If the divided surfaces be examined a few hours after the accident, they will be found to be covered with coagulating lymph. This substance, indeed, appears to be effused very quickly after the injury. Professor Thomson found, that, in animals, a distinct layer of it was effused over their wounds in less than four hours.* But, says he, whatever may be the period at which it is first formed, it is now well ascertained, that, in healthy subjects, when fractured, torn, or ruptured surfaces, to which the external air has not been admitted, are properly covered with this layer of coagulating lymph, and kept in contact, they speedily coalesce, and that, by this fibrine becoming a living intermedium, the continuity of the divided part is at length restored. Appearances, precisely similar to such as happen in divisions without communication with the external air, take place in simple incised wounds, the edges of which have been brought together before, or soon after, the bleeding has ceased. If a wound of this kind be torn open soon after its reunion, the surfaces, which had been united, are seen covered with a substance resembling jelly, which is the coagulating lymph, or fibrine of the blood. By some it is supposed, as I have said, that this lymph is poured out from the smaller vessels which have been cut; but Professor Thomson inclines to the opinion, that it is chiefly, if not wholly, formed by the secreting action of the capillary vessels of the divided surfaces.†

The simple agglutination of the sides of a wound together, is what may be considered as taking place very shortly after they have been brought into contact with one another. The next step, in the process of union by the first intention, is the extension of vessels into the coagulating lymph, and this is soon followed by an intercourse between the vessels of the two sides of the wound. The manner in which the new vessels arise in the uniting medium, as well as the way in which the inosculation of the divided vessels happens, are at present only matters of conjecture. Mr. Hunter once conceived that blood and coagulating lymph, so long as they retained the living principle, possessed the faculty of generating vessels within themselves, quite independently of any adjoining surfaces; and, in the growth of the chick, there are unquestionably some appearances in favour of this opinion. This doctrine, however, he renounced previously to his death, and adopted the belief, which is now daily gaining ground, that the new vessels are extensions from the old ones. Professor Thomson delivers the following statement: the coagulating lymph, or fibrine, soon after its exudation, becomes penetrated with blood-vessels, *which proceed from the divided surfaces*, appear to join in the process of reunion by open extremities, or, in other words, to inosculate with one another. The blood now circulates freely through the new-formed channels of communication established between the vessels, which pene-

* On Inflammation, p. 209. † Op. cit. p. 210.

trate the lymph effused upon the surfaces formerly divided; and the vessels which shoot into the lymph often acquire, in the course of a few hours, a size which renders them capable of being injected. The precise manner, in which the vessels are extended into the coagulating lymph is still unknown. It has not been positively settled, whether it is the divided vessels which penetrate the lymph. The extremities of the larger branches are closed with the effused lymph, and removed by means of it and their natural elasticity to a distance from each other. Dr. Thomson regards these circumstances as insurmountable bars to their immediate inosculation; and he remarks, that, if it be the closed vessels which are prolonged into the lymph, each small artery must obviously have its corresponding vein. But, says he, the inosculation, or direct union of the small bloodvessels from the opposite surfaces of the wound, however difficult to conceive or explain, is a truth undeniably established.* He then adverts to Duhamel's experiment, which fully proves, that, in the reunion of parts which have been divided, the bloodvessels from the opposite surfaces inosculate directly, and do not merely pass one another. Duhamel broke the legs of six chickens, and, after the bones had reunited, he cut through about one third of the soft parts, covering the callus, or new bone. When the wound had healed up, he divided another third part, and in the same manner the remaining third part, sparing neither bloodvessel, tendon, nor nerve. Only one of the six chickens survived these cruel operations; but, upon injecting the artery at the upper part of the thigh, the injection penetrated to the lowest part of the leg. "I cannot say (Duhamel remarks) whether the large vessels, filled by the injection, were dilated capillary vessels, or the large vessels of the leg, which had been reunited; but the experiment proves irrefragably the inosculation of the bloodvessels." Later observations than those of Duhamel (says Professor Thomson) have shown, that it is by the small vessels, and not by the larger trunks, that the inosculations are formed, by which the divided parts of a limb are supplied with blood: nor does he accede upon this point to the sentiment of Hunter, who conceived that he had certainly succeeded in observing inosculation on the tunica conjunctiva of the eye, the vessels of which are frequently divided by surgeons in cases of ophthalmy. He states, that the two ends of the cut vessels are seen to shrink; but, after a little while, they are perceived to unite, and the circulation is carried on again.†

The celerity, with which the process of union by the first intention is completed, is a circumstance that must excite the admiration of the philosophical surgeon. In the short space of seventy-two hours, the wound, produced by amputation of the thigh, is often securely united through its whole extent, without any suppuration, except just where the ligatures are situated. Incised wounds of a moderate size may, in general, be completely healed by this method in forty-eight hours. How different, then, is the surgery of the present day to that of half a century ago, when the bigotted prejudices of our ancestors deterred them from doing, not only what was most salutary, but most simple! The complicated business of accomplishing digestion, incarnation, and cicatrisation, is now reduced to the easy duty of bringing the sides of a clean cut wound together, and maintaining them so until they have grown together.

As John Bell has observed, "there is no wound in which we may not try with perfect safety to procure this adhesion; for nothing surely can

* P. 212. † On the Blood, p. 193.

be more kindly, when applied to a wounded surface, than the opposite surface of the same wound: it has been but just separated from the opposite surface: it may immediately adhere to it: though it do not adhere, no harm is done; still the wound will suppurate as kindly, as freely, as if it had been dressed with dry lint, or some vulnerary balsam, or acrid ointment. If only a part suppurate, while one half, perhaps, adheres, then half our business is done: and, in short, this simple way of immediately closing a wound is both natural and safe."* If I were to instance any one circumstance, in which I think the excellence of English surgery strikingly displayed, I should be inclined to cite our partiality to the mode of curing wounds by the first intention. M. Roux†, in his criticisms upon this part of our practice, may convince his readers how sincerely he believes what he says; for he actually fancies, that we have been, as it were, forced into the custom of healing up wounds as quickly as we can, because, unfortunately, in this country, we have not, as he conceives, a sufficiency of the requisite materials for dressing wounds, which are to heal by suppuration! But I doubt whether he will be joined by any surgeons on this side of the Channel in the belief, that it would be better to abandon the practice of adhesion altogether, than make it an exclusive method of treatment. He particularly mentions the wound after castration as unfit for this plan, because the edges cannot be easily put into a state of coaptation, unless a considerable piece of the scrotum be cut away, and sutures be used; and also because the closure of the wound is attended with the risk of a collection of blood taking place in its cavity, and nature is nearly as long in effecting a cure, when the sides of the wound have been brought together, as when they have not. But, if the principle were to be admitted, that the possibility of bleeding within a wound is an adequate reason for filling it with charpie, and not attempting to heal it by the first intention, we ought to renounce this last beneficial practice in every instance, where the surface of the wound is extensive, and its cavity large, as after amputation, the removal of a breast, the extirpation of tumours, &c. But, even supposing the scrotum should sometimes become filled with coagulated blood, of which M. Roux is so much afraid, it may then be inquired, which of two patients would be the best circumstanced, one with the scrotum crammed with charpie, or another with the same part distended with coagulated blood? Which would suffer least pain, have the most moderate suppuration, and get well in the shortest time? If the answer to these problems be so doubtful, as not to admit of being readily delivered, surely we may be allowed to argue thus: that if, when the evil complained of by M. Roux does really occur, the patient is not decidedly worse off than when such disaster does not happen, but the particular treatment recommended by that gentleman is followed, how much better it must be to let the patient, at all events, have the chance of a considerable portion of the wound uniting; for when this is accomplished (to use Mr. John Bell's phrase) half our business is done.

But if any wound require more strongly than others the approximation of its edges, and to be healed, if possible, by adhesion, it seems to me, that it is the incision made in the Hunterian operation for aneurism. Here the wound should be closed to let the artery lie quietly amongst its

* Discourses on the Nature and Cure of Wounds, by John Bell, p. 14. edit. 3.

† Parallèle de la Chirurgie Angloise avec la Chirurgie Françoise, p. 117. et suiv. 8vo. Paris, 1815.

natural connexions, undisturbed by the contact of any dressings, or other extraneous substances, by which the adhesion of its sides might be prevented, its ulceration induced, and secondary hemorrhage occasioned. But, extraordinary as it may appear, this is another example of our practice, selected by M. Roux to illustrate our blind predilection for healing wounds by the first intention. The wonder ceases, however, when we find that he considers ligatures of reserve (ligatures d'attente) advisable means in operations for aneurism; for they are undoubtedly awkward things in a wound which ought to be healed as quickly as possible, and they put union by the first intention out of the question. But, in London, where the inutility and dangers of these ligatures of reserve are well understood, a practice, which tends to abolish their use, will be welcomed as bringing with it another high recommendation.

### PUNCTURED WOUNDS

Are not only dangerous on account of their frequently extending to a considerable depth, and injuring large bloodvessels, nerves, viscera of importance, and a great variety of textures, they are also dangerous, inasmuch as they frequently give rise to violent and extensive degrees of inflammation. It is not uncommon to see them followed by formidable collections of matter, especially when the instrument, with which they have been made, has penetrated deeply through an aponeurosis or fascia. The extension of inflammation along the continuous textures from the original seat of the puncture, and the formation of matter under the fasciæ, are two of the most remarkable local phenomena, which are particularly liable to arise from punctured wounds.* Stabs, and all other punctures, are not simple divisions of the fibres of the body: they are attended with more or less contusion and laceration. Hence, there is not the same readiness to unite, which we observe in wounds made with sharp cutting instruments; and, when the weapon has entered deeply through tendinous expansions, the inflammation excited often spreads very extensively, attended with most severe pain in the parts affected, great tension, swelling, and abscesses running under the fasciæ to an alarming extent. Violent symptomatic fever, and great agitation of the nervous system, likewise often follow punctured wounds; effects which used to be erroneously attributed to the injury of tendons or nerves. This doctrine, however, is now nearly exploded. Surgeons frequently see nerves of considerable size and large tendons wounded, without the occurrence of great constitutional disorder; therefore, it cannot be the mere injury of these parts which is the occasion of all the general indisposition.

More is to be feared, I think, from the frequent depth of a stab or puncture, the roughness and violence with which the injury has been done, and the many different textures pierced, than from the circumstance of tendons or nerves happening to be wounded. Amongst the worst kinds of general indisposition, more frequently following punctured, than other descriptions of wounds, is tetanus; a complication still oftener seen in warm climates than our own.

Punctured wounds are generally more dangerous and difficult to cure than cuts and sabre-wounds, though much depends upon the nature of the parts injured. When great degrees of swelling and inflammation follow, when considerable abscesses form, when phlegmonous erysipelas

* Thomson's Obs. made in the Military Hospitals in Belgium, p. 29. 8vo. Edinb. 1816.

arises, or when a large artery or important viscus is wounded, and blood or other fluid is extravasated, the case is undoubtedly of a serious and dangerous nature. The same remark may be made when tetanus, or violent symptomatic fever, and great agitation of the nervous system, complicate the injury.

In the treatment of punctured wounds, mistaken doctrines were formerly the source of many serious abuses in practice. The unlimited idea, that the severe consequences of most punctured wounds were in a great measure owing to the narrowness of their orifices, induced numerous surgeons to practise, indiscriminately, deep and extensive incisions, for the purpose of rendering their external communication considerably wider. To have in view the conversion of such injuries into simple incised wounds, was always a maxim strongly insisted upon, and urged as the reason for such treatment.

Certainly, if the notion were true, that an important punctured wound such as the stab of a bayonet, could be actually changed into a wound partaking of the milder nature of an incision, by the mere enlargement of its orifice, the corresponding practice would be highly commendable, however painful. But the fact is otherwise: the rough violence, done to the fibres of the body by the generality of stabs, is little likely to be suddenly removed by an enlargement of the wound. Nor can the distance, to which a punctured wound frequently penetrates, and the number and nature of the parts injured by it, be at all altered by such a proceeding. These, which are the grand causes of the collections of matter, which often take place in the cases under consideration, must exist, whether the orifice and track of the wound be enlarged or not. The time when incisions are proper is when there are arteries to be secured, foreign bodies to be removed, abscesses to be opened, or sinuses to be divided; and to make painful incisions sooner than they can answer any end is both injudicious and hurtful. They are sometimes rendered quite unnecessary by the union of the wound throughout its whole extent, without the least suppuration.

It is true, that making a free incision, in the early stage of these cases, seems a reasonable method of preventing the formation of sinuses, by preventing the confinement of matter, and, were sinuses an inevitable consequence of all punctured wounds, for which no incisions had been practised at the moment of their occurrence, it would undoubtedly be unpardonable to omit them. To many this may seem a fair reason for enlarging the mouth of a punctured wound. Fair, however, as it may appear, it is only superficially plausible, and a small degree of reflection soon discovers its want of real solidity. Under what circumstances do sinuses form? Do they not form only where there is some cause existing to prevent the healing of an abscess? This cause may either be the indirect way, in which the abscess communicates externally, so that the pus does not readily escape; or it may be the presence of some foreign body, or dead portion of bone; or, lastly, it may be an indisposition of the inner surface of the abscess to form granulations, arising from its long duration, but removable by laying the cyst completely open. Thus it becomes manifest, that the occurrence of suppuration in punctured wounds is only followed by sinuses when the surgeon neglects to procure a free issue for the matter after its accumulation, or when he neglects to remove any extraneous bodies. But, as dilating the wound at first, will only tend to augment the inflammation, and render the suppuration more extensive, it ought never to be practised in these cases, except for the direct objects

of giving free exit to matter already collected, of tying a wounded artery, or of being able to remove extraneous bodies palpably lodged. I shall once more repeat, that it is erroneous to suppose the narrowness of punctured wounds so principal a cause of the bad symptoms, with which they are often attended, that the treatment ought invariably to aim at its removal.

Recent punctured wounds have absurdly had the same plan of treatment applied to them as old and callous fistulæ. Setons and stimulating injections, which in the latter cases sometimes act beneficially by exciting an inflammation, that is productive of the effusion of coagulating lymph, and of the granulating process, can never prove serviceable when the indication is to moderate an inflammation, disposed to rise too high. The counter-opening, which must be formed, in adopting the use of a seton, is also an objection; and though French authors have given us accounts of their having drawn setons across patients' chests, in cases of stabs, they would find some difficulty in making the practice seem unattended with harm, much less productive of good. The candid and judicious surgical reader should not always think a plan of treatment right, because the patient gets well; for, there is an essential difference between a cure, promoted by really useful means, and an escape, notwithstanding the employment of hurtful ones.

Why, however, should we mention the use of a seton? What good can possible arise from it? Will it promote the discharge of foreign bodies, if any are present? By occupying the external openings of the wound, will it not be more likely to prevent it? In fact, will it not itself act with all the inconveniences, and irritation, of an extraneous substance in the wound? Is it a likely means of diminishing the immoderate pain, swelling, and extensive suppuration, so often attending punctured wounds? It will undoubtedly prevent the external openings from healing too soon; but cannot this object be effected in a better way? If the surgeon observe to insinuate a piece of lint into the sinus, and pass a probe through its track once a day, the danger of its closing too soon will be removed.

The practice of enlarging punctured wounds by incisions, and of introducing setons, is often forbidden by the particular situation of these injuries.

I do not follow many surgical writers in recommending the indiscriminate dilatation of the orifices of punctured wounds; nor the use of the knife, for the purpose of preventing mischief only expected and apprehended but not certain of taking place. Whenever I have attended bayonet or other punctured wounds, unattended with any particular complication, I have always observed nearly the same principles as are now so generally approved of in gunshot wounds. I have abstained from dilating the orifice of the injury, except when it was necessary, either to get at a bleeding artery in the first instance, or to relieve the constriction of the parts, or to procure a freer outlet for the discharge in a later stage of the case. I have given the preference to mild, simple, unirritating, and superficial dressings. I have not placed any faith in the utility of enveloping the parts in a tight bandage; but, after applying the first superficial dressings, have usually covered the limb or part with linen wet with the lotio plumbi acetatis, or cold water. Whenever a roller was used, in the beginning of a case, it was not with the view of making pressure, but of retaining the dressings. The wound having been dressed, I then put in practice all such means as are generally

deemed most efficient in preventing and diminishing inflammation; such as venesection, the exhibition of aperient saline medicines, low diet, &c. When the pain was severe, opiates were prescribed, and on the access of much inflammation and swelling it was an invariable rule with me to be sure that the bandage was slack. On the whole, I believe, that the application of superficial dressings and cold washes is the best practice for the first twenty-four hours after the receipt of a punctured wound. But if, after this period, the pain should increase, and the swelling and tension become more and more considerable, the surgeon may then remove the linen and bandages, and apply leeches freely and repeatedly to the neighbourhood of the wound. He may also substitute for the cold lotions fomentations, and emollient poultices, under which is to be laid, over the orifice of the wound, a small pledget of spermaceti cerate, or the tepid water dressing may be employed. The poultices and fomentations are to be renewed twice a day, and the leeches and venesection, if necessary, repeated.

Sometimes, under this treatment, the surgeon is agreeably surprised to find the consequent inflammation mild, and the wound united by the first intention. More frequently, however, in cases of deep stabs, the pain is intolerable; the fever and disturbance of the nervous system severe; and the inflammatory symptoms run so high, as to leave no hope of avoiding suppuration. In this condition, emollient poultices and fomentations are the best applications; and, when the matter is formed, its speedy and effectual discharge is to be procured, either by dilating the original wound, or by making one or more incisions in other places, as may seem most advantageous. In short, the treatment must then conform to the principles, already noticed in the remarks on suppuration and abscesses.

On the accession of the symptoms here adverted to, Professor Gibson joins those practitioners who resort to dilatation of the wound, and making a transverse division of the fascia, by which means, he states that the urgent symptoms will cease almost immediately.*

### CONTUSED AND LACERATED WOUNDS.

The instruments, which have the effect of producing what is termed a *contused wound*, are either of an ordinary description, such as a cudgel, stone, &c.; or they consist of balls, bullets, and other metallic bodies, which are driven into the living textures with immense velocity by the explosion of gunpowder. Indeed, a forcible collision of any blunt, obtuse, hard body against parts of the living body must contuse, and often at the same time wound them. Gunshot wounds, strictly speaking, are only examples of severe contused wounds, though surgeons find it expedient generally to treat of them as distinct and peculiar cases: and when it is recollected how many difficult, intricate, and momentous questions the subject embraces, the necessity of considering it by itself must be generally acknowledged.

The blunt weapons, or obtuse hard substances, which, being applied with violence to any part of the living body, bruise, rupture, and otherwise hurt the fibres and vessels, may produce two different species of injury. First, they may more or less forcibly compress and crush the parts upon which they act, so as to disorder the texture of those organs which are situated under the integuments, without causing, however, any breach of continuity in the skin itself. This is the case, which is

* Institutes, vol. i. p. 63. ed. 5.

familiarly called a *bruise*, or *contusion*, of which one of the worst examples is seen in the effects of cannon-balls, which graze the surface of the body, and crush the muscles and other deep-seated parts, while the skin itself remains unbroken. Secondly, a hard blunt body, violently striking against parts, may produce at once a solution of continuity, extending through the skin, and sometimes also through other textures: this kind of accident is what surgeons name a *contused wound*. The latter injury more commonly follows, when the surface of the contusing weapon is not very broad. The cases, which rank as simple contusions, I shall consider hereafter.

The majority of wounds are attended with some degree of contusion. Those which are inflicted with the blunt edge of a sabre, or the obtuse point and wedge-like end of a bayonet, are as much contused as punctured; and hence, like other contused wounds, they do not often admit of being united by the first intention. It must be confessed, indeed, that all our endeavours to reunite the sides of a contused wound, however skilfully directed, most frequently fail. An agglutination of the parts at most only takes place at the bottom of the wound, in which situation the flesh has suffered less contusion, the violence having spent itself, as it were, upon those parts upon which it first operated. Hence, suppuration of the external portion of the wound is mostly unavoidable. Still, the attempt at reunion ought to be made; for, if only the bottom of the wound heal by the first intention, it is a great advantage gained, more especially, when the surface of a bone has been exposed, and uncovered by the injury. In bringing the sides of contused wounds nearer together, however, the surgeon is not to attempt to do it with the same closeness and accuracy, as in the instance of an incised wound. The injured parts would not bear the pressure, nor other means requisite for this purpose; and it may be laid down as an established rule, that nothing is more hurtful to contused wounds than much pressure, either from strips of adhesive plaster, or from rollers. In few of these cases, also, are sutures admissible; and I think that examples have fallen under my notice, where the rash determination of the surgeon to close large contused wounds with stitches, tight strips of plaster, and bandages, had no inconsiderable share in bringing on the rapid and fatal gangrene which carried off the patients. When I say, therefore, that a contused wound ought to be closed, and that its opposite surfaces should be brought nearer together, in order that the chance of some part of the injury uniting by the first intention may be taken, I do not mean to recommend dragging the parts together by main force, or placing them in a state of constriction. On the contrary, I think that they ought to be left quite unconfined, the adhesive plaster being used very sparingly, and so put on as rather to hold the loose parts nearer to one another, than to press and draw them into contact. Nor should the wound be covered with much plaster, as one or two strips will suffice for the object in view, and a greater number would create irritation, besides hindering other better dressings from touching the raw surfaces. Merely a strip or two are to be applied to such points as seem most advantageous in lessening the exposed surfaces, and all constriction should be most carefully avoided. That the practice here advised may be followed by a beneficial result is proved by daily experience; and theory would lead us to expect such good, when we remember that, by preventing the wound from gaping in the manner it would otherwise do, we not only afford an opportunity for parts of it to reunite, but at once diminish an

inevitable cause of inflammation and suppuration, viz. the continued exposure of a raw surface.

Contused and lacerated wounds not only differ from incised wounds in the circumstance of being more disposed to suppurate and slough, and more difficult to heal by the first intention, they differ also in the particularity of not usually bleeding much: sometimes, not even when the largest arteries are lacerated, as must be the case when whole limbs are torn away, in consequence of becoming entangled in different kinds of machinery. The circumstance, which hinders the bleeding from being considerable in such cases was first correctly pointed out by Professor Turner*; namely, the middle and inner coats of the vessel are lacerated, separated from the more elastic external coat, and thrown into irregular folds within it, so as to constitute a barrier against the escape of the blood.† Here the very same change takes place as occurs when torsion of arteries is practised. This indisposition to hemorrhage is not altogether a favourable omen, because, though the patient runs less chance of bleeding to death in these cases than in cut wounds, yet the very circumstance of the large vessels not pouring out blood evinces, that the violence, contusion, stretching, and other injury done to the parts, in addition to the mere division of them, must have been excessively severe, and that the danger of the subsequent inflammation, suppuration, and sloughing of the parts, is more than a counterbalance to any advantage proceeding from the absence of hemorrhage.

In the records of surgery, no facts are more extraordinary than those which have been published, at different periods, on the subject of whole limbs being torn away, not only without hemorrhage, but without any fatal effects. The examples of this, related by Cheselden, La Motte, Carmichael, Morand, and Gibson ‡, are some of the most remarkable.

All lacerated and contused wounds should be treated according to common antiphlogistic principles. When the injury is extensive, and attended with a great deal of contusion, venesection is to be practised, and any moderate oozing of blood from the surface of the wound promoted by the use of fomentations. With respect to dressings, they should always be of a mild unirritating quality. After lessening by means of a strip or two of adhesive plaster the exposed cavity of the wound, if this be large, and the surrounding skin loose, or detached from the subjacent parts, the wound may be covered either with lint dipped in tepid water, over which is put a piece of oiled silk, or with a pledget of unguentum cetacei, over which should be laid an emollient poultice. The first dressings should not be removed for at least two or three days. Afterwards, however, the dressings may be changed once or even twice in a day; for as soon as the sloughs begin to separate, and suppuration commences, the necessity of renewing the dressings and poultices more frequently is evident. In severe cases, fomentations may be used at the periods of dressing, as nothing will be found more effectual for the relief

* See Edinb. Med. Chir. Trans.

† Speaking of the bleeding being sometimes profuse, directly after the receipt of a gunshot wound, M. Larrey, jun. observes, "L'hémorrhagie est plus fort si une artère est divisée partiellement, que si elle a été tout-à-fait rompue, parceque, dans ce dernier cas, le vaisseau éprouve une sorte de torsion et de refoulement par la force contondante ou l'attrition; sa tunique interne se déchire et se tortille en tire-bouchon, de manière à oblitérer l'orifice de l'artère." — Hist. Chir. du Siége de la Citadelle d'Anvers, p. 60. 8vo. Paris, 1832.

‡ Institutes of Surgery, vol. i. p. 66. ed. 5. Philadelphia, 1838.

of the pain. The employment of leeches, also, should not be forgotten, as a valuable means of palliating inflammation. Professor Asalini *, of Milan, has particularly recommended the application of cold washes to contused wounds; and, I believe, the plan is decidedly useful in the first instance, when it is a great object to check the increase of extravasated fluids in the surrounding parts. I think cold applications are also highly proper when contused wounds are disposed to bleed more than usual, and yet no large vessel presents itself as the source of hemorrhage. But, in other periods and states of these injuries, I prefer emollient dressings.

If, in lacerated and contused wounds, the surgeon is less frequently called upon than in incised wounds to take measures for stopping bleeding immediately after the accident, he finds greater occasion for attending to another important duty imposed upon him in his professional attendance upon wounded persons in general: I allude to the early removal of all foreign bodies and extraneous substances. Cuts are usually made with clean sharp instruments; but contused and lacerated wounds often occur in a manner, which renders them very likely to be complicated with the lodgment of extraneous matter.

With regard to lacerated wounds, the same practical remarks apply to them which have been offered on the subject of contused wounds. In warm climates, tetanus is a frequent consequence of them. The stoppage of bleeding, and the removal of foreign bodies having been effected, the edges of the lacerated wound should be loosely drawn together, and retained with a few strips of adhesive plaster, and here and there a suture will sometimes be proper for keeping the flaps and angles duly fixed in their places; for, they ought not to be cut away. Although the union of such a wound cannot be calculated upon to any extent, great benefit results from keeping the parts as nearly as possible in their natural situation. Indeed, in some instances, union does take place through a considerable part of the wound, and this even in severe cases, as exemplified in the man who received a formidable bite from a shark, and the particulars of whom were recorded by Dr. Kennedy.† When a great deal of inflammation ensues, it will generally be advisable to remove the adhesive plaster and stitches, and apply a poultice or the water-dressing; and, if there be much fever, restlessness, or delirium, blood-letting, saline purgatives, opium, and very low diet, with proper treatment of the wound itself, are the most likely means to give relief.

Dr. Macartney remarks, "I have never seen an instance of tetanus coming on, where wounds, however severe, and from their nature likely to produce the disease, were healed under water-dressing." He adds, that Dr. Bowyer, a gentleman in extensive practice in Demerara, adopts this method after amputations and other operations; that the wounds are thus healed as favourably as the best treated cases in cold climates; and that, after fourteen amputations, not a single patient had died of tetanus. ‡

When the surface of a contused or lacerated wound has thrown off its sloughs, suppurated, become clean, and evinced a tendency to form granulations, the poultices are to be immediately discontinued, and simple dressings employed. The quality of these is afterwards to be adapted to the future appearances of the sore, agreeably to the directions already

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* Manuale di Chirurgia, 12mo. Milano, 1812.

† See Med. Chir. Trans. vol. ix. p. 240.

‡ On Inflammation, p. 193.

given in the remarks on ulcers: at first, the tepid water-dressing commonly answers exceedingly well.

Some contused and lacerated wounds would be inevitably followed by a rapid mortification of the limb, and the patient run the greatest risk of losing his life, were amputation not performed immediately after the receipt of the injury. These are generally examples, in which the soft parts are extensively and deeply wounded, and large bloodvessels and nerves injured. When mortification attacks patients so circumstanced, it is the gangrene which Larry has called *traumatic*, and in which amputation may often be performed with success, though the sloughing has not stopped. The treatment of lacerated and contused wounds, in a gangrenous or sloughing state, must be regulated according to the principles mentioned in the observations on mortification.

## OF GRANULATION AND CICATRISATION.

*Process by which all Suppurating Wounds and Ulcers are cured.* As soon as ulceration ceases, and a sore evinces a disposition to heal, the preponderating action of the lymphatics of the part (or, perhaps, of the absorbent function of the veins) over the action of the nutrient arteries terminates, and the power and functions of the latter vessels are resumed with great activity. They have now something more than their ordinary duty to perform; for they have to fill up the chasm or excavation of the ulcer, produced by the destructive process of ulceration; and to accomplish certain changes, by which the part is brought as nearly as possible into its original state.

This process of restoration is not confined, however, to the consequences of *ulceration*, but is exemplified in the filling up and repair of other chasms, or solutions of continuity, in the texture of parts, formed by the separation of sloughs, or left after the bursting or opening of abscesses. We find it, also, most usefully applied to the cure of wounds, which, in consequence of loss of substance, severe contusion, laceration, too much inflammation, an unfavourable state of the system, or other causes, cannot be united by the first intention, and must unavoidably suppurate. In all these examples, the process of repair and restoration, adopted by nature, is of one and the same description: she heals a suppurating wound exactly in the same manner, and by the same operations, which she avails herself of in the cure of ulcers in general.

One of the principal means for this end is the *production of granulations;* the little conical, or more or less rounded, granular prominences, of a softish new substance, which make their appearance on the surface of suppurating wounds and ulcers, and serve not only for filling up the chasm or cavity, but also for bringing its circumference or sides as much towards a central point or line as the circumstances of the case will allow. The manner in which this is accomplished, and its usefulness, which is much greater, than may at first be supposed, will be presently considered.

The operation by which these new productions are formed, is called the *process of granulation:* by the old surgeons, it was sometimes named *incarnation.* It consists in the formation of numerous granular substances, which originate from all points, and coalesce or meet, proceeding from the circumference towards the centre, and from the bottom towards the

mouth of the wound. The result is a tissue of a peculiar character, a *fibro-cellular texture* *, constituting the cicatrix.

Granulations consist of a deposit of animal matter, or fibrine, upon the surface of an ulcer or open wound; and into such fibrine blood is soon conveyed. When a wound does not heal by the first intention, it begins in a few hours to be painful, and attended with other symptoms of inflammation. A thin serous discharge oozes out from it, and afterwards the surface gradually acquires a uniform appearance, whatever be the tissues of which it is composed; for they all soon receive a thin covering of coagulating lymph, which at the same time seals up the interstices of the cellular tissue, and has been compared to a delicate pellicle, "somewhat similar to the almost invisible integument of the mucous membrane."† A layer of coagulating lymph having been thus deposited by the vessels of the wounded textures upon the surface of the wound, the next part of the process consists in the growth or extension of minute shoots from those vessels into the coagulating lymph. In fact, they soon begin to enter it, and to deposit the new substance, which is to be converted into granulations. These are likewise rendered exceedingly vascular by the growth of young vessels into them. By Dr. Macartney they are described as composed of a fine cellular membrane, into which bloodvessels proceed from the subjacent tissue. Probably this statement is only applicable to them in their completed state, and not intended to controvert the commonly received doctrine of their formation commencing with the effusion of fibrine.

At the same time that granulations arise, we notice the secretion of pus. There seems, indeed, to be a close and intimate connexion between the two processes; and this is so much the case, that it is not an uncommon belief, that an example of a granulating surface is never seen unattended by the secretion of pus. At all events, this view is generally correct, the circumstances brought forward against it being few, as the appearance of something like granulations between the ends of a fracture examined by John Hunter.

Pus is not, however, secreted from ulcers of cartilages, or the cornea; a fact, perhaps confirming the doctrine, that the morbid changes in the cartilaginous tissue depend upon the action of a vascular new substance thrown out by the synovial membrane.

The observations, made by John Hunter, on the process of granulation, are remarkable for their minuteness and originality. He traced, with wonderful patience, the growth and vascularity of the new substance. He frequently noticed a white matter upon the surface of sores and wounds, exactly resembling coagulating lymph: he left it undisturbed, and carefully examined it when the dressings were removed on the following day. He then found that it had become vascular, and that, when wiped or touched with a probe, it bled freely. He ascertained, by experiment, that the same changes take place on the surface of an exposed bone: he removed one of the bones of the foot, and found, the next day, that a white substance with a bluish tinge was deposited upon it, so that the bone could no longer be felt with a probe. This substance, which was resembling hydatic or fibrine, became the next day vascular, and healthy granulations were formed.

Bichat and a few others incline to the opinion, that granulations are

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* See Dupuy[illegible]

† See Macartney on [illegible]tion, p. 57.

productions from the cellular tissue, but, after what has been already stated, I cannot adopt this limited view. Undoubtedly, they may be formed by any vascular texture capable of effusing coagulating lymph.

Every granulation has an artery, which is derived from those of the subjacent original parts: after reaching what may be called the base of the granulation, it divides into numerous ramifications, which then radiate to its surface. However, from the account already given of ulcers in general, we know, that the texture and appearance of granulations vary according to the condition of the sore, and the state of the health. While ulceration is going on, little excavations are perceptible on the surface of the part affected; but, directly the healing process is established, the same surface becomes studded with innumerable small convex granulations, which communicate to it a rough appearance; and the smaller and more pointed these are, the more healthy is their nature. They then generally exhibit a lively red colour; their vascularity is considerable; the circulation in them brisk; the secretion of healthy pus from them carried on with freedom; and the sore continues to heal without pain, or inflammation.

When granulations rise much above the level of the neighbouring skin, assume a pale colour, and a flabby spongy consistence, the circulation in them is languid, they have not the power of forming healthy pus, nor the new skin, requisite for the advancement of cicatrisation. Neither have these large, high, spongy granulations any disposition to unite with one another, and then contract and shrink, so as to draw the old skin as much as possible over the part occupied by the cicatrix.

But when two surfaces, covered by healthy granulations, are brought together, and kept in contact, they quickly unite, the granulations soon join and inosculate, and the parts become permanently connected.

By the production of pus, granulations are proved to be *secreting organs.* Their sensibility establishes the fact of their being provided with *nerves*, and the development of nerves in them is quite as curious a subject, as the growth, or extension, of vessels into them: they must, indeed, be well supplied with nerves, for the slightest touch of them will give pain.

It is said that, although granulations, which spring from parts endued with great sensibility, are extremely sensitive, such as arise from *bones*, *tendons*, and *fasciæ*, have little or no sensibility, unless these textures be in an inflamed state.

Granulations not only have arteries, veins, and nerves, they are likewise furnished with absorbents. In fact, when unfavourable changes occur in the state of the heath, and of the wound, or ulcer, the granulations are frequently absorbed with considerable rapidity. It is in consequence of the presence of absorbents in granulating surfaces, that surgeons are obliged to be circumspect in the use of certain dressings and applications. Cantharides put on an ulcer will affect the urinary organs.

If arsenic, or the bichloride of mercury, be too freely applied to an ulcer, or granulating wound, it will be absorbed, and the patient be as truly destroyed by poisoning, as if he had taken those deleterious articles into his stomach. Opium is also absorbed from the surfaces of sores, and may thus produce constipation, headach, and lethargic symptoms. I have known several instances of violent and unexpected salivation, caused by the too free employment of salves containing the red precipitate. The absorption of belladonna, when used as an application to

irritable ulcers, has been known to bring on amaurosis, or loss of sight from paralysis of the retina. The older an ulcer is, the greater is its disposition to absorb whatever may be applied to the granulations.

How far the veins are concerned in this kind of absorption, and whether they may not do what is usually ascribed to the lymphatics, are points highly deserving of further investigation.

*Cicatrisation* is that part of the healing process which consists in the formation of the cicatrix or substance composing the scar, which in ulcers or wounds upon the surface of the body consists of the remains of the granulations, a new tissue of a fibro-cellular kind, and the new skin and cuticle covering them. Or, if Dr. Macartney's view be adopted, the term cicatrisation is applied to "the last stage of reparation, in which a wound, or an ulcer, assumes a covering resembling, in some degree, the skin or other adjacent surfaces; for, in no instance, does the cicatrix perfectly possess the structure of the natural tissues." The cicatrix is observed by this gentleman to differ most from the natural structure in those instances where much lymph, or granulations, have been organised, and where these substances have not been sufficiently absorbed, but continue in a callous state, adhering to the neighbouring parts, and, probably, involving some palpable branches of nerves. Hence, the feeling in the part is, sometimes, so unnatural, that various affections of the nervous and muscular systems may be the consequence.* When the chasm of an ulcer, or the cavity of a suppurating wound, has been filled up with granulations, the next desirable change is the production of new skin, by which they are to be covered. A fine, thin, smooth, bluish, pellicle, gradually extends from the circumference of the ulcer or wound, or from the margin of the sound skin to the centre of the sore, until all the granulations are covered, when the secretion of pus immediately ceases. The sore or wound is then healed; cicatrisation is complete.

The following explanation of this part of the subject by Dr. Macartney seems to me interesting: "As a preparation for the final act of healing, we observe, that the granulations on the edges of the sore are reduced by absorption to a flat surface; the vascularity of the edges about to cicatrise declines; and the thin pellicle, which covered the granulations, becomes opaque and thicker. It is indispensable, also, that inflammation should have ceased in the skin immediately surrounding the sore. The bloodvessels, which previously ascended to the surface of the granulations, now give place to vessels that are extended from the skin to the surface of the cicatrix, in a radiated manner, as may be demonstrated by the injection of the limb with a coloured fluid, in a case of recent formation of a cicatrix. These vessels, which, at first, form but few cross-communications with each other, ultimately acquire more of the reticulated arrangement of the bloodvessels in the common skin." (P. 61.)

In almost all cases, the pellicle, which precedes the completion of the new skin, is derived from the adjoining old skin, and, consequently, is seen only at the border of the sore or wound; or, rather, it appears as if the surrounding skin communicated a disposition to the nearest granulations to form skin, just as bones give an ossifying disposition to granulations formed upon them. In less common instances, new skin is also produced on parts of the sore or wound situated away from the edges. This may happen when the ulcer or surface of the wound has been very large, and the disposition to form skin at the edges seems nearly ex-

* See Macartney on Inflammation, p. 59.

hausted. Such was John Hunter's view of the subject; but, according to Sir Astley Cooper, an ulcer, or a suppurating granulating surface of a wound, has no power of producing new skin at any point away from its margin, unless some portion or portions of the original skin happen not to have been completely destroyed in places away from the edges of the sore. When cicatrisation takes place under a dry clot of blood, or a scab, Dr. Macartney believes, that it does not proceed from the edges of the wound, but over the whole surface at the same time; the covering being usually detached at once. In this mode of cure he observes, that the cicatrix is pliant, and more nearly like the natural skin than in other instances. He also adverts to certain specific sores, in which cicatrisation may begin, not only at their circumference, but at the same time in other places. "In such cases," he observes, "the healing process is very rapid, and the granulations acquire their proper integument, before there is time for their being diminished by absorption, or by their having assumed a plain surface." Under these circumstances, the cicatrix possesses a very irregular and puckered appearance. The whole of the new substance, by which the chasm is filled up and covered over, presenting a smooth surface and compact feel, is the *cicatrix* or *scar*. The new-formed cutis is less supple, less moveable, and less elastic, than the original skin, from which it also differs in being destitute of those lines or furrows which the cutis naturally exhibits. At first, it is extremely full of vessels; but afterwards both it and the subjacent granulations become less vascular, and the cicatrix, therefore, instead of being, as it is in the beginning, somewhat redder than the rest of the skin, afterwards turns even paler. The new-formed skin, however, always retains a stretched, smooth, shining appearance. Hairs do not grow upon it, and it seems not to be provided with sebaceous glands.

The formation of cuticle is a much easier and quicker process, than the production of new skin; for, while *this* in general only grows at the edges of the sore, *that* may be produced at once from every point of the cutis, as is exemplified in the healing of a blister. It is doubted whether the rete mucosum can be regenerated. Many surgeons consider the fact to be established, because in negroes the cicatrix is at first of a pale reddish colour, but afterwards turns as black, or even blacker, than the rest of the skin.

On this point, some valuable remarks were made by Dupuytren. It appeared to him that, in certain burns, when the rete mucosum is merely damaged, but not destroyed, its colouring matter generally becomes much darker than in the natural state: hence the yellow or brown spots occasioned by the scars, and which time cannot efface. In the negro the skin then becomes blacker than in the natural state. When the rete mucosum has been destroyed in some parts, but not in others, the cicatrix has an odd appearance, for the rete mucosum either being not reproduced at all, or reproduced but imperfectly at the points where it has been destroyed, the projections of the cicatrix present a white colour, while the points of the skin, corresponding to the places in which the rete mucosum has only been hurt, exhibit a brownish tinge.

While the formation of new skin is going on, the granulations undergo absorption. The whole mass of them, united together as they are in the progress of cicatrisation, is lessened in diameter, the effect of which is to draw the original parts, with which they are connected, nearer together: in particular, the old skin is thus drawn further over the part, and the extent of the cicatrix materially lessened. This contraction of granula-

tions not only takes place during cicatrisation, but for some time after it: hence a scar, which may be at first three or four inches in diameter, will finally be reduced to a half or one third of that breadth.

This process is not limited to ulcers and suppurating wounds; it is actively concerned in the obliteration of the cavities of abscesses, the sides of which have thrown out granulations. They will not granulate, however, unless they have burst or been opened.

The healing of wounds by means of suppuration, granulation, and cicatrisation, is sometimes called *union by the second intention*, as contrasted with that named *union by the first intention*, which is chiefly applicable to incised wounds. In the processes by which union by the second intention is brought about, there is an increased action of the vessels; and, according to the investigations of Dr. John Thomson, the thermometer applied to the neighbouring skin is two degrees higher, than it is when applied to other parts of the integuments.

### REPRODUCTION OF LOST PARTS.

One curious question, intimately connected with the foregoing subject, is, whether lost parts, or textures, which have been destroyed, can be reproduced? In man, and the higher classes of animals, when an entire part is lost, it cannot be reproduced, which fact is very different from what occurs in some of the lower animals, in which whole limbs are easily regenerated.

The skin and bones seem to be the two textures which manifest in the human body the greatest power of reproduction. Considerable portions of skin, perhaps even with the rete mucosum more or less complete, may be reproduced, and few experienced surgeons have not met with examples, in which the whole scrotum, after having been destroyed from effusion of urine, has been followed by the formation of another. Then, with respect to bones, the whole shaft of a long cylindrical bone, when destroyed by necrosis, is frequently reproduced. Lost portions of the brain and spinal marrow are never regenerated. Muscle is not regenerated; nor are fasciæ. Muscular fibres are united by a substance, different from muscular tissue, but such as restores to the muscle the power of performing its functions. The same is the case with tendon. The cartilages covering the ends of bones, when destroyed, are never reproduced, which, as Dr. Macartney points out, is the more remarkable, since, in what are called *false joints*, the ends of the bones, which rub against one another, become covered with a sort of spurious cartilage. The tissue of nerves is never reproduced, and, if a nervous trunk is divided, the parts, to which its filaments are distributed, are irrecoverably paralysed, notwithstanding the reunion of the divided nerve by means of another kind of tissue. I know, however, that this is a disputed point; and that Mr. Abernethy, as well as Dr. Macartney and others, espouse the doctrine of a true sentient substance being ultimately regenerated in the connecting medium of nerves, which have been divided.

With respect to ligaments, nature can also do a great deal, for, under particular circumstances, she appears to be capable of forming new ones. She has likewise the power of reproducing bursæ mucosæ, and of generating around abscesses and fistulæ a texture nearly corresponding to natural mucous membrane; but, according to Dr. Macartney's investigations, she does not replace any portion of the mucous membrane removed from the stomach or bowels.

## GUNSHOT WOUNDS,

So called from the manner in which they are produced, are generally caused by hard obtuse metallic bodies, projected by the explosion of gunpowder from cannons, muskets, pistols, or some other species of firearm.

Such bodies may be forced into, or even quite through, the injured parts; or, if the wound be made with a cannon-ball, either the limb may be carried away, or, in other instances, the muscles contused and crushed, the bones broken and comminuted, and the liver or other internal organs torn, while the skin itself remains unbroken, over all this concealed, and sometimes unsuspected, mischief.

With gunshot injuries, it is also customary to consider various severe, and often fatal accidents, arising from the bursting of shells, or from the violence with which splinters are thrown about, when a cannon-ball strikes the hull of a ship.

When firearms were first employed for the purposes of war, the component ingredients of gunpowder were not exactly known, and, as the injuries occasioned by it had far more serious consequences than those following common wounds, a suspicion was excited, that the peculiar severity of gunshot wounds depended upon something of a poisonous quality being conveyed into the part with the ball. Another notion was, that the ball was intensely heated, and burnt the parts in its passage through them; an idea that seemed to be confirmed by the observation, that the generality of gunshot wounds threw off sloughs, or eschars, before the healing process commenced. These views are now known to be entirely erroneous: there is nothing poisonous in the composition of gunpowder; nor are the soft parts burnt by the ball.

All the usual severity of gunshot wounds is referable to other circumstances; the principal of which are:—

First, the hard, obtuse kind of body, with which the injury is done.

Secondly, the immense force and velocity with which the ball strikes against, penetrates, tears, bruises, or breaks the textures which happen to be in its way.

And, thirdly, the nature of the parts injured, which, in consequence of the depth and extent of gunshot wounds, frequently comprise organs of first-rate importance in the animal economy.

Gunshot wounds are, in fact, constantly attended with contusion and laceration, by which a part of the textures, immediately around the track of the ball, is generally in such a state, that it must be thrown off in the form of a slough. It is partly for this reason that gunshot wounds scarcely ever admit of being cured by the adhesive inflammation, but necessarily suppurate. In a few instances, however, especially where the integuments of the face, or neck, or the lip, or scalp, are torn by a ball, union may be obtained with the aid of a suture; but this is an exception to the usual character of gunshot wounds. Indeed, they not only throw off a slough, and suppurate along the course of the ball, but extensive abscesses are frequently occasioned in the neighbouring parts. Thus, when a person is shot through the thigh, there will be suppuration in the track of the ball, and not merely in this situation, but generally also between the muscles and under the fascia.

Gunshot wounds, like other contused and lacerated wounds, commonly bleed less freely than incised ones; yet, the hemorrhage is sometimes considerable, and even immediately fatal. When I was serving

with the army near Antwerp, a soldier was brought to the Military Hospital, who had received, about ten minutes previously, a musket-ball in the lower part of the neck. He had not been more than two minutes in the ward, when an enormous extravasation of blood, from an injury of the right carotid, near its origin, produced instantaneous suffocation. Not a drop of blood escaped from the wound.

It is computed, that a large proportion of the killed in every great battle perish of internal hemorrhage. In Dupuytren's clinical lectures, a young man is mentioned, who received a musket-ball in the upper part of the thigh, and died of hemorrhage from the femoral artery, as he was being conveyed from one of the streets of Paris into the Hôtel Dieu.

In deeply penetrating gunshot wounds, a critical period comes on at the end of a week, or ten or twelve days; for, this is the time when the sloughs begin to loosen. It is often impossible to know at first what parts are injured: the extent and danger of the wound cannot be judged of, perhaps, until the coats of some large artery, bowel, or other important organ, touched by the ball in its passage, give way on the loosening of the sloughs. The wound may now become far more complicated than was expected, and profuse hemorrhage, or the effusion of the contents of the bowels, or other viscera, may greatly change the circumstances on which the prognosis is founded. Such bleeding may, indeed, destroy the patient in a few seconds; or the effusions give rise to fatal inflammation within the abdomen or chest. Several days after the receipt of a gunshot wound, when all the dangers of the first inflammation are nearly over, the separation of a slough may cause hemorrhage from a deep-seated artery. In some cases, the blood accumulates in the abdomen, or the chest; and in others, the patient is carried off in another manner, namely, by profuse discharges of blood from the bowels. The case of a soldier of the 44th regiment, which came under my notice in Holland, in the year 1814, affords a good illustration of the risk of hemorrhage, about a week or ten days after the receipt of a gunshot wound, the period when the sloughs begin to be loosened. This man had been shot through the ham, and, one side of the popliteal artery having been injured, it sloughed about eight days after the accident, and profuse hemorrhage ensued. A tourniquet was immediately put on, and the femoral artery secured about the middle of the thigh; which operation proved completely successful. The reason for deviating in this instance from the common maxim of cutting down to the bleeding part of an artery, and applying two ligatures to it, will be understood from the observations already delivered on the subject of hemorrhage. The foregoing case is instructive on another point: it teaches us why the separation of sloughs in gunshot wounds often leads to copious and fatal hemorrhage; a remarkable difference from what is seen in common mortification, where the arteries, being plugged up with coagulum, rarely bleed on the detachment of the dead parts. In gunshot wounds, the ball sometimes touches only a portion of the side of a large artery; the slough or ulceration of the vessel is restricted to this situation; and its cavity is neither filled up with a clot, nor always completely occupied by coagulating lymph.

The foregoing remarks chiefly relate to bleedings from such gunshot wounds as penetrate deeply, and are produced by bullets, musket-balls, or grape-shot; for the injury, arising from the blow of a cannon-ball, is attended with such a degree of contusion and laceration, that a great deal of bleeding rarely follows. We here observe the same thing as is noticed when a limb is torn off by getting entangled in machinery; a

limb may be carried away by a cannon-ball, even as high as the shoulder, or upper part of the thigh, without any bleeding of importance, or any necessity for ligatures, either at the moment of the accident, or afterwards, unless amputation be done. We had numerous proofs of this fact during the last war. A soldier of the rifle brigade had his arm shattered to pieces at the battle of Waterloo, as high as the shoulder; yet, there was no hemorrhage. A Dutch soldier was brought to the Military Hospital, whose leg had been carried away a little way below the knee, and whose thigh I was obliged to amputate: no hemorrhage preceded the operation. Then, another remarkable case was brought in the preceding year to the British Field Hospital, at Merxem, near Antwerp: the greater part of the clavicle and scapula, with the whole cushion of the shoulder, had been shot away by a cannon-ball from one of the French batteries, yet no bleeding of importance occurred, and the man ultimately recovered.

The peculiarities of gunshot wounds are numerous: one of them, occasionally noticed, is a gradual loss of the pulse in the injured limb a few days after the accident. One side of the main artery is hurt by the ball, but, instead of sloughing, it inflames, and the vessel is rendered impervious by a plug of coagulating lymph.

A gunshot wound may have one or two openings, according as the ball has lodged in or passed quite through the part. When a musket or pistol ball has entered a fleshy part, an aperture is seen rather smaller than the bullet itself, with its circumference discoloured by ecchymosis, and its edge forced somewhat inwards; and, if the ball has passed quite through the part, another larger opening, less contused than the former, is left at the point of its exit, with an irregular and prominent margin.

The direction of a ball or bullet in motion, however quick its course, is readily changed by the resistance it meets with, and the ball then becomes reflected. It should also be recollected that a ball always has two motions; that of a paraboloid curve, and that of a rotation or spinning of it on its own axis. If we had all the data for our calculations, the seemingly extraordinary course which a ball sometimes takes would be completely explicable by the laws of projectiles. In some cases, the points of entrance and exit are precisely opposite one another; but, in others, their relative positions are very different. Dr. Hennen records an instance, in which a musket-ball entered in front of the larynx, and passed all round the neck, nearly to the point opposite that at which it first pierced the skin. When balls strike the ribs obliquely, their course will often be so changed, that they will run almost completely round the body. A similar occurrence is sometimes noticed on the head, where a ball, after having entered at the temple, may be so turned as to pass round the cranium to the opposite side of the head. Facts of this kind are chiefly owing to the great strength and elasticity of the skin. As a soldier was climbing up a scaling ladder, with his arm extended upwards, a musket-ball pierced the centre of the upper arm, passed over the back of the chest, thence amongst the abdominal muscles, and, having pervaded the glutæi, stopped about half way down the opposite thigh, on the forepart of which it presented itself.

Gunshot wounds are more frequently complicated with *foreign bodies* than any other description of wound. These may consist of pieces of the clothes, of the ball itself, of fragments of bone, pieces of bomb-shells, splinters of wood, &c.

When there is only one opening, we may infer, that the wound con-

tains a foreign body. There is, however, one exception, which is, when the ball carries along with it into the flesh a pouch of the clothes, which, on being withdrawn, brings out the ball with it. A ball may also stop close to the orifice, and be ejected by the elasticity of the ribs.

In 1814, a French soldier, wounded under the walls of Paris, was brought to the Hôtel Dieu. On examining the upper part of the leg, some pieces of the soldier's dress were observed to be lodged in the tibia. By using force they were extracted. They consisted of a fragment of the soldier's gaiter, which included a musket-ball. An analogous case presented itself at the Hospital la Pitié, in July, 1830: a ball had penetrated the abdomen, carrying before it a piece of the torn shirt, which served very usefully for its extraction.

The opening, made by a ball in the clothes, is always much narrower, than that in the skin. It was the ignorance of this fact, which raised a suspicion that Charles the Twelfth had been assassinated; for the opening, made in his hat by the ball, did not appear to correspond to that made in the skin of the forehead.*

When two apertures are seen, and they have been caused by the passage of one entire ball, it is manifest that this cannot be lodged; yet other articles may be so, such as portions of clothes and splinters of bone; and, occasionally, notwithstanding a ball may have produced two openings, a part of it may remain behind, in consequence of its having struck against the edge of a bone, so as to be split into two portions, one of which passes out, while the other takes another course and continues lodged. A ball, by striking against a bone, may undergo different changes in its shape, be flattened, or split into fragments, so as to produce mischief very difficult to account for. A ball enters the lower part of the right leg, and strikes against the spine, or sharp edge of the tibia, whereby it is cut into two fragments. These fragments, then diverging a little, pass through the calf of the leg and lodge in the fleshy part of the other leg, which happens at the moment to be behind the other limb. Thus five openings may be caused by one and the same ball. Balls, by striking against iron bars, may be split into fragments, which then enter the body of the wounded person. Dupuytren saw many cases of this kind at Paris, during the disturbances in July, 1832.†

It was once a disputed point, whether the cylindrical bones could be fractured longitudinally. This question is now completely settled. I saw several examples of this kind of injury, which were brought into the hospital at Oudenbosch from Bergen-op-Zoom. They often extend the greater part of the length of the thigh bone, or tibia, and sometimes run into the knee, followed by inflammation of the synovial membrane, and ulceration of the cartilages. Where such mischief does not ensue, it is an exception to the general course of things. In University College museum, there is one excellent specimen of a fracture of the tibia, extending into the knee, and united very well. The frequently considerable extent of longitudinal fissures in the cylindrical bones from gunshot violence should be constantly recollected, when amputation is about to be performed; for, it may be necessary on this account to make the incision and saw the bone several inches above the place where the ball entered the limb. A case of longitudinal fracture of the femur, from the passage of a ball into the popliteal space, is recorded, in which the fissure

* See Dupuytren's Leçons Orales, &c. t. ii. p. 426.
† Leçons, &c. t. ii. p. 429.

extended from the internal condyle to the upper third of the bone, unattended with crepitus, and allowing the patient to stand up after the injury. It proved fatal on the fifth day.*

Some of the worst *compound* and *comminuted fractures*, ever seen in the practice of surgery, are those arising from gunshot violence. They are not only frequently complicated with extensive laceration of the soft parts, wounds of the nervous and arterial trunks, but with a degree of comminution and splintering of the bones, rarely noticed in any common examples of such injuries. It is also one peculiarity of gunshot injuries, that they sometimes cause a compound fracture, and dreadful laceration of the hip and shoulder joints, which are hardly capable of being so injured by any other means. What in fact is likely to cause a compound fracture of the head of the humerus, or femur, but a gunshot wound?

In gunshot wounds, the *prognosis* depends chiefly upon the extent and depth of the injury, and the nature of the wounded parts. Wounds of the head, lungs, bowels, considerable arteries, and large joints, extensive contusion and laceration of the soft parts, the dreadful degrees of concealed mischief often resulting from what are erroneously termed *wind contusions*, and all badly comminuted and compound fractures, may be pronounced to be accidents of the most dangerous kind.

I have slightly alluded to the true manner, in which what are called *wind contusions* are produced. A cannon-ball, especially when nearly spent, frequently strikes the surface of the body, or a limb, obliquely, and is reflected without breaking the skin. A soldier may be killed in this way without any appearance of external violence. His comrades suppose, therefore, that he has been killed by the wind of the ball. But the error of this opinion is immediately manifest, when it is remembered, that cannon-balls often carry away parts of the dress, without doing any harm to the person. I remember a case, where a cannon-ball passed amongst the six legs of three officers walking together arm in arm; yet both legs of the officer in the middle escaped injury, while one leg of each of the outside parties was so shattered as to require immediate amputation. When a cannon-ball rolls, as it were, over the surface of the body, or a limb, the toughness and elasticity of the skin keep it entire, while the muscles and even the bones may be crushed to atoms, or the viscera and internal vessels of the chest, or belly, fatally lacerated and disorganised. Hence, when these wind-contusions do not immediately kill, as they often do when the abdomen or thorax is implicated, they are, at all events, to be regarded as examples of the most violent forms of gunshot injury.

In July 1830, at Paris, a woman's humerus was completely crushed by a cannon-ball, though the skin remained entire; and, in 1814, a soldier was brought to the Hôtel Dieu with his kidneys pressed to atoms, though nothing particular was noticed in the loins but a considerable swelling, the integuments being unbroken. Sloughing ensued; and after death the crushed state of the kidneys and posterior part of the spine was detected.†

The violent contusion and laceration of parts, the several complications of fractured bones, foreign bodies, wounded arteries, and lacerated nervous trunks, are events fully accounting for the severity of the consequences of many gunshot wounds, comprising dangerous degrees of

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* See Alcock, in Lond. Med. Gaz. No. for June, 1839, p. 326.

† Dupuytren, op. cit. t. ii. p. 436.

inflammation and sympathetic fever, enormous abscesses, mortification, and the frequent loss of limb or life.

With respect to the *immediate effects of a gunshot wound on the system at large*, they vary in different subjects, even with the same kinds of injury. Of course, the results of profuse bleedings will be nearly alike in all individuals, and death be often suddenly produced by such as occur from vessels of large size within the thorax or abdomen. Some men will have their limbs carried away by a cannon-ball, without betraying at first the slightest symptom of mental or corporeal agitation; others will be seized with faintness, vomiting, shiverings, a deadly paleness, and syncope, from injuries of only a trivial kind. When this is the case, the disturbance and depression of the system may generally be removed by giving the patient a little wine or other cordial, or a few drops of laudanum, and by assuring him of his safety.

However, the long continuance of the foregoing class of symptoms ought to raise suspicions of internal hemorrhage, effusion in one of the great cavities of the body, injury of important viscera, or other serious mischief.

After the subsidence of the alarm, frequently excited in the animal economy by a gunshot wound on its first reception, a reaction follows, or that state of the constitution, which is described under the name of sympathetic inflammatory fever. This will afterwards abate as the effects of the inflammation diminish; or, if these should go on unfavourably, it may change to hectic, so as either to destroy the patient, or render the removal of the injured part necessary for his preservation.

### TREATMENT OF GUNSHOT WOUNDS.

If the injury be in one of the limbs, the first thing is to decide whether the wound is such as to require amputation, or whether an attempt can prudently be made to save the part. The decision is generally one of vast importance, because, if the injury be sufficiently bad to make the chance of preserving the limb hopeless, the operation ought to be performed *without delay*, and the opportunity of doing it, if now neglected, may never return. Violent inflammation, suppuration, and profuse abscesses, phlegmonous erysipelas, and even a rapid mortification, attended by the utmost disorder of the whole system, may come on, and the patient be thereby placed in a condition, presenting little or no prospect of recovery, whatever be attempted.

In many gunshot wounds, the stoppage of bleeding, and the removal of foreign bodies, constitute the two earliest indications. With respect to hemorrhage, the rule is also to be observed, which applies to wounded arteries in general, viz. that of exposing the wounded part of the artery, if circumstances admit of it, and putting one ligature on the upper, the other on the lower, orifice or portion of the bleeding vessel. To instances of profuse hemorrhage from the limbs, directly after the receipt of the injury, this rule is strictly applicable; but not so to many examples of secondary bleeding, where the artery and neighbouring textures are in a state of inflammation, suppuration, and sloughing; the parts incapable of bearing further disturbance; and the artery indisposed to heal, if it were tied, which, under these circumstances, is often a difficult, or impracticable, thing. Here the principles, laid down in the remarks on hemorrhage and compound fractures, are to be acted upon, and especially with reference to secondary hemorrhage from the tibial arteries.

The application of a ligature to the brachial artery, for wounds of the

radial and ulnar, often fails from the freedom of the anastomoses with the recurrent arteries. An instance of such failure, on the third day after the operation, is given by Mr. Alcock.

It was formerly the custom to dilate the orifices of all gunshot wounds with a curved bistoury. This was done, first, to facilitate the extraction of foreign bodies; secondly, to lessen the tension and constriction of the parts; thirdly, to diminish the inflammation by procuring an evacuation of blood; and, fourthly, to make a ready outlet for any purulent matter which might be formed. The practice should not, however, be adopted without discrimination.

John Hunter observed that, when an incision was made at the orifice of a gunshot wound, it generally healed up in four or five days, leaving the parts just in the same state as if the knife had not been employed at all. Some gunshot wounds it would be highly inexpedient and dangerous to dilate, as, for instance, those of the abdomen, the doing of which would occasion exposure and protrusion of the viscera.

In general, British surgeons only dilate the orifice of a gunshot wound when some clear and determinate object can be accomplished by it; as when balls, splinters of bone, or other foreign bodies, are to be extracted, a freer outlet is required for purulent matter, or sloughs; or ligatures are to be applied to a bleeding artery; or the inflamed parts are tightly compressed by an unyielding fascia. Whenever a ball has entered a part which is likely to get into this condition, the usefulness of dilatation in the first instance is yet strongly insisted upon by some authorities.

1. In whatever region of the body a gunshot wound is to be dilated, it is more frequently required for the opening by which the ball has made its exit; because whatever extraneous substances have been formed by the splintering of bones, or carried into the part by the ball, are most likely to lie in this direction.

2. Another general rule is to dilate more freely the opening which, in the patient's usual position, will be most depending.

No doubt can exist about the propriety of *removing foreign bodies* as soon as it is practicable, without too much irritation of the parts; and, on this condition, not only is the plan right of making a dilatation of the orifice of the wound, but even of practising other deeper incisions. Indeed, as inflammation has not yet come on, the proceedings for the purpose are much less painful immediately after the accident, than at a subsequent period. But we should only resort to this method when the foreign bodies can be found with certainty, and extracted with tolerable facility. Their precise situation is frequently unknown; and, on other occasions, even when it is known, they may be so firmly fixed, or so deeply lodged, that the measures, necessary for their removal, would be productive of far greater mischief, than would result from their continuance.

The generality of British military surgeons make it a rule only *to remove at first* those *foreign bodies which are near the external opening or are superficial*, and can be taken out without too much pain and irritation; or, if they meddle with others deeply placed, they do so only when compelled to it by the urgency of symptoms excited by the pressure of such foreign bodies on organs of importance. Thus a ball lodged under the skull, upon the surface of the dura mater, may produce such compression of the brain as will justify any operation calculated to enable the surgeon to extract the offending body. As for others deeply and firmly lodged, but not attended with such urgency, they often become loosened and get nearer the surface after suppuration has taken place, or the

sloughs have been detached. Something, however, will depend upon the kind of foreign body; rough angular substances, broken and irregular shaped masses of lead, loose splinters of bone, and portions of the clothes, creating more irritation than a smooth leaden ball, and therefore more urgently requiring to be extracted. Smooth, round, leaden balls sometimes lie in parts for an indefinite time without occasioning much inconvenience. Adhesive inflammation forms a cyst for them, by which they are separated from the neighbouring textures. Between such a cyst and the foreign body, there is a small quantity of serous fluid.*

Balls do not, however, always remain thus stationary; sometimes, in the early stage of the case, they change their place rapidly. Hence, it is not warrantable to practise an incision for the extraction of a ball, whose situation has not been made out directly before the operation. Balls mostly travel towards the surface, less rarely towards the central parts of the body.

No surgeons of the present time entertain any doubt, that Mr. Hunter was too timid in his precepts relating to the extraction of balls from gunshot wounds. This observation applies particularly to his advice, "that, where the ball lies so remotely from the skin, that it can only just be felt, and the skin itself is quite uninjured, no counter-opening ought to be made." In opposition to this plan, the following maxim has been inculcated:—If the ball can be felt, it matters not what depth of muscular parts may intervene, it should be extracted, and the necessary incisions made for the purpose. In one fatal case, where the ball was lodged deeply under the muscles of the calf, where it could be felt with a probe, Mr. Alcock regretted that he did not at once extract it by a free incision carried directly through those muscles, down to the foreign body.† He gives also another case, in which a ball lay imbedded in osseous matter, between the radius and ulna. "This wound, after many weeks' treatment, produced a permanent twisting downwards, and contraction inwards, of the hand, so as to render it not only useless, but exceedingly inconvenient; and, all measures failing to prevent or amend it, the arm was amputated. But, says this gentleman, had the ball been discovered and extracted in the first instance, I have little doubt, that a useful hand might have been saved." Not knowing the exact state of the limb, I can offer no opinion on what might have been the result of such a proceeding in the subsequent stage of the case; but it is clear to me, that these and numerous other facts prove, that the practice of extracting balls is more limited than it ought to be.

For the extraction of balls, bullet-drawers and forceps of particular construction are sometimes employed; but the fingers and common forceps are generally the best instruments. Balls sometimes pass nearly through parts, and then lodge under the skin: here they should be cut upon, and removed.

Dupuytren makes useful practical distinctions between the different kinds of splinters; and particularly notices such as still retain a connexion, and may live and beneficially contribute to promote the repair of the fracture; and others, which are completely detached, either in the first instance, or afterwards, and are to be regarded as foreign bodies. On the same point, Mr. Alcock proposes two maxims: 1. Since fragments, particularly long and irregular ones, generally in contact at one

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* Dupuytren, Leçons Orales de Clinique Chir. t. ii. p. 433.

† See Med. Gaz. New Series, No. 31.

or more points, will not only unite in a firm and perfect manner, but serve as a useful connecting link to the shafts; since, moreover, such fragments have extensive adhesions to muscular fibres, and, if deeply placed, cannot be extracted without a good deal of dissection, and some violence, this operation, under such circumstances, ought never to be attempted. 2. A completely detached and short fragment should be removed at once, if it can be done without much dissection or violence, as it is likely in a few hours to become dead, and act as a foreign body.*

Military surgeons differ respecting one particular case, which is *when a ball penetrates and lodges in the spongy part of a bone.* Baron Larrey only sanctions the attempt at extraction when the ball is actually producing dangerous effects: some other surgeons, on the contrary, deem it right always to try to extract it without delay, apprehending that its presence will bring on necrosis, abscesses, sinuses, and that the diseased state of the limb will be likely to continue for years. Much must depend upon the precise situation of the ball with respect to the wound in the skin, and whether it be deeply impacted, or only partially buried in the head of the bone. If plainly perceptible, not too deeply buried in the cancellous structure, and it could be got at without cutting through a great thickness of soft parts, or injuring the synovial membrane of a considerable joint, the extraction of it would be the most advisable practice. Such a case, attended with severe effects, and not admitting of extraction of the ball, might justify the excision of the head of the humerus, or the parts of some other bones, in which the ball had lodged.

*Superficial, light, unirritating dressings* are now generally preferred as the first application to gunshot wounds. On the field of battle, indeed, it would be well for many of the wounded if the surgeon, after paying attention to *hemorrhage* and the *removal of foreign bodies,* were to be content with applying simple pledgets, and covering the parts, if the weather were not too severe, with handkerchiefs or linen wet with cold water. The hasty and indiscriminate employment of tight straps of adhesive plaster, and tense bandages, has cost thousands of soldiers their limbs or lives. Dupuytren insists upon the usefulness of keeping gunshot wounds excluded from the air. He applies to them fine old linen, with numerous apertures cut in it. This is covered with cerate, and put on the part. Over the pledget is laid charpie, which is preferred by the French to lint, as being more calculated to imbibe the discharge. Instead of a roller, the application and undoing of which cause great disturbance, Dupuytren preferred long widish pieces of linen, which were made to cross over the wound, and then pinned.

One of the most eligible applications for gunshot wounds is the common tepid water-dressing, covered with a piece of oiled silk; or pledgets of simple ointment, poultices, and fomentations. In the suppurative stage, poultices and fomentations are very generally employed. They are decidedly the best applications when a slough is present, or matter is forming; previously to which states, that is to say, during the first two or three days, cold lotions are sometimes preferred. Cold evaporating washes and cold water are not to be applied, however, when the temperature of the part or limb is lower than natural, the circulation in it languid, the weather cold, and the patient particularly exposed to it. Such practice might bring on mortification.

The early stage of gunshot wounds generally requires antiphlogistic

* See Lond. Med. Gaz. New Series, No. 33. p. 240.

treatment. As soon as inflammation comes on, venesection, leeches, aperient medicines, and low diet are indicated. Wounded soldiers, being subjects thrown from a state of full health into one of considerable danger, are sometimes conceived not to thrive so well under a system of starvation as other individuals labouring under an equal degree of inflammation. Whether this idea be correct, I cannot undertake to say; but in regulating the diet some allowance should be made for habit. The wounded Cossacks, brought into the Hôtel Dieu in 1814, were observed by Dupuytren to eat with impunity ten times as much as a Spaniard in health. In many cases, the free use of the lancet is the chief means of saving life; this fact is exemplified in wounds of the chest, attended with injury of the lungs, in those of the abdomen, accompanied by injury of the viscera, and in gunshot injuries of the head, where the effects extend to the brain and its membranes.

In such examples, particularly, as well as in all others in which the inflammation is likely to be severe and dangerous, on account of its extent or situation, venesection, leeches, and the most powerful antiphlogistic means must not be omitted. As for bleeding, both with the lancet and leeches, it must be carried to the degree required by the urgency of circumstances.

When the course of a ball is such as to create risk of secondary hemorrhage, on the loosening of the sloughs, that is, between the sixth and fourteenth days, the surgeon should be upon his guard, and direct the patient to be at this time closely watched, and preparation made for the immediate suppression of the bleeding.

The first dressings should not be removed before the fourth or fifth day, unless tight bandages, stiffened with blood, cover and conceal the parts, when, perhaps, the sooner they are removed the better. With this view, they should be moistened with warm water, and cut off with as little disturbance of the wound as possible. About the fourth or fifth day will be quite early enough for the removal of the rest of the dressings, unless excessive pain, or sudden hemorrhage, should render an earlier change of them proper. Dupuytren used not to remove the first dressings before the fifth, sixth, or seventh day; but, in order to prevent unpleasant effluvia, he took away the outer pieces sooner, and wetted the remainder with a solution of the *chloride of soda*.

When gunshot wounds *suppurate* or *slough* to any great extent, they are to be treated according to the rules laid down with reference to *abscesses* and *mortification*.

When complicated with *hospital gangrene*, we are to adopt those measures, which were advised in the observations delivered on that formidable disease. Baron Dupuytren's report of the effect of the chlorides upon it does not agree with that of Lisfranc; for he finds them ineffectual in stopping it, and a solution of mercury in nitric acid is what he prefers.

When complicated with *broken bones*, gunshot wounds are to be treated on principles applicable to compound fractures.

When complicated with *tetanus*, the practice should be regulated by considerations which will be noticed hereafter.

Sometimes, after a bad gunshot wound, particularly one attended with a shattered state of the bones, has suppurated, the case, instead of taking a favourable course, proceeds from bad to worse; large, extensive, and repeated abscesses form; the matter spreads, not only under the integuments, but between the muscles and under the fascia. One collection of matter is no sooner discharged, than another presents itself. Fragments

of bone keep up incessant irritation; the fracture sometimes unites partially, sometimes not at all; the bone may be attacked by necrosis; the patient has hectic symptoms in an urgent shape, profuse night sweats, a small quick pulse from 130 to 160; no appetite, little sleep, and great emaciation, with perhaps frequent vomiting, or colliquative diarrhœa. Under such circumstances, a further perseverance in the attempt to save the limb would only terminate in the loss of the patient's life. On the contrary, by removing the limb, the constitutional derangement may often be checked, and the patient saved.

Amputation may also become indispensable, secondarily, in consequence of traumatic gangrene, which so often follows gunshot injuries, complicated with fracture or a wound of an arterial trunk. Here the practical rules are, not to defer the operation till the red line of demarcation has been formed, and to make the incision in sound textures.

Amputation may also be required, secondarily, when a gunshot wound of an alarming kind becomes complicated with secondary hemorrhage, not admitting of suppression by the ligature of a principal artery at some distance from the wound itself; for, besides the difficulty of finding the bleeding part of the artery in the midst of the diseased textures, the sloughs, matter, and blood around it, the ligature, if the vessel should admit of being tied, would be of no avail, in consequence of the artery itself being in a diseased state.

### CASES DEMANDING AMPUTATION DIRECTLY, OR SOON AFTER THEIR OCCURRENCE.

1. When a considerable portion of the whole thickness of a limb has been carried away by a cannon-ball, or the explosion of a bomb. Exceptions occur where the ball has taken off the arm close to the shoulder or at the joint itself, together with the acromion or coracoid process, and spine of the scapula. Here no parts would be left, on which the operation could be done. The same remark applies to other examples, in which the thigh is torn off at the hip. In such cases, we should free the wound from all extraneous substances, whether splinters of bone or other things, and stop bleeding if it be going on, or, even if it be not, we should imitate Dupuytren, and tie the exposed mouth of the principal artery, in order to prevent it. Yet it is impossible to extricate the patient from many serious dangers, as those of the shock of such an injury on the system; or, if he get over these first perils, he will still have to encounter all those of violent inflammation, and profuse suppuration; the difficulty of healing the stump; and the risk of inflammation of internal organs; an event as formidable as it is common.

2. When bones are much shattered, and the soft parts severely contused, lacerated, or torn away. If a bone were fractured only in one or two places, the splinters not being numerous, the chief vessels and nerves not being touched, and the soft parts not severely injured, an attempt ought to be made to save the limb; but, in the contrary circumstances, amputation should be performed without delay. These are, however, to be received as general rules, founded on the average of the terminations of numerous cases; and not either upon the absolute impossibility of cure, or the certainty of recovery of each description of injury in individual examples. Many patients with wounded limbs, condemned to operation by the nature of the injuries, refuse to submit to amputation, and yet recover. Still, they frequently gain little advantage from such refusal;

for, after having passed through all risks, long protracted hectic disorder, and undergone innumerable painful operations for the discharge of abscesses, and the extraction of broken or dead fragments of bone, they usually remain with a broken constitution, a shortened mutilated limb, deep adherent cicatrices, and a member that is only an incumbrance.

3. When a cannon-ball tears away a great mass of the soft parts, leaving the rest badly torn and contused, the principal artery or arteries being at the same time wounded, though the bone itself may not be broken, immediate amputation is necessary.

4. An injury of the femoral artery, with fracture of the thigh bone, is another case for immediate amputation. However, Baron Dupuytren does not admit the necessity for the operation when the femoral artery is wounded, unless the fracture be a severe one. If secondary hemorrhage were to occur, this event, together with the diseased state of the limb in such stage of the case, would generally call for amputation.

5. If the main artery and vein of a limb be both injured by gunshot, the safest practice is to amputate without delay for the prevention of mortification and its usual fatal result.

6. Fractures from grapeshot wounds, with laceration of the muscles, and one or more of the principal nerves, without injury of the main artery, is a case for prompt amputation, as is exemplified when a cannon shot strikes the thigh, and carries away the muscles of the posterior part of the limb, together with the great sciatic nerve. The mere division of this nerve, however, without extensive laceration of the soft parts, would not require amputation. Cases are recorded where a gunshot injury of a nerve has led to the bulbous enlargement of the end of it, productive of severe suffering on the slightest action of the muscles, or pressure, and requiring the tumour to be removed. Mr. Alcock gives one example, in which such change took place in the anterior tibial nerve, and where relief was obtained by excision of the bulbous swelling.

7. Certain injuries, formerly termed *wind contusions*, where the muscles, bones, vessels, and other textures are crushed, though concealed under the skin which remains entire. Here an incision is first to be made for the purpose of ascertaining the reality of the hidden mischief. When the bones are comminuted, the muscles disorganised, and the large vessels wounded, amputation is indispensable. But, if the vessels and bones have escaped, and the muscles are the parts chiefly injured, amputation may be deferred.

8. Gunshot wounds of the large joints, especially of the knee, are universally recognised as producing the necessity for amputation. Amputation is necessary when a ball has passed through the spongy part of a bone, near a large joint, or through the joint itself, especially when the synovial membrane is extensively opened, and the comminution considerable. However, in fractures of the head and neck of the humerus, with not too extensive injury of the soft parts, extraction of the broken part of the bone is preferable to amputation.

9. Gunshot fractures of the two upper thirds of the thigh bone, or of its neck, are generally deemed proper cases for immediate amputation, or, more correctly speaking, as soon as the patient has rallied from the faintness or depression often caused by the shock of such an accident. Fractures of the lower third is a disputed case, unless much comminuted, and the soft parts are severely lacerated.

10. A ball lodged in the articular head of the bone, or so placed in a

joint as not to admit of extraction. Perhaps, in some cases of the first kind, it would be better to remove the head of the bone. The excision of the elbow joint, if much shattered, is a justifiable and often successful proceeding, and, if adopted without delay, may be the means of saving the limb. The excision of the knee, I regard, under any circumstances, as an unwarrantable measure.

11. Fractures of the patella, unless accompanied by great comminution, or a large opening in the synovial membrane, will admit of delay.

12. Injuries of the forearm by a musket-ball, however severe, rarely forbid the attempt to preserve the limb; and, if amputation become necessary, it may be performed after the chance of saving the limb has been taken. These remarks apply even to badly comminuted fractures of both radius and ulna.

13. Extensive denudation and concussion of a bone by a small cannon-shot, or piece of bomb-shell. In this case, the medullary texture suffers injury, and the muscles are contused and lacerated, the limb insensible, the foot cold. Here mortification will be sure to follow, unless anticipated by the operation. This case is chiefly seen in the leg, where the tibia is superficial.

14. When two limbs are injured in a severe and irrecoverable degree, both ought to be amputated without delay. Convalescents from gunshot wounds should return to a full diet, and the use of wine and beer, very gradually. For some time after the cure, there is a strong tendency to inflammation of internal organs. According to Dupuytren, this fact was particularly exemplified a few years ago, at the Convalescent Hospital, at St. Cloud, near Paris, where, in consequence of the wounded receiving too liberal a supply of delicacies, wine, &c. from charitable and patriotic individuals, many of them, after having got through the danger of severe forms of gunshot violence, fell victims to inflammations of the viscera.

## POISONED WOUNDS.

As poisoned weapons are not made use of by civilised nations, and venomous animals are not numerous in this country, our opportunities of seeing poisoned wounds are but limited. Still, the bites and stings of insects, the pricks and cuts received in dissection, the bites of adders, and those of rabid dogs, cats, foxes, and, on the continent, of wolves also, form together a subject highly interesting.

With regard to the stings of wasps, bees, and hornets, they may bring on severe consequences in unfavourable states of the constitution. Professor Gibson gives the case of an elderly lady, who died in a quarter of an hour from the indisposition occasioned by the sting of a wasp. Although the sting of a single bee or wasp is not generally of much consequence, fatal effects have often been known to result from an attack of a swarm of them. A sting on the eye is also alleged to be productive of a most violent form of ophthalmia. Inadvertently swallowing a bee or wasp that happens to be in beer, or other fluid, may prove fatal. Dr. Gibson has recorded an instance of death from a bee being accidentally swallowed that happened to be in a piece of honeycomb. The recovery of one person is mentioned in the Dict. des Sciences Méd. who took directly after the accident a copious draught of common salt and water.

The bite of the *mosquito* sometimes leads to troublesome ulceration. Dr. Dorsey records one example of fatal gangrene from such a cause.

*Spiders* have long been considered as venomous; but the opinion, I

believe, is only correct in relation to some of them; nor can any of them be said to produce the severe effects formerly ascribed to them. Even the bite of the tarantula, common about Naples, has not the aggravated consequences often depicted. In Martinique, as we learn from Moreau de Jonnés, there is an enormous spider that destroys small birds and reptiles.

The *scorpion* is another venomous insect of warm climates. The largest, the scorpio afer, inhabits India, Persia, and Africa. Its poison is contained in a reservoir near the tail, and poured out of two minute apertures at the extremity of the sting. The late Mr. Allan had opportunities of observing the effects of its bite on the crew of La Diane, a French frigate, taken into our service, and abounding with scorpions, which, though quiet and torpid in our climate, became very active and troublesome on the vessel returning to a warm station. The sting was always followed by violent and extensive inflammation, swelling, and pain; but Mr. Allan never knew any dangerous constitutional disturbance excited.

The best application to the stings of bees and wasps, and the bites of gnats and mosquitoes, are a solution of muriate of soda, the liq. ammon. subcarbonatis, a solution of acetate of lead in rose water, or tincture of opium. Were the stings numerous, bleeding, purging, and a strict antiphlogistic regimen would be necessary.

In Morocco, where scorpions are numerous, the favourite antidote is olive oil. A ligature is first applied above the part: the sting is then cauterised and rubbed with the oil. If I were to meet with such a case, I should be inclined to apply a cupping-glass; for Sir David Barry's experiments prove that, when the pressure of the atmosphere is thus removed, absorption is immediately stopped.

*Bites of venomous snakes.* In Europe, the adder, or viper, is the most venomous reptile. Its poison is lodged in capsules at the roots of two moveable fangs in the upper jaw, which, when the animal bites, are directed downwards, and the poison is then compressed out of the poison cysts, and passes along grooves in the fangs into the wound. In this country, the bite of an adder rarely proves fatal to an adult. According to Fontana, the danger of the bite is generally in proportion to the smalness of the animal bitten. Hence children suffer greater indisposition, and more frequently die from the injury, than grown-up persons. The poison of vipers operates also with unusual peril on animals already weakened by disease. It is most active in hot weather, has greater effect when the circulation is quick, or when the bite happens through a vein, or in a part near the source of circulation.

Much will also depend upon the quantity of poison in the capsules, and the depth to which the fangs have penetrated. The strength of the venom is particularly great in the procreating season of the reptile.

The effects of the bites of all venomous snakes take place with great rapidity. An acute pain and burning sensation are instantly caused by the bite of a common adder, followed by rapid swelling, and a livid discolouration of the part. These effects extend to a considerable distance, indeed frequently to the whole limb, on which livid spots, or an appearance of ecchymosis takes place. This rapid swelling is caused by the effusion of serum into the cellular tissue, like what occurs in diffuse inflammation of that texture from other causes. The constitutional effects are, giddiness, extreme prostration of strength, depression of spirits, faintness, syncope, small quick irregular pulse, difficulty of respiration, profuse,

cold, clammy sweats, confusion of vision, headach, vomiting of bilious matter, a general yellow tinge of skin, and vast pain about the navel. When the case ends fatally, a rapid and extensive gangrenous affection of the cellular tissue is usually noticed.

In the *treatment of the bites of venomous snakes*, two indications present themselves: —

1. To endeavour to prevent the passage of the poison into the system.

2. To resist and lessen its operation on the constitution after it has entered the circulation.

For fulfilling the first indication, the following means are proposed: —

1. Excision of the bitten part, or destroying it with caustic. The bite of an adder, however, rarely produces effects severe enough to justify such proceedings, and, unless the excision were to go beyond the depth of the fang, it would be likely, as Sir D. Barry conceives, to do harm by exposing the mouths of larger vessels to atmospheric pressure.

2. The application of a ligature or tourniquet.

3. Suction. In Sir D. Barry's experiments, several dogs and rabbits were bitten by vipers. To the bites of some he applied cupping-glasses; to the bites of others he did nothing. Now, although the animals left to their fate did not ultimately perish, yet they were invariably attacked with convulsions and stupor, and the dogs with vomiting; whereas, when the cupping-glass was applied for half an hour to those which had been bitten by one, or even two or three, vipers, they suffered no bad symptoms whatsoever, and exhibited no mark of constitutional poisoning. Sir D. Barry is not an advocate for scarifications. The ligature, and simple washing of the part, and exclusion of it from the air, are the only measures which he approves of before the cupping-glass is applied; and even then only when suction, or the action of the cupping-glass cannot be immediately obtained. When a cupping-glass has been applied an hour, the contents of all the vessels will have taken a retrograde course; a stagnation of fluids will be the consequence, and the absorbent faculty of the cupped surface suspended. Thus, according to Sir David Barry, by letting the first cupping precede excision, we may remove some of the poison, and lessen the chance of the remainder being taken into the system.

4. The next proceeding is excision, which is to be followed by a second cupping. It may not, indeed, be necessary to employ excision at all for the bite of an adder. What I am now explaining relates rather to the severer descriptions of poisoned wounds, and especially to the best mode of preventing the fatal consequences of the bite of a rabid dog, cat, or fox.

5. In such cases, the part having been cupped, cut out, and cupped again, the cautery, or a powerful caustic, which will hermetically close the mouths of the vessels, may be employed, as advised by Sir David Barry.

6. Specific effects have been ascribed to certain local applications in rendering the poison inert; as, for instance, to olive oil, to the liq. ammoniæ, and eau de luce. Their inefficacy was, however, completely demonstrated in France, by Hunaud and Geoffroi.

With regard to *constitutional treatment*, ammonia and arsenic have the strongest evidence in their favour as internal medicines. L'eau de luce, once regarded as a specific, consists of ammonia with a small proportion of amber, and therefore resembles the spir. ammon. succinatus. Ammonia

may act usefully in preventing syncope and depression of the vital powers, but is not a specific. Persons under the influence of the poison of serpents, or affected with hydrophobia, or tetanus, are capable of bearing extraordinary doses of this and other powerful medicines, such as opium and arsenic; which last has, perhaps, more evidence in its favour, as an antidote for the bites of snakes, than any other article. The doses of liq. arsenicalis, given every half hour, by Mr. Ireland, to soldiers in the West Indies, bitten by the coluber carinatus, contained one grain of arsenic. He combined with this treatment purgative clysters, and as soon as purging and griping commenced, the arsenic was discontinued.

In South America, the plant Mikania guaco has high reputation for its virtues in these cases, though probably its power is exaggerated; and, in fact, there are many causes of deception. The bites of some snakes get well without any particular medicines. The bites of serpents in general are very unequal in their effects, according to the season of the year, the temperature of the air, the empty or full state of the poison bags, and the strength, health, and size of the animal bitten. Instances occur, both among the Indians and the white people, who inhabit the mountainous and thinly settled parts of the American states, of almost instantaneous death from the bite of the rattlesnake. On the other hand, many others undergo very trivial indisposition from a similar injury. The entrance of a fang into a vein is stated to be inevitably and quickly fatal. There was a man, a few years ago, in St. George's Hospital, who had been bitten by a rattlesnake. He was not destroyed so quickly as some accounts of the rattlesnake would lead us to suppose. There were two wounds on the back of first phalanx of thumb, and another on the forefinger. The hand soon began to swell, and, in ten or eleven hours, the whole limb, armpit, and shoulder were very cold and enormously swollen. All the surface of the body was indeed remarkably cold. At this period, the mind was collected; but, immediately after the accident, there had been some incoherence. From the armpit, the swelling extended down the side, with extravasation of blood in the loins, giving them a mottled appearance.

The temperature of the body now rose, repeated faintings ensued, vesications made their appearance in several places, a large abscess formed on the outside of the elbow, and discharged half a pint of reddish matter. Sloughing in the axilla, on the forefinger, and at a few other points, ensued; and death took place on the eighteenth day, when the original bites had entirely healed. The body, on dissection, exhibited no remarkable morbid changes, except the mischief in the arm.

*Of punctures and cuts received in dissection.* Whether the bad consequences resulting from these injuries should be referred to the insertion of a poisonous matter in the part, or to the effect of the simple mechanical injury in particular states of the constitution, is a question yet unsettled. The common belief is, that such consequences, at all events, sometimes depend upon the introduction of a poisonous or deleterious principle into the wounded part, and this view I am disposed to deem correct, for the following reasons: —

1. If the severe effects, occasionally following cuts and punctures, received in dissection, were referable to the mere mechanical injury, how does it happen that they are noticed with such extraordinary frequency when the fingers or hands are wounded, and this sometimes in the slightest manner, in the examination of the bodies of persons who die of peritonitis, and especially of puerperal peritonitis? Why also should

such effects be more common after pricks or cuts, met with in the opening of recent bodies, than of those which are more advanced in their decomposition? These circumstances are generally admitted to be facts, and, as they are mentioned as such by those who dispute the doctrine of poison, it is rather extraordinary that their direct tendency to prove the agency of a virus should have been overlooked by them in all their reasoning upon the subject. "Some dead animal substances," observes Dr. Macartney, "are more likely to communicate this dangerous disease than others. The brain, in the recently dead state, is extremely apt to produce it, even when no wound is received. The sero-purulent fluid, found in the large cavities after death (if no means of prevention be employed) seldom fails to infect persons, and the most dangerous animal fluid is that contained in the cavity of the abdomen after puerperal peritonitis, or the serum found in parts which have suffered diffused or gangrenous inflammation. The white cancer of the liver, and the substance of medullary tumours, are found to be very irritating when merely applied to the hands, without a breach of surface." (*Op. cit.* p. 106.)

On the other hand, we sometimes see apparently the same consequences brought on in particular constitutions by cuts, punctures, or other slight mechanical injuries, which cannot possibly be complicated with the lodgment or operation of any poisonous matter. It is also a fact, that, notwithstanding the numerous pricks and scratches of the hand, received in dissection, the production of any severe effects on the part and constitution is restricted to a very reduced proportion of such cases. It might also be urged, as an argument against the doctrine of poison, that the general indisposition is always in proportion to the extent of the local mischief; and the disease does not exhibit any determinate character, such as marks the effects arising from other poisons.

Dr. Macartney believes, that the spring season disposes persons to this species of inflammation; and that the state of the constitution gives a strong tendency to be affected by inoculation with dead animal matter. "When the general health is injured by intemperance, anxiety, or fatigue, even common wounds will be followed by consequences not very dissimilar to those attending the introduction of dead animal fluids. From observing this fact, some persons have been induced to deny, that a poisonous quality exists in dead animal matter, and have ascribed the consequences of wounds received in dissecting to the nature of the wound itself, which is often punctured or lacerated. This opinion, Dr. Macartney argues, is perfectly disproved by the same irritation being communicated on an unbroken surface, and by the security derived from using the solution of alum, even when there is no wound."

The bad consequences, occasionally following pricks or cuts received in dissection, begin with uneasiness and festering of the wounded part; considerable pain and irritation in the course of the absorbents; swelling and suppuration of the lymphatic glands at the inner side of the biceps or in the axilla; and more or less fever and constitutional disturbance. In some instances, the pulse becomes greatly accelerated, but weak, and a sense of unaccountable distress and anxiety is felt, and expressed in the countenance. Often there is extreme prostration of strength, with a furred tongue, and serious derangement of the functions of the stomach, bowels, and liver. In bad cases, the cellular tissue becomes immensely distended with serum, and this not only in the limb, but from the axilla over a large portion of the side of the chest, and even of the abdomen;

the parts affected exhibiting the general appearance of phlegmonous erysipelas, or the skin being paler and colder, like what happens in diffuse inflammation of the cellular tissue. Sometimes, as Dr. Macartney has correctly described, inflammations arise, one after another, in parts remote from the original wound, and are unbounded by the effusion of fibrine. Pus is not always formed in these tumours, and, if opened on the supposition of their being abscesses, they are often found to contain only a bloody serum. Yet, in a large proportion of the cases which I have attended, purulent matter was formed and discharged. A very common place for such collections of fluid is under the great pectoral muscle, and, as Dr. Macartney remarks, out of the course of the absorbents leading from the hand to the subclavian vein. In some instances, vesicles or pocks arise in the neighbourhood of the original injury. If the patient escape with his life, the health frequently continues in a shattered state, and anomalous complaints recur from time to time for several months* ; and, as I have known, for two or three years afterwards.

Practitioners differ widely about the right treatment. One party, believing in the presence of a virulent matter, advocate the plan of applying nitrate of silver, caustic potash, liquor ammoniæ, nitric acid, or liquid muriate of antimony, to the puncture or cut, as soon as it begins to be troublesome; and, instead of antiphlogistic treatment, recommend a generous diet, tonics, wine, and other cordials, the bowels being merely regulated with aperient medicines.

Another party, doubting the existence and operation of any poison in the part, confide principally in antiphlogistic treatment, discharging the matter early, applying cold lotions, or poultices, to the part itself, with numerous leeches, and employing copious and repeated venesection, cold washes to the head, purgatives, and sometimes opium to tranquillise the excitement of the system. The advice, which has usually been offered by me to students, is, that the wound should be well sucked in the first instance, the nitrate of silver then applied to it, the hand covered with a cold evaporating lotion, and the limb kept quiet in a sling.

In the beginning, I believe, that antiphlogistic treatment should generally be preferred; but that when phlegmonous erysipelas, or diffuse inflammation of the cellular tissue, or abscesses, come on, the case should be treated according to rules explained in speaking of those disorders.

Dr. Macartney states, that, during the last fifteen years that he held the professorship of anatomy in the Dublin university, no severe disease occurred from wounds received in dissection, when the proper means of prevention had been employed. These consisted in immediately washing the wounded part, and afterwards keeping it wet for a few hours with a solution of alum in water.

*Bite of a rabid animal.* (*Rabies canina. Hydrophobia.*) The bite of a mad dog, or of certain other rabid animals, is the most dangerous kind of poisoned wound met with in this country, because it is apt to be followed by one of the most uncontrollable and rapidly fatal disorders to which human nature is liable.

All examples of hydrophobia admit of being divided into two classes: — first, those which cannot be ascribed to the bite of a rabid animal, or to the application of its saliva to a wound or an abraded surface; and, secondly, all cases which are produced either by the insertion of the saliva into a wound, or its application to an abraded surface.

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* See Macartney on Inflammation, p. 105.

The first class of hydrophobic diseases is not strictly within my province. I may mention, however, that it comprises *symptomatic*, and *idiophatic* or *spontaneous*, cases; the first division being merely a nervous affection, accompanying certain inflammatory and febrile disorders, in which a considerable dread of water is occasionally manifested by the patient. As for the real existence of *spontaneous or idiopathic* hydrophobia, this is a subject of dispute, and I think there is ample room for doubting the correctness of the doctrine, since the histories of most of the persons, from whose cases the inference of the existence of such a disease is drawn, cannot be depended upon. They were, in short, generally drunken irregular characters, and in the habit of lying about the streets in the night-time. Now persons of this description might have been bitten by rabid dogs, or some abraded part of the skin might have been licked by dogs labouring under rabies, though not known to be indisposed; and hence no recollection of the circumstance might have been retained. Dogs, in the early stages of rabies, are seldom prevented from going about as usual, and are even domesticated in families, and fondled by children and others, whose hands and faces they are permitted to lick. Now, should there be a slight pimple, or abrasion of the skin, this custom might lead to the communication of hydrophobia. But, leaving the question about spontaneous hydrophobia to be settled by physicians, I proceed to the consideration of the form of the disorder, which originates from the introduction of a specific poison into a wound, or its application to an abraded part of the skin, which poison is contained in the saliva of a rabid dog, cat, fox, or, as happens on the Continent, in that of a rabid wolf.

It is sometimes asserted, that hydrophobia always originates in animals of the dog kind, and in no other animals, and especially that it never originates in animals of the cat species, though communicable to them by the bite of a rabid dog. But this is an obscure point, about which as much dispute prevails as about the spontaneous origin of hydrophobia in the human subject. The indisposition may, however, be certainly transmitted from these animals, not only to the human subject, but to some other quadrupeds, and, as is alleged, even to birds, as, for instance, to the common fowl. Although animals of the dog and cat kind can communicate the disease to some other animals, it is not positively known, whether the herbiverous tribe can do so; though one case is related, in Ashburner's Essay on Hydrophobia, where a fowl became rabid after having been inoculated with the saliva of a rabid ox; but I do not know whether this statement has received any confirmation from other quarters. In Hufeland's journal, an instance of hydrophobia that was occasioned by the bite of a badger, is recorded. Attempts have been made to ascertain whether man can propagate the disease to other animals; but no instance of such transmission of it was ever completely made out, until, the year 1813, when Magendie and Breschet took some of the saliva of a man in the last stage of hydrophobia, and inoculated a dog with it, which became rabid on the eighteenth day after the inoculation, and bit two other dogs, one of which became rabid, and died in thirty days. This seems to be a strong fact in support of the opinion, that man may communicate the disease to other animals. There has never been an example of any human being in the hydrophobic state imparting the disorder to another human being, though some persons in this disease, now and then, become so unmanageable as to bite those who are near them. I remember an instance, in St. Bartholomew's Hospital, in which a medical man

was bit by a patient who was labouring under hydrophobia, but no ill consequences ensued.

The wound, occasioned by the bite of a rabid animal, is not always followed by hydrophobia: this fact deserves particular attention, because attempts are frequently made to convince the world, that there are certain specifics and nostrums for the prevention of hydrophobia. Of the numberless persons who are bitten by dogs undoubtedly rabid, only a very limited number suffer from hydrophobia. Dr. John Hunter, who published an excellent paper on this subject, gives a list of twenty persons who were bitten by the same mad dog, yet only one of the whole twenty was afterwards attacked by the disease. According to Dr. Hamilton's computations, it appears, on an average, that not more than one out of every sixteen or seventeen persons, bitten by animals certainly rabid, becomes affected. Perhaps this calculation may be below the mark; and it undoubtedly is so, with regard to persons bitten by rabid wolves. On one occasion, in France, twenty-three persons were bitten by a rabid female wolf, and thirteen of them afterwards died of hydrophobia. In another instance, nine out of ten had a similar fate; and in a third example, in which twenty-four individuals were bitten by a wolf near Rochelle, eighteen died. It seems, then, that the bites of rabid wolves are extremely dangerous; a fact fully accounted for, as I conceive, by the circumstance of their teeth being larger, and penetrating more deeply, than those of the generality of dogs. The depth, extent, and situation of the bite are evidently circumstances which must materially influence the chance of the system becoming affected. Thus, bites on the hands or face, which are uncovered parts, are more dangerous than bites on other parts, which are covered by the clothes; because, in the latter examples, the envenomed saliva is likely to be wiped off the teeth, before they penetrate the body, and hence there must be less chance of its being inserted in the wound.

Dogs appear to be more susceptible of the disease than the human species: one rabid dog bit four persons and twelve dogs; none of the former were attacked with hydrophobia, although they underwent no particular treatment, and merely had recourse to common means, which daily experience proves to be unentitled to any confidence; but every one of the dogs became rabid. The term *hydrophobia* is scarcely applicable to the disease as it presents itself in dogs; for they can generally lap water without difficulty, and are sometimes very greedy of it, yet their doing so is generally fancied to amount to a satisfactory proof, that they are exempt from the disease. Now this is a serious mistake; for, as I have explained, they are for the most part fond of water, and lap it very eagerly. As for rabid wolves, when they are pursued, they will swim across wide and rapid rivers without the least hesitation or dread of water. Nor should it be imagined, that dogs are furious in the beginning of the disorder: at first they are merely somewhat irritable; afterwards they will bite other dogs, and even men, if they happen to be in their way; but they will not commonly turn out of their course to do so. Under the influence of the disease, in its early stage, the habits of a dog undergo a considerable change; thus he becomes fond of picking up small objects on the ground, and will even devour his own excrement; his voice is altered, the tone of his bark is quite different from what it is in the healthy state, being affected, indeed, as much as the voice of a cholera patient. The same circumstance is observed in other rabid animals, especially sheep. As for the opinion, that dogs are more subject to hydrophobia

in warm weather than at other times, it is a completely erroneous supposition; and this is so far from being the case, that heat has no concern in it at all; for, in Jamaica, in some parts of which the heat is sometimes very great, not a single instance of a mad dog occurred during the long space of forty years. Now, as rabid dogs are occasionally met with in winter, other credulous persons suggested another hypothesis, which was, that dogs became rabid at this season of the year because they could not always get water enough, in consequence of the frozen state of the ponds; but one fact is sufficient to refute these idle speculations: in France, a list was kept of all the dogs which became rabid in a certain year; and it was found, that the smallest number occurred in January and August, one the coldest, the other the hottest, month in the year. I think, then, we can attach no value to any explanations of the cause of the origin of rabies in dogs, founded upon the influence of either heat or cold.

In the human race, the interval between the bite and the supervention of the disease is different in different examples. The majority of individuals are attacked at some period between the thirtieth and fortieth days; and the longer a person continues well after the latter period, the less chance is there of his ever suffering from the disease at all. From a list kept of a hundred and thirty-one cases, it appears that no person was affected before the eleventh day after the bite, and only three before the eighteenth. A few cases are reported by writers, where the interval between the period of the bite and the commencement of hydrophobia was as long as ten, twelve, twenty, and even thirty years; but these statements do not gain much belief, and few cautious reasoners will venture to give credit to any history, which represents the interval as having exceeded a year and a half. The wound, inflicted by the bite of a rabid animal, generally heals as readily as other common wounds do; and, indeed, it is usually healed long before the hydrophobic symptoms commence, which do not frequently come on in less than five or six weeks after the bite. The wound will, of course, be mostly well before that period. When, however, the constitutional symptoms do begin before the wound is healed, the bitten part, instead of presenting healthy granulations and secreting good pus, has an inflamed and sloughy appearance, and the discharge, which is scanty, consists of an ill-conditioned thin sanious matter. At some indefinite period after the receipt of the bite, and occasionally long after it has healed, the patient feels a sharp pain in the part which was bitten; and such pain, if the wound should have been in the hand, extends particularly to the trapezius muscle, or to the side of the neck. In the meanwhile, the cicatrix, if the part should have healed, swells, inflames, and sometimes suppurates, and discharges an ichorous fluid; but, in other instances, the part may not inflame at all, and the indisposition may come on without the patient experiencing any inconvenience in the situation of the previous bite. In different constitutions, the other symptoms also vary: in the beginning of the indisposition, or the *first stage*, there is generally great depression of the spirits, and an indescribable anxiety; sometimes a chill or rigour is one of the earliest occurrences; frequently the sleep is disturbed by frightful dreams or spasmodic twitches; the pulse is more frequent and strong than in health, and the nervous system more susceptible of impressions. In fact, all the external senses become more acute; the eyes, the pupils of which are full and open, cannot endure the light; the person courts the shade, or even conceals himself in a dark place; the most trivial noises agitate him; and in this first stage, though the thirst is increased, the appetite is

lost. In some patients, such is the augmentation of sensibility on the surface of their bodies, that we cannot even touch their hair, without producing a violent convulsive agitation of the system. This fact was exemplified in one case seen by Magendie. The duration of the first stage is sometimes very short, and the form of it such as not always to raise a suspicion of the commencement of this terrible and fatal complaint. Some patients are indisposed not more than a day or two, but others five or six days, previously to the *second stage*, which commences with a manifestation of a dread of liquids. The sight of water, or any attempt to drink fluids, now brings on violent convulsive agitation of the muscular system, and such a feeling of suffocation as those endued with the greatest fortitude cannot endure. These paroxysms of violent convulsive disturbance of the muscles, and the sense of suffocation, are certainly the most prominent effects of the attempt to swallow, or even look at, liquids; but they may also be excited in hydrophobic patients by other causes, such as the opening or shutting of a window or door, a current of air, a bright light, or the glare of a mirror. Some patients, though not able to swallow liquids, will swallow juicy fruits, if their outer surface be made quite dry before being offered to them. The influence of different sounds on hydrophobic patients is very curious: some of these unfortunate individuals can bear a great deal of noise, without inconvenience; but, if the noise happen to be of a kind which is associated with the idea of fluids, then excessive agitation is produced, and paroxysms of the greatest suffering are brought on. Few hydrophobic patients can bear the noise of a pump, or the clatter of cups and saucers, or the sound of earthenware.

When patients, by an extraordinary effort, do get any fluid down into the stomach, it is soon ejected again, together with a copious quantity of mucus and a greenish fluid. Another very distressing symptom is the production of a thick ropy slime about the fauces and throat, which is so tenacious as to be compared by the patient to birdlime: his constant endeavours to free his mouth and throat from this oppressive secretion keep his jaws in continual motion, and, as soon as he gets rid of one portion of it, another is formed, so that he has no respite from his sufferings. In the latter stage of hydrophobia, the pulse is hurried, the respiration laborious, the countenance anxious, and the features horribly contorted. Sometimes the patient is really furious and uncontrollable, though most frequently it is otherwise. He may be so unruly as to bite himself and others who are near him; but mostly he is quite rational and governable. A good deal of pain is generally felt in the epigastrium and chest; the patient is always constipated; but the urine is copious and high coloured.

With regard to the usual period of death from hydrophobia, this is a point particularly deserving of attention, because the period of the disorder, at which death occurs, is one criterion between hydrophobia and some other affections, which are occasionally confounded with it. The patient seldom lives longer than four or six days from the commencement of the hydrophobic stage, and then he is either carried off by a general and violent convulsion, or dies quietly in a state of complete exhaustion. The most common period of death is from two to three days from the time when the dread of fluids is first decidedly manifested. I have heard of a case that proved fatal in twenty-four hours: but the patient was a child.

Between hydrophobia and tetanus, the following considerations will serve as a criterion. Tetanus always begins with a spasm of the muscles of the jaw, which remains firmly fixed; in hydrophobia, on the contrary, the

jaw is constantly in motion, from the incessant efforts of the patient to get rid of that ropy viscid secretion to which I have already referred.

In hydrophobia, the muscles are not constantly rigid; they are sometimes relaxed; but, in tetanus, they are incessantly hard and rigid; the spasms may be, and indeed are, periodically increased in violence; but the muscles affected are never entirely relaxed.

In tetanus, though there may be difficulty of deglutition, there is rarely a positive aversion to fluids, or a dread of them, and the patient will remain a long time in a bath without any inconvenience; this is not the case in hydrophobia, — the very idea of being put into a bath would excite such commotion in the patient, as might probably soon destroy him.

The paroxysms of tetanus are neither excited nor increased by light; neither are they affected by the noise or sight of water; but those of hydrophobia are violently increased by causes of this description.

Tetanus mostly comes on soon after the infliction of the wound, that is to say, within a few days; but hydrophobia does not usually begin until a more considerable time has elapsed from the period of the bite.

Then, tetanus will come on after any kind of wound, — even after a surgical operation; but, as true hydrophobia can only be produced by the application of the saliva of a rabid animal to an abrasion or wound, it must have been preceded by the bite of such an animal, or by the application of its saliva to an abraded portion of the surface of the body.

In the examination of persons who have died of hydrophobia, inflammation may generally be traced in some part of the alimentary canal, in the mucous membrane of the pharynx, œsophagus, stomach, or intestines; indeed, the mucous texture of these viscera may not only exhibit traces of inflammation, but of what almost amounts to gangrene. Marks of inflammation are also frequently discovered in the respiratory organs, the mucous membrane of the larynx, trachea, or bronchi. In some instances, there are appearances of inflammation about the medulla spinalis, increased vascularity, a thickened state of its membranes, and an enlarged tortuous state of the veins, running in the direction of the medulla itself. In the museum of University College is the stomach of a person who died of hydrophobia; it has been turned inside out and dried, and put into spirits; an increase of vascularity is very perceptible in it, and, about the lesser curvature, a cluster or chain of enlarged glands.

The poison of hydrophobia is generally believed to be contained in the saliva of a rabid animal; but, in consequence of the salivary glands not appearing to undergo any structural change, M. Trolliet, who wrote a good account of the disease a few years ago, brought forward the doctrine, that the secretion, with which the hydrophobic poison is really blended, is the mucus of the respiratory organs. He argued, that, as traces of inflammation existed in the lungs, and in the mucous membrane of the air passages, and nothing wrong could be detected about the salivary glands, his view must be correct. Trolliet's observations on this point, however, gained but few converts, and it was soon ascertained, that vestiges of inflammation about the mucous membrane of the respiratory organs in rabid animals was far from being a constant occurrence; for M. Magendie dissected several rabid sheep, in which no traces of inflammation in any part of the organs of respiration could be perceived. In dispelling the error, which I have now been considering, dissections have been useful; but, I am sorry to be obliged to confess, that, in other respects, they have not thrown any light either on the nature

or the treatment of hydrophobia; in fact, though traces of inflammation are frequently noticed in the above-mentioned organs, they are observed only in a certain proportion of cases. In the bodies of persons destroyed by hydrophobia, there is no regularity in the appearance of inflammation in any particular situations or organs, so that, when it is met with, it seems rather as an incidental than an essential occurrence. Sometimes the lungs are emphysematous, vesicles being produced under the pleura pulmonalis, as is occasionally thought, by the rupture of some of the air-cells in the violent convulsive efforts of respiration in the course of the disease.

As hydrophobia is still regarded as an incurable disease, it must always be an object of the highest importance to prevent its attack, or the commencement of the symptoms. Fortunately, this may generally be accomplished, by removing the wounded parts as speedily as possible. When, therefore, we are called to a person, who has been bitten by a rabid animal, or by one suspected to be in this state, we should lose no time, and, if the operation be practicable, have immediate recourse to the complete excision of the bitten parts. Sometimes considerable perplexity arises from the situation, or number of the bites; thus, we may meet with cases, where the parts into which the animal's teeth have entered, are very numerous; we may also be consulted for persons, in whom the teeth have penetrated among the small bones of the carpus, or tarsus, or close to a large artery. I remember an instance, in which the bite was situated close to the radial artery. In this circumstance, amputation has been proposed; but it might perhaps be a more justifiable plan to perform the complete excision of the bitten parts, together with the portion of the artery that happens to be in the way, and then secure the ends of the vessel. The excision of the bitten part is a proceeding which should be adopted early; for it is unquestionably the most likely means of preventing an attack of hydrophobia; but in order to answer this purpose, the incision must be carried deep enough. Now, it frequently happens, that there is an uncertainty about the possibility of cutting out every part reached by the animal's teeth, and on this account, before the operation is begun, I recommend a very simple, but obviously prudent measure to be adopted, namely, washing the wounded part well; we may let a stream of water fall upon it from some height, out of the spout of a tea-kettle, or throw warm water forcibly against the part with a syringe. Thus we may possibly wash away any virus lodged upon the surface of the wound, or near its orifice. I recommend the plan, which Sir David Barry advised, next to be pursued: the ablution is to be followed by the application of a cupping glass to the part; thus, we shall have a chance of removing another portion of the virus, and, at all events, we shall suspend the action of the absorbents in the part, which action, as Sir David Barry's interesting experiments prove, cannot go on when the atmospheric pressure is removed. Having done these things, we should perform excision in the most complete manner possible, and then apply the cupping-glass again. Lastly, by way of still greater security, we may cauterise the part. Such are the most effectual plans, which I can suggest, for preventing the absorption of the hydrophobic poison, and, no doubt, if performed in the order I have specified, they would rarely fail. In examples of the bites of snakes, we have not the same opportunity of preventing the influence of the poison on the system, because the effects of the poison take place with surprising rapidity, and, unless we were on the spot at the moment of the bite, the system would

be affected before we could put the preventive means in practice; but, in the kind of poisoned wounds now under consideration, the virus is slower in its operation, and hence our plans for averting its action on the system altogether will have a better prospect of success. The interval between the bite and the constitutional disorder being long, and the admission of the virus tardy, the doctrine is often maintained, that if excision has not been performed at first, it is still called for so long as the constitutional derangement has not actually commenced, provided that not more than eight or ten weeks have elapsed from the period of the bite; for, after the sixth week, the chances of attack lessen from day to day. Of course, the sooner we excise the part, the better is the chance of preventing hydrophobia. Caustic alone should never be depended upon; for many instances of its failure are upon record.

For the prevention of hydrophobia, some other plans have been proposed. One medicine, formerly in great repute, was the *Ormskirk medicine*, but its reputation, at the present day, has declined. The same may be said of submersion in the sea. Some years ago, a Russian physician, Marochetti, extolled the practice of giving copious doses of the *genista tinctoria*, or butcher's broom, and of pricking with a lancet certain small pustules, or vesicles, which, according to his statement, form under the tongue, between the third and ninth day after the bite. These vesicles, or pustules, it is alleged, form near the orifices of the ducts of the submaxillary glands. Many endeavours have been made to discover them; but, I believe, they have never been observed in this country. In France, M. Magistal is said to have noticed them in several instances, and to have tried Marochetti's plan, which failed in his hands, and is not at present a subject of much interest with us.

The importance of preventive treatment will be duly appreciated, when it is recollected that, after the commencement of the constitutional symptoms, the cure of hydrophobia is so rare, that the very circumstance of a recovery generally creates doubt about the possibility of the illness having been true hydrophobia.

In some other cases of poisoned wounds, especially those of the bites of certain venomous snakes, the patients will bear immense doses of the most powerful medicines, without danger of being poisoned. The liquor arsenicalis has been given, every half hour, in doses containing not less than one grain of arsenic, without any deleterious effects; the same fact is observed in hydrophobia and also in tetanus. M. Magendie dissolved ten grains of opium in water, and threw the solution into the venous system, without producing any narcotic effects, or derangement of the animal economy by the experiment; nay, the hydrocyanic acid itself is alleged to have been injected into the veins without the usual deleterious consequences. Such facts are adverse to the probability of any medicine being ever discovered capable of curing hydrophobia.

Magendie having observed in some experiments on animals, that the injection of water into the venous system seemed to have a tranquillising effect on the nerves, was induced to make trial of this plan in hydrophobia. In one patient he threw a considerable quantity of water into the veins during the paroxysms, so as to cause an artificial plethora, at first with some prospect of success, for the patient became tranquil, appeared for a time to be soothed, and actually lived nine days, which was a most uncommon event, as patients generally die in forty or fifty hours, and very few indeed live beyond the sixth day. The particulars of this case, therefore, were no sooner made public, than they raised expecta-

tions that a very important discovery had been made; but subsequent trials of the plan have not established its value, and it is now deemed of as little use as every other scheme for the cure of this disease.

Another plan, of which the most favourable report was received from the East Indies, was that of bleeding a patient *ad deliquium*. Instances of the success of this practice are given; but the trials, made of it in Europe, have not confirmed its efficacy. Indeed, I cannot mention any mode of treatment entitled to much attention, except for the purpose of stating that it has been tried unavailingly: thus, opium has been given in immense doses without any good effect; and so have the acetate of morphia and pure ammonia. Belladonna has been given by the mouth, and injected into the veins, without any useful result. Tobacco clysters have been employed in vain. In other examples, the parts have been washed with oxymuriatic acid, and the same medicine has been given internally, in the quantity of a drachm in the course of twenty-four hours, made into pills with crumb of bread. Galvanism has been tried, with the same result; and amongst the extraordinary schemes ventured upon, I may notice that of endeavouring to stop the action of the hydrophobic poison on the system by the influence of another powerful animal poison, such as that of the viper. On this principle, vipers have been purposely suffered to bite the patient; but the plan, which was tried in Italy, had no useful result. Arsenical preparations, and the Tanjore pill, which was once so famous in India as a means of preventing the fatal effects of the bites of snakes, the nitrate of mercury, turpentine, and thirty or forty other things which might be enumerated, have all been amply tried, and found to possess no real efficacy in hydrophobia.

### OF PARTICULAR DERANGEMENTS OF THE MUSCULAR AND NERVOUS SYSTEMS FROM WOUNDS.

I have already treated of the ordinary general effects of wounds, such as inflammation, suppuration, abscesses, and fever; but besides these usual events, we observe, that wounds sometimes lead to such disorder of the animal economy, as manifestly to affect the nervous and muscular systems in an extraordinary manner and degree. Thus, in certain individuals, a very trivial local injury — one that involves no part of importance — will give rise to violent disturbance of the nervous system. Some persons always faint on receiving a mere scratch, or the prick of a needle, while others are seized with convulsions and vomitings from equally slight causes. In several instances, I have seen patients die before the completion of operations which would not have been at all dangerous to the generality of persons, or those who had the advantage of better stamina. I have seen individuals die on the operating table, though they had not been at all debilitated, neither had they lost much blood during the operation. Now, if such idiosyncrasies were foreseen, it would be advisable, I think, for the surgeon to direct a dose of opium, or some cordial, to be given before the operation.

One of the most dangerous affections of the animal economy, occasionally produced by a wound, is *tetanus*, a disease that occurs with much less frequency in this country and other parts of the world having a temperate climate than in hot countries, where it is disposed to originate from slight injuries. Tetanus may be defined to be a spasmodic contraction, with rigidity of the voluntary muscles. In some examples, only the muscles of one or more regions are affected; in others, the disorder

extends its influence to the voluntary muscles throughout the system. Their extraordinary contraction, rigidity, and tension may be said to be maintained without a complete relaxation at any time, in which respect tetanus differs from hydrophobia, as well as from ordinary spasms and convulsions. When the muscles behind the neck and down the back are thus stiffened and contracted, and the body drawn backwards, the disease is called *opisthotonos;* but when the action of the abdominal muscles preponderates, so as to bend it forwards, the disorder receives the name of *emprosthotonos.* According to Baron Larrey, who had many opportunities of seeing the disease when he was with the French army in Egypt, it appears that, in that country, when the wound was in the back, tetanus commonly assumed the form of *opisthotonos;* but if the wound happened to be in the anterior part of the trunk, and tetanus followed, it was generally in the shape of *emprosthotonos.* The reality of emprosthotonos has been doubted; but if we refer to Larrey's Mémoires de Chirurgie Militaire, we shall find that, amongst the wounded of the French army in Egypt, this was actually the most common form of tetanus. Sir Gilbert Blane published two cases, which agree with the Baron's statement; for, in them, the side of the body, on which the local injury was situated, became the seat of the tetanic affection; another variety, termed *pleurosthotonos.*

Tetanus is called *complete* when the muscles of the body at large are affected; that is, when the greater number of the voluntary muscles are spasmodically and rigidly contracted. When this is the case, the muscles antagonise and counteract one another, and the body is not drawn more in one direction than another. When the disease is confined to the muscles of deglutition, and to those of the lower jaw, it receives the name of *trismus* or *locked-jaw.*

Now, although the muscles in tetanus are in a state of incessant contraction, without *complete* relaxation, there are certainly periodical diminutions of their rigidity. In fact, inasmuch as the spasmodic action of these organs usually has paroxysms of increased violence, there must be periods or intervals during which they are less severely affected; yet they always continue rigid and hard — there is no complete relaxation of them; and the jaws being permanently closed, there is often the greatest difficulty in administering medicines, or getting food into the stomach.

Tetanus is divided into the *traumatic* kind, or that which arises from wounds; and into the *idiopathic,* or that species of tetanus which originates from other causes. Another important division of tetanus is into *acute* and *chronic.*

The *acute* is exceedingly dangerous, and often fatal; but the chronic may frequently be cured, and, at all events, it is curable in a much greater proportion of cases, than the acute. Traumatic tetanus often comes on and advances to its termination in a surprisingly rapid manner. Thus, a case is recorded of a negro in the West Indies who died of tetanus in a quarter of an hour, from a slight scratch of the thumb; but, in general, its course is more gradual. It was found by the surgeons of the British army in Spain, who saw a great deal of tetanus, that if the disease did not commence on or before the twenty-second day from the receipt of the wound, there was little chance of its coming on at a later period. This is an important circumstance to be remembered. In Egypt, Baron Larrey found, that the latest period of attack was the fifteenth day from that on which the wound happened. Traumatic tetanus frequently

proves fatal on the second, third, and fourth day from its commencement, but sometimes even as late as the seventeenth. I had a soldier under my care in one of the military hospitals in Holland, who lived five weeks after the supervention of tetanic symptoms: this was a case of chronic tetanus, following a gunshot wound and amputation of the thigh, at Bergen-op-Zoom; and certainly it was a horrible specimen of the effects of tetanus, for the muscles were drawn entirely away from the bone, which was left protruding far beyond the flesh, while enormous abscesses formed in the hollow of the stump, and made their way so extensively as absolutely to encompass nearly the whole of the pelvis.

With regard to the symptoms of tetanus, the first thing usually noticed is a sensation of stiffness in the neck, gradually increasing, and at length causing pain when the head is moved. This first symptom is followed by an uneasy feeling at the root of the tongue, with a difficulty of mastication and swallowing. When the disease has made further progress, the attempt at deglutition is attended with violent convulsive efforts; in particular, when the patient attempts to swallow liquids, he experiences much inconvenience, and in consequence of the pain and severe paroxysms of spasm which then attack him, he will sometimes manifest a strong aversion to fluids, and thus his disease may bear a resemblance to hydrophobia. It was on this account, that I particularly adverted to the characteristic differences between the two diseases. The next symptom which the patient complains of is pain about the ensiform cartilage, or a violent shooting pain, directed from that part towards the spine in the course of the diaphragm. This additional grievance brings on an increase in the violence of the spasms; and, in particular, the muscles of the lower jaw now contract with great power, so that the jaws remain inseparably applied to each other. As the disease continues, there is a marked increase in the spasmodic contractions of the diaphragm, which come on every ten or fifteen minutes, and are succeeded by extraordinary degrees of spasm and rigidity of the muscles of the back, and also of those of the lower extremities. At length, the abdominal muscles begin to be affected, and the belly feels as hard as a table: so violent is their action, that the recti abdominis have been known to be lacerated. The spasms next extend to the muscles of the lower extremities, and even to those of the arms; but the muscles of the fingers usually remain undisturbed to the last. Nor are those of the tongue affected till a very late stage of the disorder; and when this happens, the patient cannot control the motions of that organ, so that it is frequently thrust between the teeth and terribly lacerated. These muscular contractions are attended with the most excruciating pain during their attacks; the pulse is contracted, hurried, and irregular; the respiration quick and oppressed; but, during the remissions, neither the pulse, nor the breathing, may be seriously disturbed. In the generality of cases, the heat of the body is not increased; the urine is voided in small quantities, and sometimes with difficulty; and there is invariably obstinate constipation. As for cerebral disturbance, the patient remains free from it till the last stage; and, when the patient dies, it is generally in a paroxysm of violent convulsions. The blood has been asserted not to exhibit in tetanus the inflammatory crust, and the crassamentum is stated to be loose; but these are points which are variously represented by different writers.*

* "In tetanus, and where death ensues from great muscular efforts, all the blood is found nearly as liquid as water."—Macartney on Inflammation, p. 124.

Baron Larrey had to treat a case of tetanus, produced by so trivial a cause as the irritation of a small fish-bone lodged in the throat of a French soldier in Egypt. In cold countries tetanus is much less frequent; and when we see it in this country, it is generally as a consequence of wounds, either peculiar in their situation or in their nature, namely, they are usually lacerated, contused, or punctured wounds in tendinous parts; wounds of the thumb, toes, or fingers, or deep-punctured wounds in the sole of the foot, compound fractures, or compound dislocations of ginglymoid joints, and especially of the thumb. These are the most common exciting causes of traumatic tetanus, when it occurs in this country. But, although contused and lacerated wounds of tendinous parts are those most likely to bring it on, any description of local injuries may excite the disease; thus, we sometimes see it caused by simple wounds in common parts; sometimes by wounds in a healthy healing state; sometimes by sloughing wounds, and the most complicated forms of local injury. I have known it follow amputation, castration, and the removal of a diseased breast. It has been known to originate from a burn.

Dissection has thrown no light on the nature and treatment of this formidable complaint. Sometimes the morbid appearances bear a close resemblance to those observed in the examination of the bodies of persons who have died of hydrophobia. We may meet with traces of inflammation in the pharynx and œsophagus, and in the mucous membrane of the intestinal canal. In one instance, Baron Larrey noticed a layer of coagulating lymph on the lining of the pharynx and œsophagus, which organs were contracted in an extraordinary degree. In another case, he found scales of osseous matter deposited on the arachnoid covering of the medulla spinalis; but it is hardly possible that these formations could have been concerned in the production of the disease, because they must have required more time for their completion, than the sudden origin and rapid course of the disease would have admitted. In some examples, the coverings of the medulla spinalis are found inflamed; and, in others, the substance of the medulla spinalis itself is changed. Thus in one case, examined by Dupuytren, the coverings of the medulla spinalis exhibited marks of inflammation; and in another, examined by Brera, the texture of the medulla itself was altered. None of these morbid appearances, however, are sufficiently constant to justify the opinion of their being essentially connected either with the origin, or the symptoms of tetanus. When the arachnoid tunic of the medulla spinalis is inflamed, it is said that the symptoms produced are those of opisthotonos, or that form of tetanus which consists in so forcible an extension of the spine, that it is bent considerably backwards.

With respect to the *proximate cause of tetanus*, this is a subject involved in considerable obscurity. Why should a wound in one individual produce tetanus, while a similar wound in the same part in another individual may be followed by no serious consequences whatsoever? From the frequency of tetanus in warm climates, it is natural to suppose, that the state of the constitution is concerned in the production of the disease; namely, that it acts as a predisposing cause: and of this fact, I think, there can hardly be a doubt. Yet we must not altogether exclude local circumstances from consideration, for they seem to have their share in the production of tetanus. If this were not the fact, we should not observe that certain descriptions of wounds, and wounds in particular situations, more frequently give rise to tetanus than ordinary wounds. We must, therefore, presume, that there is something in the state of the

wounded parts themselves conducive to tetanus. If it were not so, we should not find, that lacerated and contused wounds, and injuries of tendinous parts, so frequently produce it. Then, another question arises, whether the partial division of nerves is the exciting cause of tetanus? Baron Larrey relates some cases in support of this doctrine; but whether the opinion be true or not, the fact is, that tetanic patients cannot always be cured by making a complete division of the nerve. Mr. Liston relates an instance, in which the branch of the median nerve distributed to the thumb was partially divided, and in which amputation was performed, in the hope of curing the tetanic symptoms, but without success. When the limb was examined, the extremity of the nerve was found inflamed and thickened. Dupuytren records another case, in which tetanus arose from the knot of the lash of a whip being detached from it, and forced into the ulnar nerve.

It was noticed by Baron Larrey, that when tetanus comes on, the secretion of pus from the surface of the wound ceases, or its quality is considerably altered; and hence he was led to suspect, that the origin of the disease might be, in some degree, owing to the stoppage or disturbance of the process of suppuration. This induced him to try what would be the effect of endeavouring to renew the secretion of pus. But this stoppage of suppuration appears to me to be rather the effect of tetanus than the cause of it: indeed, I mentioned, when on the subject of suppuration, that all great disturbances of the constitution had immense influence on the process of suppuration, as well as on the secretions in general; and it is not at all surprising therefore, that in traumatic tetanus we should find suppuration stopped, or the pus converted into a scanty, dark-coloured unhealthy secretion.

With regard to the *prognosis in acute traumatic tetanus*, I may remark, that the disease generally proves fatal. Dr. Parry thought, that one criterion, respecting the probable issue of the case, might be derived from a calculation of the velocity of the circulation; and it was his belief, that when the pulse was not more than 100 or 110 before the fifth day, a favourable termination might be hoped for. Then, it is remarked by men of great experience, that if the patient live beyond the ninth day, he will have a much better chance of recovery than he had previously.

*Idiopathic tetanus* is well known to be less dangerous than the symptomatic or traumatic form of the disease: many cases of the former end favourably, but the traumatic species of tetanus — that which surgeons have to deal with — is generally fatal. It is, indeed, a form of disease, over which the resources of medicine and surgery have much less control.

The *treatment of traumatic tetanus* comprises both local and constitutional measures. Local treatment seems naturally to suggest itself, because, the disease being brought on by a wound, we must suspect that some irritation is existing in the part, or some peculiar operation is going on in it, which is concerned, not only in producing the disease, but in maintaining and aggravating its symptoms. The suspicion of the disease being dependent upon the partial division of a nerve, led to the practice of endeavouring to detach the wounded part from all nervous communication with the sensorium. This was attempted in two ways — first by amputation of the wounded limb. Thus Baron Larrey proposes the following question: whether in traumatic tetanus it would not be wiser to amputate, without delay, than to make trial of other means, which experience proves to be almost constantly unavailing? The same surgeon

even published cases in support of the practice of amputation; but, on looking attentively over them, it seems that all those in which amputation proved successful, were instances of *chronic* tetanus; and we now know, that the chronic variety of this disorder may frequently be cured without amputation, and that it is generally more under the control of medical and surgical treatment than the acute form of the complaint. Indeed, Larrey himself admits, that amputation is of no use in acute tetanus, nor when the disease has made considerable progress. I believe he only means amputation to be practised in the beginning of those cases, which are likely to be slow in their progress, and for these I should say it is unnecessary. Military surgeons generally disapprove of amputation, as a means of stopping tetanus. In the hospitals of the British Legion in Spain, the practice is also stated to have been fruitless.* Sir Astley Cooper, Mr. Abernethy, and other distinguished surgeons, also join in this opinion. I have already alluded to the case recorded by Mr. Liston, in which he amputated the arm, in the hope of arresting the tetanic symptoms, where there was a partial division, and an inflammation, of the branch of the median nerve distributed to the thumb. The amputation seemed to stop the spasms for a moment, but they soon returned with greater violence. In this instance one curious circumstance was exemplified, namely, as soon as the operation was finished, Mr. Liston wished to let the arteries bleed a little while before they were secured, but he found that they had contracted so much, that scarcely any blood could be obtained. In fact, no ligatures were necessary, for there was no hemorrhage.

Another less severe local treatment has been proposed, one which acts, however, on the same principle as amputation; it is that of making a deep incision in the wound, so as completely to divide the partially injured nerve. This practice has occasionally answered; and I remember one instance of tetanus, produced by an injury of the supra-orbitary nerve, where a complete division of this nerve, performed by cutting down to the bone, had the effect of stopping the disease. In the Medical Gazette, No. 271, the particulars of a case are recorded, in which Dr. Murray, of the East India Company's service, succeeded in arresting an attack of tetanus by dividing the posterior tibial nerve behind the inner malleolus, the disorder having been rapidly induced by the entrance of a rusty nail into the sole of the foot. The relief was certainly very remarkable. On the same principle, moxa, cautery, and caustic have been used to destroy the seat of irritation, and cut off the nervous communication of the part with the sensorium. In Baron Larrey's history of military surgery, there are instances where the median nerve had been included in the ligature on the brachial artery, and also cases, in which a ligature on the femoral artery had embraced the branches of the crural nerve; here it was suspected that the tetanus, which ensued, might have originated from the unskilful inclusion of the nerves, and the proposal was made to cut down to the artery, and remove the ligature. In one case, Larrey actually tried this plan; he exposed the femoral artery, and took away the ligature; but the tetanus was only stopped for a short time by this proceeding, and then it returned with increased violence. Finding this expedient unavailing, he then cauterised the whole surface of the stump, and administered opium. The patient ultimately recovered;

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* See "Alcock's Med. Hist. of the Legion." 8vo. Lond. 1838.

but it cannot be affirmed, that the cure was absolutely promoted by the removal of the ligature. No doubt the practice was rational; yet nerves are so frequently tied without tetanus being brought on by it, that it is difficult to say what influence the tying of the nerve truly had in the instance before us.

In consequence of the stoppage of suppuration in the wound at the commencement of the tetanic symptoms, some surgeons endeavour to renew the discharge by means of blisters; but as the suppression of suppuration seems to be rather an effect, than a cause of the disease, it does not appear that much good is likely to be derived from this suggestion; indeed, I can trace but little evidence in favour of such treatment.

Another practice is that of stimulating the wound with tobacco poultices, turpentine, laudanum, and other applications. This practice was tried upon an extensive scale in our army in Spain, and in the French army in Egypt; but the reports of it are not such as to justify the hope of its proving useful. It is discouraging indeed to learn from Sir James M'Grigor, that in several hundred cases, which happened amongst our troops in Spain and Portugal, very few were benefited by any medicine or plan whatsoever, after the disease had made any progress, and attained the acute form.

In consequence of the blood being sometimes buffy, and the pulse being full and quick in the beginning, we might suppose, that bloodletting would be beneficial, especially in strong robust persons; but notwithstanding such foundation for the practice, experience has produced few facts in evidence of its usefulness. It is a treatment that has been extensively tried, but without any decided good, so far as I am able to judge; and some surgeons of vast experience positively declare, that death is accelerated by it. I hardly dare venture, therefore, to recommend venesection, especially as it has failed in every case, where I have seen it tried myself. In Mr. Alcock's work is an abstract of seventeen cases of traumatic tetanus, which occurred in the British legion in Spain. The first six were treated by bleeding, opiates, and calomel, and all of them proved fatal. Of the remaining eleven, one for which carbonate of iron was administered recovered; while of the other ten, in which bleeding, acetate of morphia, calomel, and opium, and tartarised antimony, were employed, only one got over the danger of tetanus, and this patient afterwards fell a victim to irritative fever arising from injury of the knee-joint. With regard to the question of taking away blood in tetanus, I would abstain from venesection; but if the patient were strong and athletic, with a full quick pulse, I should not be afraid of having recourse to local bleeding, of applying cupping-glasses near the spine, or leeches to the throat and neck, as it is in those regions that inflammation, when it does prevail, is mostly observed. The application of antimonial ointment, or of a long strap of blistering plaster, or even of the actual cautery, to the integuments over the spine, has been occasionally tried, and, as is reported, with some degree of success.

Obstinate costiveness being invariably attendant on the disease, one indication is to restore the functions of the intestines, and to procure evacuations from them, which is sometimes difficult; for tetanic patients are not easily affected by purgatives. Mr. Abernethy used to prefer for this purpose calomel and jalap, mixed with treacle; but we have now a more convenient and certain medicine, namely, *croton oil*. It is more sure in its effects than any other purgative that can be administered; we may give one or two drops of it mixed with mucilage

or gruel. By this dose a copious evacuation will generally be produced; a considerable advantage, because we are commonly exhibiting at the same time another medicine, which has a contrary effect, namely, opium. Now if we can keep the patient under the influence of opium, and also succeed in maintaining the regular and proper action of his bowels, we are doing almost as much for him, I believe, as it is in the power of medicine to accomplish. The painful nature of the muscular contractions led to the trial of narcotic medicines almost as a thing of course; and, accordingly, opium has been fairly and repeatedly tried. Other narcotics have also not been forgotten; in particular, hyoscyamus has been frequently given, and found to relieve the patient's sufferings, though inadequate to effect a cure. Patients in tetanus are not so easily acted upon by medicines as in the generality of other diseases; in fact, they seem to require immense doses of medicines, and especially of opium. It is not uncommon to give from half a drachm to one drachm of opium every six hours, and from half a drachm to one drachm of the extract of hyoscyamus. In tetanus we may certainly give medicines in large doses; but I would not recommend the immense quantities here specified as a prudent plan to begin with. The safest maxim is to commence with small doses, and gradually increase them. In some cases, the stomach does not appear to digest the medicines put into it: thus, in one instance, Mr. Abernethy opened a person who died of tetanus, and thirty drachms of opium were found in the stomach.

Opium is sometimes administered in clysters; and it is not unusual, in trismus, to have recourse to frictions with opiate liniments about the neck and jaws. For this purpose laudanum alone, or equal parts of laudanum and soap liniment, are employed. Perhaps purgatives, with opium, or the muriate, acetate, or sulphate of morphia, are the most valuable medicines in tetanus. The warm bath has been occasionally tried, but no confidence is now placed in it; indeed, in the West Indies some individuals died almost as soon as they were removed from it; and as for the cold bath, it has proved in traumatic tetanus decidedly injurious. Amongst other things, mercurial frictions have been extensively tried: I have seen them used in five or six cases, but invariably with ill success. What confidence can be placed in them, when we hear, on the authority of Sir James M'Grigor, that a soldier, in Spain, who happened to be using mercurial ointment for the itch, was positively attacked with tetanus while under the influence of mercury.

Dr. Elliotson conceived that there was some resemblance between tetanus and paralysis agitans and chorea, in which the sesqui-oxide of iron has been given with great success: he was therefore led to try the same medicine in three cases of traumatic tetanus, two of which were cured by it. He gave from two drachms to half an ounce every two hours, obviating costiveness with castor oil and turpentine. The particulars of several other successful cases have likewise been communicated to him. I prescribed the sesqui-oxide of iron in one case of traumatic tetanus, but without success. The disorder had advanced too far, I believe, when the medicine was begun.

## FRACTURES.

A *simple* fracture is so called, when there is no external wound communicating with, or extending down to, the broken part of the bone. A

person may have a broken bone and a wound at the same time on the limb; still the fracture may be a *simple* one; because it is essential, that the wound should communicate with the injury of the bone, to constitute what is denominated a *compound fracture*. If I were to fall down and break my thigh, and at the same time receive a cut, or laceration of the soft parts of the thigh, quite unconnected with the fracture, the case would not be of the sort, which, in surgical language, is distinguished by the term *compound*. I may also observe, that the kind of wound, which is essentially requisite to render a fracture compound, is generally produced by the protrusion of the broken bone itself: I say *generally*, because, in compound fractures, the result of gunshot violence, the wound is always occasioned by the ball, or bullet, that enters the limb. When the bone is broken in several or many pieces, the fracture is said to be *comminuted*, while *complicated* is the epithet applied to fractures combined with a variety of circumstances, adding to the difficulty of the treatment, or requiring especial attention. Thus, the combination of a fracture with the wound of an artery, a dislocation, (for there may be dislocation and fracture of the same bone together,) injury of viscera, or of any organs, whose functions are highly important, will make the case a *complicated* fracture. Thus the rami of the ischium and os pubis may both be broken, and the fragments of bone may be so displaced as to lacerate the urethra, and give rise to an extravasation of urine. In a fracture of the ribs, the lungs may be wounded, in which case the additional complication of emphysema may be produced. Hemorrhage is more frequently a complication of compound fractures of the legs than of any other fractures, except such as implicate the anterior and lower angle of the parietal bone, in which accidents the spinous artery of the dura mater is usually ruptured, though the hemorrhage is then not external, but takes place on the dura mater. I may state also, that whenever there is extensive laceration of the soft parts, or whenever the fracture runs far along the shaft of the bone into one of the large joints, as for example into the knee, the accident ranks as a *complicated* fracture.

But, besides these distinctions, there are others derived from the direction of the fracture, as when it is *transverse*, *oblique*, or *longitudinal*, particularities worth remembering, because they have considerable influence over the difficulty or the facility of effecting a cure. Thus, if the thigh-bone be broken, and the fracture be oblique, the lower portion of the shaft of the bone will be much more easily displaced, and more difficult to keep reduced, than if the fracture were transverse. The reason of this fact is sufficiently obvious, for, in consequence of the obliquity of the surfaces of the fracture, the two ends of it are enabled to glide over each other, and the muscles arising from the pelvis, and inserted into the femur, patella, and bones of the leg, draw the lower fragment towards their origin, or more fixed point. But when the fracture is transverse, the resistance of the upper end of it will tend to maintain the lower in its proper situation, at least, so far as the preceding kind of displacement is concerned. Next to the circumstance of a fracture being *simple*, *compound*, or *complicated*, that of its *direction* is most important to be remembered.

The long cylindrical bones, which serve as pillars or arches of support for the body, or as levers for the action of the muscles, are, by the nature of their office, particularly exposed to fractures. Their shape, use, and situation, are all so many circumstances rendering them extremely subject to be broken. On the other hand, the broad flat bones, such as the

scapula, sternum, and os ilium, though sometimes fractured, are much less frequently so injured than the long cylindrical bones. The bones of the skull, however, which are broad and flat, are exceptions to this observation; but this is owing partly to their superficial situation, or their not being covered by any great quantity of soft parts, and partly to the force with which the head is generally struck by falls and blows. In short, the head is a part remarkably exposed to external violence; and I may say, as a general rule, that the more superficial a bone is, and the more exposed it is to the action of external violence, the more liable it is to be broken.

It has been sometimes asserted, that the action of the muscles is invariably concerned in the production of fractures; but this doctrine goes beyond the bounds of accuracy. We know that the patella is often broken by the violent action of the muscles in front of the thigh; that the olecranon and part of the os calcis are sometimes torn off from a similar cause; and also that the humerus is occasionally broken by the force of the muscles attached to it. I once attended a man, who broke his arm by aiming a blow at another person, whom he did not succeed in striking; neither did he fall; yet the humerus was broken. It is true, that when a person falls down, he endeavours to save himself, and for this purpose puts his muscles into violent action, which may therefore be supposed to have some share in producing certain fractures; yet that muscular action is *always* concerned in producing fractures must be an incorrect hypothesis. When the cranium is fractured, can we possibly suspect the action of the muscles, or, at any rate, of any muscles belonging to the patient himself?

Fractures then are produced, first by external violence, operating directly on the part broken; secondly, by external violence applied to parts more or less remote from the seat of the fracture; and thirdly, by the action of muscles, as in ordinary fractures of the patella. When a person alights on the ground from a great height, and fractures his thigh or leg, the resistance of the ground and the weight of the trunk produce the fracture; there is no violence applied directly to the broken part, but the extremities of the bone receive the force, and the middle portion of the bone bends and breaks. This case is very different from one, in which a man's leg is broken by the kick of a horse; here the violence is applied directly to the part which is fractured.

Fractures are more common at some ages than others. Particular bones, too, are broken with remarkable frequency in young persons, while certain other bones are more usually the subject of the accident in aged individuals. In children, the femur, the humerus, and the clavicle are often broken; in adults, the bones of the leg and forearm, the femur, humerus, clavicle, and ribs; and in old persons, the neck of the thigh bone suffers in numerous instances. The functions of some of the bones render them very liable to fracture; thus, the radius, which supports the hand, and receives all the impulses communicated to this busy part of the limb, is far more commonly broken than the ulna. The clavicle, which keeps the shoulder in its right position, and supports, in the manner of a pivot, all the motions of the upper extremity, is particularly liable to be broken. I have said, that fractures may occur at all ages; but, as the texture of the bones varies at different periods of our existence, some differences in their liability to fracture will be created by this circumstance. The quantity of earthy matter in the bones of children is comparatively small; but as man advances in years, the proportion of this

ingredient increases, while that of the animal matter diminishes; the consequence is, that they are rendered considerably more brittle than in the early period of life. In children, the large proportion of animal matter in the bones communicates to them a degree of elasticity and flexibility, far exceeding what is noticed in the bones of older subjects. In children the bones are also much protected by the quantities of adipose substance, and the muscles are not yet sufficiently developed to act violently upon them. The bones of children ought, therefore, to be rarely broken; but their venturesome tricks and carelessness in some measure counterbalance the advantages which I have been noticing, and explain the reason why the fractures of particular bones are tolerably frequent in the early periods of life. The bones of children, in bending, sometimes break only in the convexity of the curve; a peculiarity restricted to the early periods of life. In adults, in whom the texture of the bones is actually strongest, one might expect a corresponding diminution of the frequency of these accidents; but the protection of firmness of texture is counterbalanced by the many dangerous employments in which a large class of society is engaged, in the long interval between childhood and old age. In full manhood, too, the muscular system has acquired its greatest force, and hence fractures of the bones of adults are very common indeed. A predisposition to fractures is known to be brought on by certain diseases, as, for instance, syphilis in its worst and most aggravated forms: a thigh-bone, in the museum of University College, belonged to a person who had been taking mercury a little while before his death, for venereal complaints,—in fact, there is a node on the bone; now, the femur of the opposite side, contained also in the same museum, broke spontaneously, that is to say, from the slight action of the muscles while the patient was turning in bed. This is an instance of predisposition to fracture, arising from the influence of impaired health in certain conditions of the venereal disease. In the advanced stages of cancer, the bones are also frequently broken by the slightest force or pressure, or the common and even very weak action of the muscles. Rickets, fragilitas, and mollities ossium, scurvy, scrofula, fungus hæmatoides, and certain diseases within the cancellated texture of the bones, are all well known to communicate a predisposition to fractures. I may also remark, that, when a tumour presses upon a bone in such a manner as to cause the absorption of the osseous texture, of course a predisposition to fracture will be produced. At University College are the remains of a thigh-bone, which is absolutely reduced to a mere shell by the pressure of a tumour in the region of the ham, and from the weakened appearance of it, it is manifest that the slightest force would have been sufficient to occasion a fracture of it. At the same institution is also the humerus of a boy, that was broken by shampooing, tried for the relief of some scrofulous affection; in fact, the bone was broken twice: the first fracture united, but the second did not do so. In this case, no doubt the texture of the bone had been weakened by scrofulous disease. In the same collection is a preparation illustrating the alteration, which any cancerous disease in the body may produce in the bones: it is part of the skull of a woman, who had cancer of the breast; some of the texture of the bone is absorbed, and an animal matter, which is sometimes described as a scirrhous substance, is deposited in its place. If a similar change were to occur in one of the long cylindrical bones, it would become so weakened as to be broken with a very slight force. In the museum of St. Thomas's Hospital, there are or used to be two thigh-bones, which were broken in consequence of their texture

being weakened by the effect of cancer; in the sternum of one of the patients, from whom they were taken, is a proportion of scirrhous matter, occupying the place of the earthy matter which has been absorbed. All pathologists know, that this effect of cancerous diseases in the body on various parts of the skeleton is not an uncommon occurrence.

With respect to the *general symptoms of fractures*, some of them are rather *equivocal*, because they may attend other cases. Of this description are pain, inability to use the limb, and more or less swelling: all these symptoms may be noticed in other cases, as in contusions, in the generality of dislocations, and in rheumatism; they afford, therefore, no positive information about the nature of the case. The symptoms, on which greater dependence may be placed, are, first, the separation, which often takes place between the two ends of the broken bone; secondly, the inequality or projection of the broken part of the bone, which, when it is not covered with a great thickness of soft parts, is frequently obvious; thirdly, a change in the natural shape of the limb. Thus, an angular deformity may be produced, the limb seeming to be bent, and the axis of one fragment not corresponding to that of the other; or there may be a shortening and rotation of the limb inwards or outwards, from which position it may be more easily moved than in the case of a dislocation; the limb in the latter kind of accident being always more fixed.

But of all the symptoms and signs of a fracture, none is of greater importance, or affords a better proof of the nature of the injury, than the *crepitus*, or grating noise or sensation, occasioned when one end of the broken bone is moved upon the other. It is true, that, in some cases, where the quality of the synovia is altered by disease, a grating may be felt when a joint is moved; but, generally, there is no risk of such a case being mistaken for a fracture. Yet it should be known, that the absence of crepitus is no proof, that a fracture may not exist; for, when a fracture has continued some days, the ends of the bone become smooth, and there will consequently be no crepitus or grating. The two ends of a broken bone may also be so much displaced as not to be in contact, and then, of course, no crepitus can happen. On other occasions, a portion of the soft parts may be interposed between the fragments, as, for instance, a portion of muscle: and here, likewise, no crepitus will be felt on moving the part; but whenever the grating noise or sensation can be distinguished, it is one of the surest signs of the existence of a fracture. The grating may usually be perceived on pressing upon or trying to bend the bone itself, or on bending, extending, or rotating the nearest joint. One symptom of a fracture is the loss of the use of the limb or part: this is, no doubt, a common effect of most fractures, the functions of the limb or part being more or less impeded; but no positive conclusion can be drawn from this circumstance, because it is one that accompanies other injuries and diseases, and does not invariably attend a fracture. When the portion of the limb, in which the fracture takes place, has only one bone on which its inflexibility and firmness depend, then the loss of its use will immediately result from its being broken. Thus, when the humerus or femur is broken, the patient immediately loses the power of using the limb; but if only one bone happens to be broken in a part of a limb in which there are two bones, the patient may then retain some use of the member. For instance, if the ulna alone be broken, considerable power of using the hand and forearm will remain; but, if both the radius and ulna be broken, then the circumstances will be different, and the functions of the part will be more or less completely interrupted. Some-

times even when there is only one bone in a limb, and that is broken, a degree of power of employing the limb will be retained, that is to say, the use of it will not be so entirely destroyed as to render the nature of the case at once manifest. Thus, in a fracture of the neck of the thigh-bone, if one fragment be wedged and entangled in the other, there will be no separation of them, nor any retraction of the limb; and patients in this condition have actually been able to walk some distance after the accident. This circumstance might cause the real nature of the injury to remain unsuspected; but it is very rare. When the injured part of a limb contains two long bones, and only one of them is broken, the other supports the fractured one, and generally prevents retraction, or much displacement of the lower fragment; in fact, the perfect bone acts as a splint in keeping the broken bone steady, and hindering deformity; and, under these circumstances, great attention may be requisite to detect the nature of the accident.

With regard to *swelling*, which is one of the symptoms of a fracture, it may be produced either by extravasated blood, by the increased fulness of particular muscles in consequence of the shortening of the limb, and the approximation of their origins and insertions to one another, or by the prominence or projection of the broken bone itself. By any or all of these causes, there may be an *immediate* swelling produced. The muscular swelling is exemplified in fractures of the thigh-bone, in which the middle portions of the triceps, the rectus, and the other extensors of the leg give a preternatural convexity and fulness to the forepart of the thigh. A similar effect may be observed in the arm, when the humerus is fractured above its middle: then it is the coraco-brachialis and biceps which chiefly produce the muscular prominence. Besides the immediate swelling, to which so many causes may contribute, a still greater degree of tumefaction follows at a later period, and is the result of inflammation. This kind of swelling of course requires some time for its production; and hence, when a bone has been some hours unset, the swelling, from all the various circumstances which I have mentioned, may be considerable, and such as may render the true condition of the bone obscure. When, therefore, a limb is suspected to be broken, it should always be carefully examined in the first instance, because then the examination may be made with less pain to the patient, and the nature of the injury can be made out with less difficulty than at a later period, when the inflammation and swelling have attained a considerable degree.

The *displacement* attending fractures is a subject, to which too much attention cannot be paid. Surgeons should certainly have precise ideas about the particular kinds of displacement to which the various kinds of fractures are liable; because the displacement is necessarily accompanied by deformity, or deviation of the part from its natural shape; and the grand object in the treatment is unquestionably the prevention of such deformity by every possible means. We should therefore study and inquire into the causes of the displacement of the ends of a broken bone, and of the several varieties of it, which may occur in different cases. In fact, without this knowledge, we should not be qualified to practise this part of surgery with reputation to ourselves and advantage to the public. First, then, I may observe, that a fracture may be without any displacement at all, as when the tibia is broken transversely a little way below the knee-joint: the bone is there so thick, that the fracture will scarcely admit of any displacement. Also, when the upper and thick part of the ulna is broken, and the radius is perfect, there is

usually no material degree of displacement. The same fact is often exemplified when the upper portion of the fibula is fractured, while the tibia continues entire. The displacement may either be *immediate* or *secondary*. When immediate, it is produced by the same violence as produced the fracture: thus, the wheel of a heavy carriage may pass over a person's leg, and break it, and at once produce a displacement of the broken ends of the bone. A musket ball may have the same effect. Here the displacement is *immediate*. *Secondary displacement* may arise from two or three causes, the principal of which is the action of the muscles; but the weight of the limb will also be concerned in its production, if the injured part be not properly supported, or carefully carried. There are several kinds of displacement, in regard to the direction in which it may take place; first, it may happen *in the direction of the diameter of the bone*, as seen in a transverse fracture. In such a case, the two ends of the fracture may be either partially in contact, or not at all: in the latter case, the displacement in the direction of the diameter of the bone must obviously be very considerable. In some cases, the displacement is *longitudinal*, as is most frequently noticed in oblique fractures, where the surfaces of the broken bones slip or glide over each other, the lower portion being generally drawn upwards, and the limb consequently shortened. But the *displacement* may take place *in relation to the axis of the bone*, the two fragments forming an angle, so that the axis of one portion of the bone does not correspond to the axis of the other fragment. This is termed the *angular displacement*. A fourth description of displacement is the *rotatory*, in which the lower fragment of bone is twisted inwards or outwards. Thus, in fractures of the thigh-bone, the lower portion of it will generally be twisted or rotated outwards by the action of the muscles and the weight of the foot. A fifth description of displacement is not seen in the generality of fractures, but only in particular ones; and consists in the upper detached portion of a fractured bone being drawn away from the lower part of it by the muscles attached to it. Examples of this displacement are seen in fractures of the olecranon and patella, in which the muscles draw up the upper fragment away from the rest of the bone.

With regard to *the causes of* these several forms of *displacement*, they are of various kinds: a bone is often broken by a fall; but sometimes by blows or kicks; the fall following the fracture and aggravating any displacement, which the injury, producing the fracture, may already have caused. In some instances, the weight of the limb may displace the fracture in the direction of the axis of the bone. Thus, in a fracture of both bones of the leg, if the limb be laid upon its outer side, and the lower part of it be not duly supported, there will be an inclination of the inferior part of the tibia too much outwards. But, of all the causes of displacement, the action of the muscles is by far the most common, the most powerful, and the most difficult to counteract. Its usual effect is to draw the lower portion of the fractured bone upwards, or to make it, as the phrase is, *ride* over the upper fragment. The muscles, principally concerned in causing the displacement, are those, whose insertions are below the fracture. Thus, when the humerus is fractured between its head and the insertion of the pectoralis major, this muscle, together with the latissimus dorsi and teres major, will draw the lower portion inwards. The fibres of the deltoid, it is true, may have some tendency to pull the upper fragment outwards; but it is the muscles specified which have the greatest share in occasioning the displacement. The same principle lets

us understand, why it is so troublesome to maintain the lower end of the fracture in its right place, when the thigh is broken; for the muscles of this part of the body are remarkably strong and numerous. Arising from the pelvis, which they make their fixed point, they are inserted into the femur below the fracture, and also into the patella and bones of the leg, which parts are their more moveable attachments, and consequently disposed to be drawn up by them more or less towards the pelvis. In fractures of the leg, the gastrocnemius, the soleus, and the peronei muscles, all tend to draw the lower portions of the fractured bones to the outer and posterior side of the upper fragments.

*Prognosis.* Those broken bones which have the greatest number of muscles attached to them are usually the most difficult to repair without deformity, because the muscles are the principal cause of the ends of the fracture being displaced; and when the muscles are numerous, or particularly strong, more difficulty is experienced in counteracting their influence.

Fractures of the long cylindrical bones, near large joints, are generally more serious accidents than other fractures situated in the middle portion of such bones, because in these no risk of inflammation of the synovial membrane, of abscesses, or anchylosis is induced, one or more of which consequences are exceedingly apt to supervene, if the fracture extend into or near a joint. *Compound* are more dangerous than simple *fractures;* for, the inflammation is more violent, the constitutional symptoms more severe, and, if the wound in the skin cannot be united by the first intention, large abscesses may ensue, and the case will sometimes take so bad a course, as to render amputation necessary. Indeed, when bad compound fractures are cured, it is frequently not until after long confinement in bed, repeated abscesses, or even sloughing, many exfoliations, and severe and protracted hectic disturbance of the system. In compound fractures near the ankle, an anchylosis of the tibia and fibula to the tarsus, and of the bones of the tarsus to one another, may follow. However, anchylosis is not the invariable consequence of a fracture close to a joint. A *comminuted fracture*, and also one in which the bone is broken, not exactly into a great number of fragments, but only in two or three places, are more serious than if it had only been broken at one part. A similar remark applies to the case, in which there is a fracture in two different portions of the same limb, as, for instance, in the leg and thigh together; here it would be exceedingly difficult to effect a cure without deformity, far more difficult than if there were only one fracture in the leg or thigh. In *oblique fractures*, as the lower fragment has a tendency to glide over the upper one, the chance of deformity is more serious. *Longitudinal fractures of the cylindrical bones* are generally severe cases, because they rarely occur, except from the effects of gunshot wounds, and are liable to extend into joints. At one time, so few specimens of this sort of fracture had been preserved, that the reality of it was a matter of dispute; but it is now known by military surgeons that it frequently takes place, and Cloquet has given an account of some fractures of this kind, which occurred in individuals who had been crushed and buried in the ruins of a building. *Complicated fractures*, or those accompanied with a wound of a considerable artery, a dislocation, previous disease of the bones, or an insane and unmanageable state of the patient, or with various other perplexing circumstances, are rendered more difficult of cure by these complications. In the museum of the University College, is a preparation, exhibiting a fracture of both

bones of the leg in two places, which accident was complicated with hemorrhage; the treatment tried was pressure, which, I think, afforded little prospect of success in preventing hemorrhage, either from the anterior or the posterior tibial artery. At all events, the result was mortification; indeed, injured in the degree in which the limb was, it was certainly in the worst possible condition for bearing pressure, which, besides being injurious to the soft parts, could have had little operation on either of the arteries specified, whichever it might be, that was the source of the bleeding. Here, if taking up the femoral artery were unadvisable, and cold applications would not have answered, it might have been better to have amputated at once, according to the rule which I mentioned when speaking of gunshot wounds, namely, that very bad compound fractures, accompanied by the injury of a considerable artery, are cases for immediate amputation. In this case, not only was the limb not saved, but the patient lost his life. Fractures of the lower extremities are generally more serious than fractures of the upper ones, for they are more difficult to reduce, and keep reduced, and complete union requires a longer period of time for its accomplishment. Fractures in debilitated and aged persons do not get well so soon as in healthy and young people: in infants and children it is really surprising with what quickness and facility fractures are repaired, and this notwithstanding the impossibility of keeping such patients duly quiet and in the right position. Fractures of the neck of the thigh-bone, *entirely within the capsular ligaments*, occur most frequently in old persons. Now, partly from the patient's age, partly from the difficulty of maintaining the surfaces of the fracture in co-aptation, and partly from the scanty supply of blood to the pelvic fragment of the femur (the only supply of which is through the medium of the vessels of the round ligament), it is exceedingly difficult to bring about bony union, so difficult, indeed, that it was at one period often supposed to be impossible to effect it. When fractures are accompanied by certain diseases, as syphilis, scrofula, scurvy, rickets, &c., the prognosis should always be guarded; the friends of the patient should be apprised that the unfavourable condition of his health may have disadvantageous effects on the process by which nature brings about the union of a broken bone. I have, however, attended many ricketty children for fractures, and generally found that their bones unite again with tolerable readiness. In such individuals, the bones are more easily broken it is true, but I have not met with any very great difficulty in bringing about the reunion of them.

The danger of fractures depends more on the injury done to the soft parts, or on the state in which they are placed by the accident, than on the affection of the bone itself. The injury of the bone, abstractedly considered, is not dangerous; and whatever bad consequences follow, will mainly depend either upon the degree of mischief done to the soft parts, or upon the inflammation of such parts, excited by the same violence that broke the bone; or upon the irritation of them by the spiculæ and sharp projections of the fracture. In short, the principal evils to be apprehended, will depend on the condition of the soft parts, produced by the manner in which they are affected by the fracture, or else by the same force that occasioned the injury of the bone. This is illustrated by what takes place in a fracture of the sternum, ribs, cranium, or spine; here the peril manifestly arises from the injury done to the important organs, which those parts of the skeleton are designed to protect. A fracture of the cranium is in itself an occurrence not likely to cause a

single bad symptom; but, if we take into the account the injury which may have been done to the brain, we shall see where the real danger lies; and, in the same manner, if we reflect, that when the ribs are broken, the lungs may be injured, or that when the vertebræ are fractured, the medulla spinalis is likely to be wounded or compressed, we discern at once that the danger depends not so much upon the state of the bones, as upon the effects of the accident upon other organs.

In the *treatment of Fractures*, several minute circumstances present themselves, which some persons may think of little importance, but which, as Dupuytren observes, being neglected, may lead to serious consequences. Thus, the precautions to be taken in stripping the patient of his clothes, and in transferring him from one place to another, so as to avoid subjecting him to cruel sufferings, and the aggravation of injuries already done to the soft parts; the situation, in which the patient should be placed; the form and degree of hardness or softness proper for his bed during the treatment; the manner in which the surgeon should proceed to dress his patient; the means of ascertaining the consolidation of the callus; and the advice to be given in this stage, are all so many points, which experience pronounces as needing great attention. If the case be a fracture of the leg, the patient's boots and stockings ought to be slit up, and not drawn off. If he be carried on a litter, or on a door, as the celebrated Pott was, the surgeon need not be in a hurry to remove him from it, until his clothes have been taken off, the bed well arranged, and the requisite apparatus has been prepared. In lifting the patient to the bed, an assistant must take the patient round the body, another by the two lower extremities; while the surgeon, or some other careful person, must take charge of the fractured limb. In fractures of the lower extremities, the patient should lie upon a firmish, unyielding bed, and his pillow is not to be large and high, which would cause him to slip downwards, and alter his position.

The *first indication* is the *reduction* or *setting of the fracture*, by which is meant, the bringing of the fragments into their proper situation, in relation to one another. Technically speaking, it is performed by *extension*, *counter-extension*, and *coaptation*. *Extension*, means pulling the limb in the direction away from the trunk, in order to obviate the retraction of the lower fragment. Now, it must be evident that, if extension alone were employed, the whole limb and the body too would yield, and be drawn in the same direction, and the patient would perhaps be pulled off his bed; it is necessary to prevent this inconvenience, by what is called *counter-extension*, that is, by pulling the upper part of the broken limb in the opposite direction. I need scarcely say, that some cases will not require extension and counter-extension at all; there may be no displacement, and then such proceedings would only be putting the patient to useless pain. Extension, counter-extension, and coaptation, when they are necessary, should always be performed with the greatest possible gentleness, no more force being exerted than is absolutely indispensable. Whenever there is displacement, they are manifestly proper; but, under other circumstances, that is, when a bone is broken, and the ends of the fracture are not at all out of their right position, the attempt to make better what is already right, is too absurd to require any comment. Modern experience teaches us also, that not one quarter of the force is necessary for the purpose of reducing broken bones, that was formerly resorted to, because surgeons of the present day avail themselves of the advantages, derived from the relaxation of those muscles which have the

chief power of displacing the fragments. Thus, in a fracture of the bones of the leg, the powerful muscles of the calf are relaxed by bending the knee, by which means the displacement may be obviated with little difficulty, and with the employment of less force, than would otherwise be necessary. The same thing is illustrated in the case of a broken thigh; but here the exact position, which, in Pott's opinion, has the greatest effect in relaxing the principal muscles capable of disturbing the fracture, is unfortunately not that in which the most effectual mechanical means for maintaining the reduction can be employed. The principle of relaxing the muscles, therefore, I think, should not completely preponderate over all other influential circumstances. It was noticed by Desault, that what is gained by the relaxation of one set of muscles, is lost by the increased tension of others: this is another fact, which should not be forgotten, and, at all events, in whatever position the limb is placed, there is an abundance of muscular fibres capable of producing a considerable and very troublesome displacement of the fracture. This circumstance deserves particular attention, because it enables us to understand, that we must not depend entirely upon position for effecting the end we have in view, but that we should bring to our assistance every other means within reach. As in oblique fractures of the long bones, there is mostly considerable displacement, greater extension will be demanded, than in the case of a transverse fracture. The latter kind of accident generally requires but little extension, merely just what is sufficient to lessen the friction and pressure of the surfaces of the fracture against one another at the period of coaptation; indeed, in such a case, there is seldom any retraction, and whatever displacement exists is of other descriptions.

When extension and counter-extension are practised to obviate the retraction, or shortening of the limb, no unnecessary force should be exerted; the bone should be pulled steadily and gently in the natural direction of its axis, until it resumes its proper length, and then the two ends of the fracture are to be adjusted, or, in technical language, *coaptation* is to be performed. From an early coaptation of the ends of a fractured bone, the patient will experience much less pain than from the operation at any subsequent period, because inflammation has not yet had time to commence. Severe spasms are noticed by Dr. Houston, as sure to be the consequence of extending a fractured limb, that has lain for any time in the flexed position. "Yet," says he, "even with the certainty of giving rise to temporary suffering of this kind, I would not be deterred from the operation, having often found, even after spasms, pain, and high inflammation had set in, by bringing the broken fragments properly together, and placing them so that no motion could take place between them, that a check has been given to the cramps of the muscles, and relief from pain procured. The momentary suffering, caused by such a procedure, will be amply repaid by the subsequent ease, and good final result."* The maxim of always setting a broken bone as soon after the accident as possible, and that of not allowing the displacement to continue, though inflammation may have come on, receive the approbation of all surgeons of judgment and experience. In certain cases, a good deal of trouble arises from continual spasms of the muscles; and, if the patients be strong and athletic, it will be advantageous to bleed them freely, and put them under the influence of opium or morphia, and then the reduction will be more easily accomplished and maintained.

* See "Dublin Journ. of Med. Science," vol. viii. p. 490.

Dr. Houston has published some interesting cases and remarks in favour of treating fractures of the lower extremity in the straight position. This position, he maintains, is the best for stopping the spasms, which, in many cases, prove a source of considerable suffering and perplexity. He argues, that the spasmodic contractions of the muscles surrounding a broken bone, appear to be wholly the result of the unusual condition into which these organs are thrown by the loss of the customary support of the bone, and aggravated, perhaps, in some instances, by the irritation of pointed fragments. In fractures of broad portions of bones near joints, as of the condyles of the femur, head of the tibia, or lower end of the humerus, and in fractures of one of the bones of the leg, or forearm, he finds, that patients scarcely ever complain of startings in the injured limb, because, in such examples, notwithstanding the fracture, the muscles enjoy a mechanical support, which keeps their origins and insertions at fixed distances apart. Taking a completely opposite view to that of Pott, Dr. Houston believes, that the primary cause of spasms of the muscles in fractures is the loosening of one or other of their fixed points of attachment, and that, by leaving them in a loosened state, or giving one set of muscles a greater degree of relaxation than another, such as is communicated to the flexors, by bending the limb, a check to their movements is not likely to be produced. Dr. Houston considers it well proved, that no degree of injury, unless accompanied by fracture, is followed by spasms of the kind here alluded to; that no fractures, except those of the limbs, give rise to those spasms; and that, even in the latter examples, if the ends of the fracture are so circumstanced as not to admit of derangement from the action of the muscles, there will be no spasmodic affection of the limb. Hence, he makes the following inference, that, for the prevention and relief of this harassing symptom, the fragments should be restored to their original places, and immoveably retained in them, all hurtful pressure being avoided.*

The *second indication consists in preventing the return of the displacement;* or, in other words, *in keeping the ends of the broken part of the bone steadily in contact,* so that *nature may have a favourable opportunity of uniting them.* This indication is so plain as hardly to require explanation: the ends of the fracture must be kept motionless; for, if this rule were neglected, they would not be united by osseous matter, but an artificial or false joint be produced by the ends of the fracture becoming smooth, and joined together by a soft ligamentous substance. With the view of promoting this motionless state of the fracture, and keeping the muscles quiet, Pott and his numerous followers prefer maintaining the limb in fractures of the thigh and leg in the bent position; while others, as Dr. Houston, decide against this method, and insist upon it as a fact, that relaxation of the muscles, having a tendency to spasmodic contraction, excites and promotes such contraction; whilst, on the other hand, extension of them is declared to be the most likely way of preventing or subduing the spasmodic action. Instead of adopting this explanation, I feel assured, by long experience, that the straight position is generally the most advantageous for a broken thigh, not for the reasons given by Houston, but because it admits of a more efficient apparatus being applied than can be used in the bent position, and especially in the posture so erroneously advocated by Pott. In the extended position, Dr. Houston observes, the patient sooner becomes reconciled to the bed than in the bent

* See Houston's "Obs. in Dublin Journ. of Med. Science," vol. viii. p. 477. *et seq.*

one; he can be shifted more readily, so as to vary the points of contact between his body and the bed, and thus save himself from excoriations, or sloughing; he can assume the sitting posture, and maintain it with less fatigue, for a considerable time. A better judgment may also be formed of the length and shape of the broken limb, by its admitting of a comparison with the sound one. The limb can be kept more steady; and extension, if necessary, can be more readily and effectually practised.* These observations, I think, apply more properly to fractures of the thigh, than to those of the leg, which seem to me to be treated with the greatest possible success in a slightly bent position of the knee on M'Intyre's apparatus.

For the purpose of keeping a broken bone motionless, we have recourse to various mechanical means, consisting, generally, of long thin portions of wood, tin, or pasteboard, termed *splints;* together with pads, compresses, cushions, and bandages. Instead of splints, the use of plaster of Paris casts, and of what the French term *l'appareil immobile*, is sometimes advocated as the best means of fulfilling this second indication, especially in the treatment of fractures of the leg; but, for reasons which need not here be considered, this plan cannot be said to gain much ground. At the same time, the principle is universally acknowledged, that when once a fracture is properly set, the less the apparatus is meddled with the better, unless particular circumstances occur to render an examination of the part necessary, or some alteration of the limb, or the applications to it indispensable. These contrivances form what is called the *apparatus* for fractures. According to Desault, the moderate pressure of a bandage on the surface of a fractured limb assists in preventing cramps of the muscles of a broken limb; and this principle, which is also commended by Dr. Houston, is commonly acted upon in practice, except when the degree of inflammation present renders such pressure unadvisable. In order to prevent the hard splints from hurting the skin, we interpose between them and the integuments some kind of soft materials, such as pads filled with tow, wool, or chaff of oats, which is preferred in France. In fractures of the shoulder, and of the bones of the upper extremity, a *sling* is another contrivance of great service; for it not only supports the limb in the most desirable position, but keeps it as quiet as the leg would be by confining the patient in bed. In other words, a sling is as useful for fractures of the upper extremities, in keeping the parts quiet, as the recumbent position is for fractures of the lower limbs, with this additional advantage, that, as the patient is not confined in bed, he can take exercise, and his health is less likely to suffer. The sling should never be omitted, when the clavicle, scapula, humerus, bones of the forearm, or those of the metacarpus and fingers, are broken.

Sometimes almost every thing is effected by the relaxation of certain muscles, or by position, without splints, which could not act either directly or effectually on the fracture. For instance, in fractures about the shoulder, affecting the scapula or clavicle, the treatment is conducted altogether without splints. Then, in certain other cases, splints are indeed used, not as a temporary substitute for the bone, nor as a means of giving support and steadiness to the part for a time, but for the sake of keeping the limb in a particular position. Thus, in fractures of the neck of the thigh-bone, splints are used, not to support that particular part of

* See Houston's "Obs. in Dublin Journ. of Med. Science," vol. viii. p. 489.

the bone, but to maintain the limb quiet in a determinate posture. In fractures of the patella and olecranon, the same fact is illustrated: in these cases, splints are not employed on the principle of affording lateral support, as in a common fracture of the thigh or leg, but to retain the limb in a particular posture. Here splints could have no direct action on the fractured part.

Besides bandages, pads, compresses, and loops of tape, other contrivances form parts of the apparatus for fractures, as, for instance, what is called the *double oblique plane*, on which the lower extremity may have the advantage of the bent position, though the patient lies on his back: it is often used for fractures of the leg, and of the neck of the femur, and for oblique, and other fractures of the shaft of that bone. The *foot-board* is an essential part of the double oblique plane, as without it the limb would receive but indifferent support. In general, the foot-boards of the best double oblique planes are so constructed, that their situation and the angle of them can be altered and regulated according to circumstances. *Fracture-beds*, or beds invented expressly for the accommodation of patients with bad fractures, *fracture-boxes*, and contrivances to keep off the weight of the bed-clothes, called *fracture-cradles*, are other mechanical aids sometimes resorted to. Thus, in fractures, when much inflammation exists, the patient frequently cannot bear the weight of the bed-clothes; and then the cradle is found convenient. Common beds, intended for the reception of patients with fractures, should be furnished with hard unyielding mattresses, and not soft feather beds, which soon sink in the centre, and not only have an unfavourable effect on the patient's posture, but render his condition very uncomfortable. Fracture-beds are now brought to great perfection; and when the patient is likely to be confined for a long time with a severe compound fracture, or a fracture of the spine or pelvis, I would recommend him to procure, if possible, a fracture-bed, which will enable him to obey the calls of nature without any disturbance of his body or limbs, and which, if necessary, may be converted into a double oblique plane. It also allows the head or chest to be raised or lowered without the slightest disturbance of the fracture, or any effort of the patient himself, who may even be inclined to either side, if such posture be required, in an equally quiet manner. What is termed a *fracture-box* is intended to hold the limb securely and steadily, with the assistance of cushions and pads; it consists of a bottom-piece, two sides, and a foot-board; a soft cushion, or pad, is laid along the bottom of it, and the lateral pieces, which have hinges, and are fastened with straps, are also kept from hurting the integuments with soft cushions or pads, calculated to fill up the interspace between them and the limb. A fracture-box is of great service in the treatment of some bad compound fractures, requiring to be dressed every day; but in University College Hospital, it is not employed, because M'Intyre's apparatus, there preferred, answers every purpose.

*Process by which broken bones unite.* A solution of continuity in the soft parts unites with wonderful quickness, the cure by adhesion taking place in a few hours. The process of union in bones is slower and more complicated, nature requiring a longer time for the reparation of a fracture than for the union of a wound, and the process not being, in the first case, so simple, clear, and manifest. Even at the present day, with all the assistance of experiment and actual dissection, different statements and theories are advanced by different authorities. A few years ago, lecturers on surgery got over this subject very easily, and those teachers,

whom I happened to attend, explained the matter in a concise and summary way, by stating, that the only difference between the union of bone and that of soft parts, was, that the coagulating lymph, effused between the ends of a fracture, gradually acquired the consistence of cartilage, earthy matter was deposited in it, and thus the bone was united, and acquired its former strength, the only particularity being in fact the deposit of phosphate of lime in the uniting medium. But, even before the time alluded to, considerable progress had been made in the investigation of the process by which broken bones unite, and great merit is due to Du Hamel for the success with which he examined this part of surgical pathology. After making numerous experiments to ascertain the steps adopted by nature in uniting broken bones, he inferred that the periosteum and the medullary membrane were the sources of the new bony matter, or *callus*, as it is called, or of the substance which was the means of union. The periosteum and the medullary membrane he considered as the exclusive organs of ossification. He maintained that, in the process by which a broken bone is united, the periosteum, covering the end of one fragment, grows to that of the other, and then swells and forms a rising round the fracture. In the swelled portion of the periosteum, he described vessels as becoming developed, and depositing specks of osseous matter, which formed a kind of osseous ferule, or hoop, directly round the fracture. Now this explanation partly agrees with later observations, and especially with those made with so much care by Baron Dupuytren. Besides the changes leading to the production of the *external callus*, Du Hamel found, that the medullary membrane was not inactive, but contributed its share to the promotion of union in nearly the same degree as the periosteum. One error in Du Hamel's theory, however, was the supposition, that the bony ferule would permanently remain, as the bond of union. It is occasionally asserted, that the periosteum is exclusively the organ of ossification. Without entering into a minute consideration of the objections to the latter opinion, be it sufficient to say, that callus, or new bony matter, is often produced in parts where the periosteum is totally destroyed; and it is well known, that the patella may be united by bone, although it is not furnished with a periosteum at all; it is true, that it rarely unites by osseous matter, when broken transversely, but when it is fractured by external violence, or in the longitudinal direction, osseous union is not an uncommon result.

Bordenaave, having had an opportunity of examining a bone that had been formerly broken, and long united, and, finding no bony ferule in the situation of the previous fracture, conceived that Du Hamel had been mistaken, and he therefore espoused the doctrine, that union is accomplished by the vessels of the bone itself, and that they effuse coagulating lymph between the ends of the fragments, which lymph is first converted into cartilage, and finally into an osseous consistence. Baron Larrey also rejects the theory, that the periosteum is the organ of ossification, and he adverts to examples, where, although portions of the cranium had been removed, and the pericranium had been destroyed to a considerable extent, nature made considerable efforts to repair the loss. In young subjects, especially, such efforts may indeed accomplish a great deal, and, I think, we must acknowledge, that the facts and arguments, brought forward by Larrey, amount to a refutation of the opinion, that the periosteum is exclusively the organ of ossification. The experiments of Dupuytren, Villermé, and

Breschet prove, that all the doctrines to which I have adverted are too limited; for, whenever a bone is broken, the soft parts around the injury are more or less contused and torn, and it is alleged, that not only the periosteum and medullary membrane, but also the soft parts around the fracture, the cellular tissue, and muscles, or rather their vessels, are concerned in repairing the injury of the bone. It was found, that when the ends of the fragments were kept steadily together, they became surrounded by a swelling and a subsequent ossification of the soft parts, and that, in this manner, a kind of external case was formed to include and support the ends of the bone. This first production corresponds with Du Hamel's bony ferule; for, as I have said, he noticed that a sort of bony hoop is produced around the fracture. Dupuytren calls this hoop or ferule the *provisional callus*, because it is only a temporary production, and is absorbed as soon as it has fulfilled the purpose for which it is designed, namely, that of acting as a splint, or means of support to the broken part of the bone, until nature has had time to bring about a more complete and direct union of the ends of the bone themselves.

In the *first stage*, then, of the union of a fractured bone, comprising a period of about ten days, there is merely a swelling of the soft parts around the fracture; and, on examination of the limb in the dead subject, the swelling appears to consist of a reddish substance, as would seem from the quantity of blood effused. The swelling is greatest or thickest opposite to the fracture, and gradually diminishes above and below the injury, till it is completely lost in each of these directions. About the *tenth day* the redness has disappeared, the blood being now absorbed, and coagulating lymph effused. At this time, a reddish vascular spongy substance is formed between the ends of the bone, which substance is not itself of an osseous nature; but in the swelling, around the fracture, specks of bone now begin to be deposited, a change, or new action, characterising the beginning of the *second stage*, which extends from the tenth until the twenty-fifth day. During this second stage, then, the effused lymph on the ouside of the fracture becomes ossified; it first assumes a fibrous structure; it then becomes cartilaginous; and, by degrees, calcareous matter is deposited in it. In the meanwhile, similar changes are going on in the medullary membrane, so that, in the process of union, nature is labouring without and within the bone to give it a temporary means of support, and steadiness, while the principal and permanent work of ossification is as yet only preparing for commencement.

The bone is still capable of partial flexion; the ends of the fracture not being yet consolidated.

In the *third stage*, extending from the twenty-fifth day to the end of the sixth or eighth week, the external swelling becomes completely ossified and firm; the internal medullary membrane undergoes the same change; but the ends of the fracture are not united, and the bone is only strong from the support received from the external and internal osseous formations. The ends of the fracture themselves are not yet consolidated directly together, and the bone may still be broken again, or bent, by any violence or weight applied to it in a careless way.

The *fourth stage* extends from the sixth or eighth week to the end of the fifth or sixth month, during which time the external or provisional callus has become completely ossified, and even covered with periosteum. The ossification of the medullary membrane is also perfected; and the ends of the bones themselves being now truly united to one another by bony matter, the former solution of continuity is hardly distinguishable.

The *fifth stage* reaches from the fifth or sixth month to the twelfth. During this period, the external provisional callus is absorbed and removed, and the direct union of the fragments is so strong, that it would be as difficult to break the bone in the situation of the former fracture as in any other place. For a certain time after the injury, the medullary cavity is filled up by a kind of internal provisional callus, obliterating, as it were, the cavity of the bone. These final changes take place in the interval between the sixth and the twelfth months: then all irregularities are removed; the external callus is absorbed, and the medullary canal restored.

In the museum of the College of Surgeons, there is a bone which is united in such a way, that a portion of the medullary cavity is turned outwards, instead of inwards, a large splinter having been entirely detached: yet union took place. Long splinters and fragments frequently unite, but they sometimes perish, and fall into the state of necrosis.

The source of the external provisional callus is not then exclusively in the vessels of the periosteum; the surrounding cellular tissue and muscles having a share in the production of it, and this, in a still greater degree, when the ends of the fracture are considerably displaced. The formation of the definitive, or permanent callus, which follows that of the temporary one, is not completed till the eighth, ninth, or even the tenth month after the accident; but as, when it is finished, the provisional callus becomes unnecessary, nature then takes away, not only the external provisional callus, but also that which is formed in the medullary cavity, and this becomes restored to its original state. All these changes, however, are not brought about until long after the occurrence of the fracture, much longer than was formerly supposed.

The provisional differs from the definitive callus, not only in its situation and duration, but also in its lesser consistence and solidity. When it is finished, it only possesses the strength necessary to resist the action of the muscles, and the weight of the part; nay, there are cases in which, on the removal of the splints, it will yield to these two forces, especially in oblique fractures; and it is of consequence for the surgeon to recollect this fact, namely, that the limb may be straight so long as the splints remain applied, but that from the too great weight on the limb, or the too powerful action of the muscles, after the removal of those supports, deformity may still ensue. If the splints are removed too soon, or the part be used too roughly and boldly, while the strength of the fractured bone depends entirely on the external and internal provisional calli in a certain stage of their formation, it is possible that a degree of deformity may yet follow. Sometimes the strength of the provisional callus will be overcome by a shock or blow, or some other form of external violence, and sometimes by the effects of constitutional disease. I have seen patients with bad fractures, whose limbs had proceeded a certain way in the process of cure, when they were attacked with fever, and the provisional callus was so weakened, that it admitted of being bent with facility, though it had previously been quite inflexible. This fact proves that the provisional callus is weaker than the definitive one; and the knowledge of it is useful; for, supposing a limb to be badly set, if the provisional callus has only advanced to a certain stage, an attempt may yet be made to improve the shape of the limb. This has been done in France, with success; yet, it must be manifest, that the older the provisional callus is, the more difficult will it be to amend the shape of the bone, for the callus becomes firmer and more unyielding in proportion

as its ossification is more advanced. The definitive callus, though less bulky than the provisional one, is harder, stronger, and more compact, being indeed, when it is perfectly finished, stronger than the rest of the bone; and, if the bone be broken again, the fracture will not be in the situation of the definitive callus. Leaving out of present consideration the effects of scurvy, I may say, that the definitive callus is never destroyed by disease: in this respect also, it is stronger than the provisional callus, and whatever deformity may exist in the limb after the definitive callus is formed, cannot be lessened.

Hitherto I have been considering chiefly the process of union in simple fractures of the long cylindrical bones, which have been properly set. When the two ends of a fracture are in apposition only at one point of each of their surfaces, it can only be at this point that there can be any definitive callus of the ordinary kind; but, as a compensation for this disadvantage, the external callus is never entirely absorbed, but remains as a substitute for what would be the definitive one under common circumstances. When the two surfaces of the fracture are not at all in contact, but the ends of the bones touch one another laterally, strictly speaking, there is no provisional callus. In such a case, not only the periosteum, but the vessels of the adjacent cellular tissue and muscles, assist in the work of producing new bone, by which the two fragments are to be connected. The side of one fragment here becomes soldered by osseous matter to the side of the other, and whatever new bone is formed for this purpose, remains permanent, or, in other words, is a definitive callus. Lastly, in compound fractures, attended with suppuration, the bones remain disunited for several weeks, and then union takes place in a different manner from what I have been explaining. In this instance, no provisional callus is produced; but at the end of several weeks, the ends of the bone soften and granulate, and in proportion as the secretion of pus subsides, the granulations of the surface of the fracture deposit osseous matter, or, as the French pathologists say, they are themselves converted into bone. It appears then, that the process of union in compound fractures is different from what it is in simple ones; and it will generally be found, that the greater the degree of displacement of the fracture, and the greater the injury done to the surrounding soft parts, the less will the work of producing the external provisional callus be confined to the periosteum.

Broken cartilages do not unite by cartilage but by bone; osseous matter is deposited around the part, forming a kind of hoop or ferule, which is alleged to be formed by the vessels of the perichondrium. This mode of union is exemplified in fractures of the cartilages of the ribs. Fractures of the patella, olecranon, condyles of the humerus, and coronoid process of the ulna, generally unite by means of a fibrous ligamentous substance, and the acromion, when fractured, may also unite in the same manner.

Different bones require different lengths of time for the union of their fractures. In the upper extremities, fractures are sooner cured than in the lower ones; the ribs and clavicle are generally united with tolerable firmness in about a month, and even sooner in young subjects. Fractures of the humerus require about six weeks for their reparation; but those of the tibia and femur are not firmly united before the eighth week. When I speak of bones being *firmly united* at particular periods, I allude only to that firmness which is derived from the provisional callus, and do not mean that the definitive callus has been produced. The latter work,

which may be regarded as the completion of the cure, is one that is not accomplished till a much later period.

The time required for the union of a broken bone will also be much influenced by the age of the patient, his state of health, the kind of fracture, and the efficiency or inefficiency of the treatment. A compound fracture, and a very oblique fracture, are longer in uniting than a simple one, which is either transverse, or of less obliquity. In infants, a broken bone will make as much progress towards a cure in a week or ten days as it would in a month in an adult. When the bones of infants happen to be broken during parturition, they are generally united with considerable firmness in a week or ten days. The tendency to quick union is strongly evinced during the development of the skeleton, that is, while the individual is growing; and, I may say, that it is most considerable while this development is taking place with the greatest vigour. Hence the impossibility of keeping children quiet does not seem to interrupt the process by which a fracture unites; and however much they may move and toss themselves about, the injury is generally repaired with wonderful expedition. This is a circumstance which should always be remembered in the treatment of fractures in children; for, if these accidents are not vigilantly attended to during the first ten days, and the position of the broken bone is neglected, we may afterwards find the process of union too far advanced to admit of the shape of the limb being rendered better again. Circumstances are different in the adult, in whom the ossific process does not actually commence till after the tenth day; a fact which led Sir Stephen Love Hammick, and some other surgeons to defer the application of splints during such space of time, and merely to employ cold lotions, with the view of keeping down inflammation. This practice would not be advisable in children; for, after the ten days had elapsed, we should most frequently have to regret the omission of splints, by means of which, in the early stage of the accident, we might have had effectual command over the shape and direction of the limb, but which would now perhaps be irremediably deformed.

As a general rule, Dupuytren recommended the apparatus to be kept on for twenty-eight, or thirty days, in children; forty in adults; and a much longer time in aged persons. It ought not to be removed until we have ascertained that the consolidation is complete. In order to be sure of this, the surgeon lays hold of the two fragments, and cautiously tries if he can produce any motion between them. If the callus yield, the apparatus must be reapplied immediately; if it do not, the splints may be discontinued, and the part merely supported on each side with a piece of thick pasteboard. At this period, it will not be safe to let the patient walk immediately; for the callus may give way under the weight of the body, or the action of the muscles. He must be kept quiet in bed for ten days, or a fortnight longer. He may then sit up in his bed, or in an arm-chair, with his limb rolled, and on a pillow. Crutches may next be given him, and they should be tipped with cloth to prevent them from slipping on the floor. If possible, the patient should not attempt to go up and down stairs, nor to walk in slippery or uneven places.

The process of union is retarded by old age, and by every temporary disturbance of the system: such as an attack of fever or erysipelas. The union then proceeds more slowly, or may even be completely suspended. The process is retarded also by several of those diseases which sometimes operate as predisposing causes of fractures; as, for instance, certain diseases which weaken the texture of the whole skeleton, or that of particular

bones, the chief of which are rickets, fragilitas, and mollities ossium, cancer, scrofula, and, as some allege, the venereal disease in its advanced stages; but, with regard to this last disease, I must observe, that it is disputed whether the condition of the bones may not be brought on rather by the mercury which is given for the cure of the disease, than by the disease itself. Pregnancy is generally set down as one of the causes impeding bony union, and it is even asserted, that fractured bones in pregnant women will not unite until after delivery; but this is not always the case, for I once attended a woman, who lived in the neighbourhood of St. Paul's, who fractured both bones of her leg in the fifth or sixth month of pregnancy; yet I found that the fracture united favourably, and in about the usual time.

Another circumstance, sometimes retarding the union of a fracture, is the lodgment of a dead portion of bone between the ends of the two fragments. In the museum of University College are several preparations exhibiting this fact.

In the writings of Schmucker, an interesting case is related, in which a portion of dead bone was lodged between the fragments of a broken tibia, and retarded the uniting process for eight months; at the end of which time an incision was made and the sequestrum taken out, after which the union took place in three or four weeks.

The continuance of a fracture in a disunited state depends sometimes on constitutional causes, and sometimes on circumstances directly affecting the broken bone itself. Among the latter causes, I may specify a total want of apposition between the two ends of the fracture. If the bones do not touch at all, there will probably be no union, or more time will be required for it.

Another circumstance, contributing to prevent union, is moving the fractured limb too frequently, or even continually, by which the ends of the bone are prevented from being in steady apposition. We shall find a remarkable proof of this recorded by Baron Larrey. When the French army was retreating from Syria, there were among the wounded a great number of soldiers with compound fractures, whom it was necessary to place on the backs of dromedaries and camels, in order that they might travel with the rest of the army: for if they had been left behind they would have been murdered by the Turks and Arabs. They were obliged to continue their retreat day and night for several weeks, jolted very roughly in this mode of travelling; the consequence of which was, that many of these fractures did not unite by osseous matter, and were sent to Marseilles, a year after the period of the retreat from Syria, still uncured. Too much motion of a broken limb is, then, one of the circumstances impeding the favourable union of fractures, and occasions what is called a *false joint;* indeed, one of the principal indications in the treatment of fractures is to prevent all motion of a fractured part.

One occurrence, sometimes impeding the union of fractures, and first pointed out, I believe, in my writings, is the interposition of a portion of muscle between the ends of the broken part of the bone. I have been present at one or two dissections, in which the want of union was ascertained to be produced by this cause. In one of these instances, in which the humerus had been fractured obliquely, the lower fragment, the end of which was sharp, had been drawn up into the biceps muscle; consequently, there was no apposition of the ends of the fracture, as a quantity of muscle intervened between them.

The greater number of fractures, not uniting by bone, are either in the

patella, neck of the thigh bone, or shaft of the humerus. With regard to the humerus, I may observe, that most of those fractures, which do not unite by bone, take place just below the insertion of the deltoid: here the upper fragment is pulled outwards by this muscle, while the lower one is drawn inwards by the coraco-brachialis. The failure of union, therefore, seems to depend upon the non-apposition of the ends of the fracture; and, perhaps, upon the disturbance by the action of the muscles in question.

Besides these cases, false joints or union by ligament may also happen in other bones, or other parts of bones; thus sometimes a fracture of the shaft of the femur will either not unite by bone at all, or very tardily; fractures of the lower jaw may fail to be reunited by osseous matter, or the process may be very late in its completion. A few years ago, there was a man in the Queen's Bench with a fractured radius, which had been in that state a long while, and there was not the slightest degree of bony union. A fractured tibia, too, will sometimes not unite in the regular way. I have seen two cases which did not unite by bone for nearly two years, though they were both simple fractures.

From these general observations on the *first* and *second indications* in the treatment of fractures, and on the nature of the process by which broken bones are reunited, I now proceed to the consideration of the *third common indication*. After the broken bone has been reduced, or set, and means have been taken for retaining the ends of the fragments in apposition (for these are the objects aimed at in the two first indications), it is necessary, in the next place, to attend to any unpleasant symptoms or circumstances likely to arise, or which may have already followed; for example, there may be an unusual degree of pain from various causes, swelling from effused blood, a severe degree of inflammation, erysipelas, the formation of abscesses, &c. Now any or all of these circumstances may follow the setting of a fractured limb. When pain occurs, we ought to ascertain, that it does not arise from the immoderate pressure of bandages, or badly padded splints. In either of these cases, the mode of relief is manifest enough; we are to undo the bandages, and either leave them off for the present, or put them on again in a more skilful manner. For the prevention of inflammation, the chief means is undoubtedly quietude of the part, which the favourable progress of the cure requires on another account, namely, for the purpose of preventing the displacement of the ends of the fragments; but, while quietude is enforced, other measures should not be neglected; as, for instance, low diet, which, however, can only be continued for a few days, because its effects will be to retard the formation of the callus, in the same manner as too much bleeding, or any other weakening plan, is known to do. For fractures, abstractedly considered, bleeding is never requisite; but we bleed when the injury of a bone is attended with much contusion of the soft parts, a description of mischief generally greatest when the fracture has been produced by direct violence, as by a blow, or a kick. Hence, considerable swelling, and sometimes laceration of the skin and muscles, are often produced by the same violence which breaks the bone. Under these circumstances, the bandages and splints should never be tightly applied at first; and sometimes it is most advisable to refrain from making any kind of pressure with them till the inflammation has subsided, and have recourse to cold evaporating lotions, and bleeding, in a degree proportioned to the patient's age, strength, and constitution, or to the violence of the contusion. Under such circumstances, many good sur-

geons do not think it right to apply splints at all for some days, but endeavour to keep off and subdue inflammation by means of cold evaporating lotions, bleeding, and leeches; they put the limb or part in an eligible position, and, applying no bandages, merely lay a piece of linen on the part wetted with the cold lotion. The practice of omitting the use of splints in the early part of the treatment is not generally commendable, though the inflammation and swelling may occasionally render it indispensable. As the common maxim, I should say, that the sooner the splints are put on the better; but they must not be applied too tightly at first. As for bandages, they had better not be put on when much inflammation and swelling prevail; folded linen, wetted with a cold lotion, will be much more useful, and not attended with risk of doing harm. Costiveness should be obviated; but as fractures of the lower extremities are liable to a hurtful degree of disturbance from frequent purgation, it is not advisable to carry the practice thus far. Leeches and cold lotions are the best topical remedies for the inflammation in the early stages of fractures; after a time, if there be any disposition to the formation of abscesses, fomentations and even poultices may be applied, but leeches and cold lotions are often preferable in the commencement of the case. We must not, however, allow too much disturbance of the limb to be produced by the employment of these, or any other applications; and if they cannot be put in practice, without this disadvantage, they had better be dispensed with. The best way of using cold lotions will be to squeeze them out of a sponge upon the eighteen-tailed bandage, roller, or folded linen, which may be upon the limb, so that the fluid may pass between the splints, and wet the bandage or linen without the splints being taken off at all. When the limb is well set, its position right, and the bandages and splints skilfully applied, the less it is moved the better; this may be set down as an axiom in surgery, and it is a principle, which is so much valued by Baron Larrey, that after reducing the fracture, and putting it into the proper posture, he then makes use of an apparatus, which is not taken off till the bone has united. This practice is followed even in compound fractures. The apparatus is soft and flexible at first, and being wetted with a solution of acetate of lead, to which is added a little camphorated spirit and white of egg, it is afterwards converted into a stiff firm case, precisely corresponding to the shape of the limb, and consequently well adapted to keep up equable pressure upon it, without chafing or hurting the skin. Baron Larrey was led to adopt this mode of practice, in consequence of the necessity he was frequently under of moving patients in the army from place to place with bad compound fractures; for, by means of the apparatus here referred to, they could be moved any distance with the greatest security; and I may state, that his son, who has published a treatise on fractures, and in recommendation of the same principles, gives an account of several individuals who were moved, with severe compound fractures, great distances without injury: one individual had been brought to Paris from a place a hundred miles distant, the day after the accident.

If no pain is produced by the splints and other parts of the apparatus, and the fracture is well set, the less frequently they are taken off the better. However, with the ordinary plans pursued in this country, it would be unsafe not to examine the limb now and then, and, more especially, between the tenth and twenty-fifth days; for, if the process of ossification in the provisional callus were allowed to go on beyond this period, the fracture might unite in a bad position, and such deformity be

the result as would not afterwards be remediable. On the other hand, if the state of the limb be vigilantly attended to till the bone has *knitted*, as the expression is, less caution will afterwards be necessary, as the risk of the ends of the fracture changing their respective situations will now be considerably lessened.

## UNUNITED FRACTURES.

Sometimes fractures continue for a long time without evincing any disposition to unite; and, in other instances, they lose all tendency to be consolidated by osseous matter, the ends of the bone becoming rounded and smoothed, and connected only by a fibrous ligamentous substance. Now, when this mode of union takes place, the case is said to terminate in the formation of an *artificial joint*. A main point in the treatment of such fractures as have continued a long time without osseous union, is to ascertain the cause of the deviation from what is the usual course of things; for here, as well as in every other part of surgical practice, the cause of what is wrong should be investigated, because, as soon as it is removed, the effects will probably cease. Thus, if the continuance of a fracture in a disunited state were to depend on general indisposition or bad health, which could be removed, the cure of the injury of the bone would then, perhaps, admit of being accomplished; but sometimes the cause of want of union in the fracture, depends on a constitutional disease which is totally incurable. Thus, when no callus forms in a patient with cancer, there is little prospect of bringing about the union of the bone by osseous matter, because no means are known by which the original disease can be cured, or the patient's state of health materially improved. The same may be said of mollities and fragilitas ossium, and of some other constitutional affections, in which we have no means capable of leading to the re-establishment of a sound state of the constitution. However, many diseases, causing this backwardness in fractured bones to unite by osseous matter, do admit of cure; such are rickets, scurvy, and lues venerea in its advanced stages. In these instances we may hope, by proper treatment, to bring about such an improvement in the health as will be followed by a deposit of bony matter for the union of the fracture. It is certain, however, that diseased bones will sometimes unite. Sir Benjamin Brodie had a syphilitic patient, with an enlarged clavicle, which broke from some exertion of the arm, the fracture extending through the diseased part; yet this fracture united in the ordinary time. With regard to rickets, I have attended many children in this state with fractured limbs, and in all these examples, there was no remarkable indisposition of the broken bones to undergo bony union. Also with respect to a pregnant woman, whom I attended with a fracture of both bones of the leg, the bones united very well in about the usual time. I remember a woman in University College Hospital, who had cancer of the breast, and such fragility of her bones, that she had met with several fractures from slight causes. Twice she came into the hospital for such accidents, which ended favourably. Cases are met with, in which the formation of callus is kept back by illness excited by the state of the soft parts around the fracture, or occurring as an accidental complication. Thus there will sometimes be an attack of fever or erysipelas, in which events the formation of callus will be retarded as long as the general indisposition continues. Sir Benjamin Brodie has seen two cases where fractures did not unite, in consequence of the constitution having been impaired by a kind of

voluntary starvation, to reduce the *embonpoint* of the individuals: he also suspects, that too tight a bandage may sometimes impede the process of union.

Dr. Houston regards the doctrine as not being well established, which ascribes the imperfection in the formation of callus to the want of inflammatory action. In illustration of this point, he recites the case of an old woman who broke her thigh, and after she had continued in the hospital several months, without complaining of much suffering, the limb was surrounded with adhesive plaster, and she was able to walk about on crutches. "She did not, however, long survive her convalescence, and upon examination of the limb after death, it was discovered that, in addition to a transverse fracture of the middle of the thigh, a perpendicular one, four inches in length, ran up to the trochanter. The transverse lesion exhibited a perfect false joint, with fibrous capsule and synovial membrane, whilst the portion detached by the perpendicular fracture had become firmly and universally united to the original bone. The explanation usually given of the cause of such a failure, want of sufficient action, will not hold good in this case, as the action was fully competent to the reparation of the lateral fracture, though it failed in the transverse one. Want of proper apposition, and the frequent occurrence of motion between the two main pieces of the bones, were more probably the causes of non-union at this part."* Dr. Houston also adverts to an instance of a middle-aged man, in whom almost every long bone in the body had been broken at one time or another, from trifling causes; but notwithstanding great weakness of constitution, all these accidents were repaired with very little suffering, and in a moderate time. Unquestionably, there is sometimes great difficulty in explaining the cause of the failure of our endeavours to unite a broken bone; but generally some of the circumstances, to which I have referred, will account for it.

When the want of union is owing to the fragments not being properly in contact, or to the fracture not being well set, or to its being moved about too much, then the indication will be obvious — the bone must be better set — the fragments must be put in a state of more accurate coaptation, and such an apparatus employed, and such quietude of the limb observed, as will more effectually and steadily maintain the reduction. However, these means will only answer when an artificial joint is not completely formed; for, after this has happened, no improvement of the general health, nor any means calculated to render the limb more motionless, will be attended with success.

If there were interposition of any soft parts, such as portions of muscle, between the ends of the broken bone, and we were sure that such complication was the cause of want of union, and could not get the ends of the fracture together by freely extending the limb, and altering the position of the bones, we should then be justified in making an incision, and dividing the muscle interposed between the ends of the bone; but, I believe, the diagnosis would never be clear enough to vindicate such operation. In the same manner, if a portion of dead bone, a *sequestrum*, as it is termed, were to intervene between the ends of the fracture, and to prevent union, or retard it for a great length of time, the indication would be obvious enough; we should be required to make such an incision as would enable us to remove the sequestrum. Some fractures do not unite by bone, or do not readily admit of osseous union, in consequence

* Dublin Journ. of Med. Science, vol. viii. p. 493.

of anatomical circumstances. These are believed to have some considerable share in making it difficult to unite certain fractures of the neck of the thighbone by osseous matter. Fissures of the cranium are very slow in uniting.

When a fracture has remained a considerable time without union, and common measures have been found unavailing, various methods for expediting the process of osseous union have been proposed by surgeons. The most ancient is that of moving the ends of the broken bone freely upon one another, so as to excite a degree of inflammation in the parts about the injury; this plan has occasionally led to the establishment of the requisite process for the formation of callus. When John Hunter had occasion to treat patients in this condition, he sometimes made them get up and walk about with the splints on: I have seen this method tried at St. Bartholomew's Hospital, where it was not uncommonly resorted to at the period of my apprenticeship there. However, if an artificial joint be already formed, this plan will not have the desired effect, and other expedients will be necessary. One of these, first suggested by Mr. Charles White of Manchester, consists in making an incision down to the fracture, and dividing the ligamentous connexion, then turning out the two ends of the bone, and sawing them off; the limb being next carefully put up in splints, as in a case of recent fracture, and care taken that the two ends of the fracture are as correctly in contact as possible, and steadily thus maintained.

The first operation of this kind, performed by Mr. White, was attended with the most encouraging success: the case was one of a broken humerus, that had remained for a long time without bony union. The proceeding has been repeated by other surgeons, and with various results; sometimes the plan has had the desired effect, and sometimes it has not answered; nay, in certain instances, it has not only failed in procuring union of the bone, but occasioned loss of life. Richerand and Larrey mention cases which had this unfortunate termination. I remember a man in St. Bartholomew's Hospital, who broke his humerus, and the fracture, instead of uniting, led to the production of an artificial joint. In this example, Mr. Long cut down to the fracture and sawed off the ends of the bone; but, although this was most completely done, and the greatest care afterwards taken to keep the ends of the bone steadily in contact, no bony union followed. Of late years, therefore, surgeons have been more shy of resorting to White's operation, and not solely on account of its results having sometimes been so unfortunate, but also because another method has been proposed, which is, at all events, milder, if not more successful. The method, to which I allude, consists in introducing a *seton* between the ends of the disunited bone, in order to excite such inflammation in the situation of the fracture as may be followed by the formation of callus. Dr. Physic, of New York, proposed the seton, which he tried with success, first in a case of fracture of the lower jaw-bone, and afterwards in an instance of a broken thigh that had remained a long time without union. Experience has since proved, however, that the seton fails in a certain proportion of cases: I have seen two in which it did not answer, although it had had the fairest trial. The success of the seton is then very uncertain; but, as this latter plan is less severe than that of cutting down to the fracture and sawing off the ends of the bone, it seems to me to merit the preference. It may not answer; but its danger is not equal to that of the operation requisite to turn out

the ends of the bone and saw them off. In some instances, however, the ends of the fracture were not sawn off, but merely scraped.

Instead of these methods, Mr. Amesbury thinks that another practice, which is still milder than that of the seton, will generally answer; namely, pressing the ends of the fracture methodically and strongly together; thus, when the humerus is broken, and the fracture is transverse, the pressure is made in the longitudinal direction, which is effected by means of a short sling, and an apparatus expressly calculated to fulfil the indication; but when the fracture is oblique, the pressure is made in the transverse direction, and with the requisite degree of force. This treatment has proved successful in several cases, and, as it is a mild and simple plan, I think that it ought always to be tried before the other more severe methods are resorted to. But, if an artificial joint were already completely formed, I should not expect that this mode of treatment would be effectual. When a fracture of long standing, and not united by bone, is dissected, the union is generally ligamentous, though the uniting substance differs from common ligament in not having a distinctly fibrous structure. In other cases, there is absolutely a false joint produced; the rounded ends of the bones are covered by a thin ligamentous substance, and the inner surface of the capsule is lined by a smooth membrane, like the synovial membrane, and, as Sir Benjamin Brodie observes, capable of secreting the synovia. It is only where the want of osseous union causes loss of the use of a limb, or other serious grievance, that any severe operation for the purpose of exciting ossification would be justifiable. A disunited fracture of the rib would not demand it; nor would some other cases promise any benefit from it.

## COMPOUND FRACTURES.

When a fracture is attended with a wound of the integuments and other soft parts, which wound leads down to, and communicates with, the interspace between the two ends of the broken bone, the accident is of a far more serious nature, and more apt to be followed by severe and dangerous consequences, than when no such wound is present: the case being termed a *compound fracture.*

In a *compound* fracture, the wound is generally occasioned by the protrusion of one extremity of the fracture, except in gunshot fractures, and some others produced by direct violence. In gunshot fractures, the external wound is produced by the ball itself, or other substance, which breaks the bone; and, in some other instances, it may be caused by the same violence that breaks the bone, as when the accident is the result of the passage of the wheel of a heavy cart over the limb, or by the limb getting entangled in machinery. Under such circumstances, the same cause which fractures the bone may tear and mangle the soft parts, so as to occasion a wound communicating with the fracture. When the bone is broken obliquely, the extremities being sharp, one of them is very likely to be forced through the skin, particularly if the individual be intoxicated at the time of receiving the injury, and moves himself roughly and carelessly; also, if he be carried unskilfully by others, without the limb being duly supported, a protrusion of the bone will be likely to happen. In fact, many simple fractures are converted into compound ones, by the awkward manner in which the patient is carried after he has received the injury; and Mr. Pott, who met with a compound fracture of one of his legs, by his horse falling as he was riding through a crowded part of the Borough, was so impressed with the danger frequently pro-

duced by the manner in which patients are carried after accidents of this kind, that, as soon as his misfortune occurred, which was in the most populous street and greatest thoroughfare near London Bridge, he begged the by-standers, who surrounded him in great numbers, not to touch him until a door or some contrivance had been brought, on which he might be carried home without further harm.

When a surgeon is called to a bad compound fracture, the first question which he has to decide, is the same as that which must always be determined in the early stage of bad gunshot wounds, namely, whether the case will safely and judiciously admit of an attempt being made to save the limb? In all bad accidental injuries affecting the limbs, and caused by external violence, the principles of treatment are the same. Therefore, what has already been stated with regard to this question, in relation to gunshot wounds, is also perfectly applicable to bad compound fractures. If, then, from the first, there seems no probability that the limb can be saved, it will be the surgeon's duty to amputate without delay. In fact, he will never afterwards have so good an opportunity of doing the operation with the prospect of saving the patient, because the constitution is now tranquil in comparison with what it will soon be when inflammation and fever have commenced. This principle I inculcated with regard to gunshot wounds, and it applies to compound fractures, as well as to all other bad injuries of the limbs from outward mechanical violence. If the present opportunity be neglected, there may never be another; because inflammation will come on, followed by fever, and sometimes by a rapidly spreading mortification; and, even if the patient were to live beyond the first stages and dangers of inflammation, he would yet have to encounter a series of profuse abscesses of great extent, and hectic disturbance of the most alarming kind. During the suppurative stage, when the patient had passed through the first dangers, there might be, indeed, an opportunity of performing amputation, but one not so advantageous as what presented itself before the system had become universally deranged by the effects of inflammation, great suffering, and severe hectic disturbance. At all events, if the surgeon do not amputate immediately, he must not do it until suppuration is established, unless mortification happen to come on, in which event the case would be one of *traumatic gangrene*, where the practical rule is not to wait for the red line of separation. If an exception to the common maxim were not here made, the patient would generally die in twenty-four or forty-eight hours, without any line of demarcation having presented itself. But if an attempt has been made to save the limb, and it is frustrated by the formation of enormous abscesses, tedious and extensive exfoliations, frequent returns of inflammation, or attacks of erysipelas, or by extreme prostration of strength, and all the urgent symptoms which I have, on a former occasion, described as constituting hectic fever, tending to the patient's dissolution, the surgeon should then seize the best opportunity he can get of amputating the limb, because if he does not remove the cause of the hectic symptoms, the result will necessarily be fatal. How long he can rightly persevere in the endeavour to save a limb with bad compound fracture will, of course, depend partly on the state of the limb itself, and partly on the condition of the patient's health, the strength which he may retain, or the degree of hectic present.

I should not recommend amputation for compound fractures in the first instance, unless they were of the worst description; at this early period, the operation is only necessary when the bone is very badly shattered, and

the soft parts extensively torn, or when a large joint happens to be seriously involved in the mischief. The superior skill with which compound fractures are treated at the present day, is productive of a remarkable degree of success, many limbs being now saved which formerly would have been taken off without delay. In fact, with all the advantages of private practice, and the judicious principles which prevail in this part of surgery, it is only the worst descriptions of compound fractures that call either for primary or secondary amputation.

Supposing it is decided to attempt the preservation of the limb, the first indication, after the reduction, is to endeavour to close the communication of the fracture with the atmosphere, and unite the wound by the first intention. In this object we sometimes succeed, but on other occasions fail, because the parts are more or less torn and bruised, and not simply divided. Sir Astley Cooper's plan is to cover the external wound with lint dipped in the blood, a mode of dressing which effectually excludes the air, and disposes the wound to unite favourably; but this method, unobjectionable as it may be, is not exactly the common practice, and most surgeons bring the sides of the wound together with strips of adhesive plaster, just as is done for the union of ordinary incised wounds. In University College Hospital, lint, wetted with tepid water, is frequently preferred. If we succeed in uniting the wound, then all danger is removed, the compound fracture being, as it were, at once converted into a simple one. In certain instances, the wound only unites partially, and the rest suppurates; yet, if inflammation be kept within moderate bounds, the case will generally go on favourably. In other instances, no union takes place at all, the wound sloughs, and large abscesses form; there will then be a great deal of constitutional disturbance, and the case will not be free from danger.

The reduction of compound fractures is conducted on the same principles as those which are observed in the reduction of simple ones, regard being paid to the relaxation of the muscles, and to bring about the coaptation in the gentlest manner possible. Sometimes one of the ends of the fractured bone protrudes through the skin, and cannot be got back without a great deal of violence being done to the soft parts. In such a case, the projecting portion of bone should be sawn off, or the external wound enlarged, so as to allow the bone to be restored to its proper situation, without any further injury of the integuments.

When the fracture is both *comminuted* and *compound*, the first indication is to remove such spiculæ of bone as are perfectly loose, detached, and near the surface, and thus a considerable source of irritation will be removed. Of course, under such circumstances, there is little chance of union by the first intention; yet, the sooner the spiculæ are removed the better, as it will put the wound into a more favourable condition for healing without the formation of abscesses.

Reduction having been accomplished, the next object is to close the wound accurately, either with strips of adhesive plaster or by covering it with lint dipped in tepid water, or in the blood flowing from the part, as recommended by Sir Astley Cooper. In the warm season of the year, the bandage may be kept wetted in a cold evaporating lotion, in order to keep down inflammation. The best plan of proceeding, if it be a compound fracture of the leg, and we intend to put the limb on its side in the bent posture, is to place the inferior splint with its padding and the eighteen-tailed bandage under the fibular side of the limb. Then we should effect the reduction of the fracture, and having done this, and

put the limb into the right position, next dress the wound itself, and lay down the tails of the bandage. It is a great advantage to have the splint arranged under the leg before we attend to the coaptation of the fracture, for thus the limb lies steadily upon a convenient surface of support, and the rest of the necessary measures are completed without the ends of the fracture being again disturbed. It is not my intention to say, however, that this is the most eligible position for the limb, but as the practice of Pott still finds a few advocates, the exact method of putting on the apparatus adapted to this plan, has appeared to me to deserve a brief notice.

The most advantageous position for a compound fracture of the leg I find to be that in which the patient lies on his back, with the knee slightly flexed, and the limb supported on a double-inclined plane, or M'Intyre's apparatus. When the latter kind of splint is employed, it should have an excavation, or aperture, in the situation where the heel is placed, as directed by Mr. Liston, so that all hurtful pressure on this part of the limb may, with the aid of soft padding, be effectually prevented. With this apparatus, common rollers answer better than the many-tailed bandage, as they may be applied so as to include the limb and apparatus together, and at the same time to admit of those circles being taken off without the slightest disturbance of the wound or fracture which cover the place of the injury. Thus, the position of the fragments may be ascertained, the wound dressed, leeches applied, &c., in the most advantageous manner, as often as may be judged advisable.

In all leading points, the treatment of compound fractures resembles that of simple ones, with the exception of the measures called for by the wound itself; and also of those plans, which may be rendered necessary by the greater risk of inflammation, abscesses, and severe constitutional disturbance. Thus, the presence of a wound, if attended with suppuration, will make it necessary to undo the splints and bandages more frequently than would otherwise be the case. Here cleanliness is an essential point; and it is frequently advisable to put under the limb a piece of oilsilk, so as to keep the bedding from being soiled with the discharge; and, in the hot season, the parts may be bathed with a weak solution of the chloride of soda. When the discharge is profuse, it is sometimes a good plan to cover the pads themselves with oilskin; for then they can be washed every day, and kept perfectly clean with a sponge. While the inflammation is considerable, we should not put up a compound fracture too closely and tightly, because, in this state of things, the pressure of the bandages and splints will do more harm to the soft parts than good to the fracture. At the same time, I am of opinion, that those surgeons who do not put on splints at all, so long as the inflammation lasts, are not the best practitioners; and that, as a general rule, the sooner splints are applied the better. Still there are many cases in which they cannot be put on tight, and a few others in which they should be dispensed with for a short time, particularly as exemplified in fractures of the elbow, attended with much inflammation and swelling of the joint.

In compound fractures of the lower extremity, a *fracture-box* is sometimes a better apparatus than common splints; for it affords great accommodation and convenience, having a foot-board whose place and position can be altered, and whose two sides can also be let down at pleasure. The bottom, sides, and foot-board of this machine are duly lined and covered with cushions. Now, when the sides are thus properly lined with soft materials, or well-contrived cushions or pads, the limb often feels

much easier than with splints; and if there should be occasion to apply leeches, or any particular dressings, one of the sides may be let down, and the business accomplished without any disturbance of the limb. Sometimes both sides of the machine are let down at once: and thus the limb may be examined, and any necessary dressings applied, without subjecting the parts to any kind of motion. Before double oblique planes and M'Intyre's apparatus began to be employed, the fracture-box was even of greater importance, and more frequently used than at present. In University College Hospital it is not employed at all, because here M'Intyre's apparatus supersedes all occasion for it.

For the prevention and diminution of inflammation, we must have recourse to common antiphlogistic plans; but it is not an unusual belief, that patients with compound fractures, especially in London, will not bear venesection. Although this doctrine has been carried too far, it is nevertheless true, that if a patient were to be too much reduced by bleeding, he would not be able to bear all the profuse discharge, long confinement, and constitutional disturbance which he would have to encounter. Hence circumspection with respect to venesection is necessary; but leeches, cold applications, and aperient medicines, not urged to such an extent as to disturb the limb too frequently, should never be neglected.

When the wound does not heal by the first intention, considerable inflammation of the limb and a more or less severe attack of inflammatory fever, are likely to follow. Then, if large abscesses form, hectic symptoms will soon take the place of those characterising the first description of fever. The treatment must now be regulated by those principles which were explained in the observations on hectic fever. The sulphate of quinine and the diluted sulphuric acid should be given to check the night sweats; opium to procure rest; chalk mixture to relieve diarrhœa, and other medicines, according to particular symptoms. With respect to abscesses, a most useful part of the treatment will consist in preventing the lodgment of matter; and generally, in these cases, many abscesses form in succession; first one forms, and as soon as it is discharged, another takes place; and so the case may go on for several weeks, with a repetition of fresh inflammation and suppuration. I believe, that, in compound fractures, the discharge of pus is sometimes kept up longer than it would otherwise be, by continuing the use of relaxing applications too long. If there be reason to suspect this circumstance, we should discontinue them, and substitute for them astringent lotions, made with the sulphate of zinc or of copper. Many practitioners are partial to the plan of making pressure on the situation of the matter with compresses; but, in general, the best plan is to form an adequate outlet for it, and employ bandages directly the inflammation subsides. If there be not a sufficient outlet, I should say, that pressure cannot be of any service.

Another indication is to remove all loose portions of exfoliated bone. Some patients do not recover until long, very long, after the occurrence of the accident; and one frequent cause of the difficulty of cure, is the presence of a portion of dead bone in the part. The lodgment of a sequestrum will often retard the union of the bones for an extraordinary length of time. Hence, the dead bone should be removed as soon as practicable; and this, even though it may be more or less entangled in the callus.

With respect to the question of amputation, when hectic is present, the severity of the constitutional symptoms, and also the particular state of the fracture itself, must be considered; we are to be guided by the com-

bined consideration of these two circumstances; and when we see that perseverance in the attempt to save the limb will most likely end in the patient's destruction, we should seize the best opportunity which circumstances afford of performing amputation.

One other circumstance it may be right to mention, namely, that many patients with bad compound fractures die, not from the bad effects of the injury of the bone itself, nor of any mischief resulting from it to the limb; but in consequence of sloughing of the soft parts over the sacrum or the trochanter, or over some other prominences of bone, where the skin particularly suffers pressure in the usual position of the patient. Such mischief is seen to arise, not only from long confinement to bed by compound fractures, but from such confinement rendered indispensable by injuries of the spine, and various tedious diseases. In these examples, there is such languor of the system, such a weakness of circulation, and diminution of nervous influence, that the parts, most exposed to pressure, will frequently slough. The principles, applicable to the treatment of this kind of mortification, have been already noticed.

### COMPLICATION OF FRACTURES WITH HEMORRHAGE FROM LARGE ARTERIES.

The museum of University College contains a specimen of a compound fracture of the leg, which was amputated for gangrene, that followed pressure tried for the stoppage of bleeding from one of the tibial arteries. Any considerable degree of pressure, under such circumstances, will never be endured with impunity; and, even if it could, I should say, that the plan would be inefficient in relation to the hemorrhage from vessels of this size and so deeply situated. On account of the great ill success, usually attending compound fractures of the leg, complicated with hemorrhage from one of the principal arteries, amputaton has been the common practice. In fact, the broken part of the limb will neither bear pressure, nor a tedious operation for securing the artery; for, the cellular tissue is mostly gorged with blood, and if we were to pursue either of these methods, mortification would generally ensue.

All surgeons should make up their minds about the treatment of such a case, because it is an urgent one, leaving little time for consultation. If the fracture were not one requiring amputation on other accounts, I would neither have recourse to that operation in the first instance, nor to strong pressure; nor to the expedient of tying the wounded artery itself, unless it happened to be the anterior tibial in the lower and superficial part of its course, where it could be taken up without any serious additional disturbance and irritation of the injured part of the limb; but if cold applications and a gentle degree of compression failed, and there was no doubt about one of the tibial arteries being wounded, I would either try the effect of the pressure of a ring tourniquet on the femoral artery, or imitate Dupuytren, whose experience in some cases of this description demonstrated what course ought to be pursued. Thus, in one female patient, fifty-five years of age, who met with a fracture of both bones of the leg, complicated with laceration of the posterior tibial artery, he took up the femoral artery, and having thus succeeded in checking the hemorrhage, he treated the fracture by ordinary means, and the patient's life and limb were saved. In another case, a bullet had passed through the upper spongy head of the tibia, and wounded the popliteal artery. The ligature of the femoral artery was here also attended with success. Delpech adopted the same practice, and the results were equally favour-

able. Hence, if a fracture of the leg were not such as to require immediate amputation on other accounts, hemorrhage alone, I think, would not be a justification of it.

It is true, that here the valuable maxim of *always securing a wounded artery with two ligatures, one above, the other below the opening in it*, is deviated from; but were we to perform such an operation on the injured part of the limb itself, loaded as it is with extravasated blood, and perhaps already much swollen and inflamed, gangrene would scarcely be avoidable. There would be no difficulty in proving its ill success, by reference to several cases reported to have occurred in the London hospitals.

## OF DISLOCATIONS OR LUXATIONS IN GENERAL.

When the head, or articular surface, of a bone, is thrown out of its proper place, with respect to the corresponding articular cavity, or surface, of another bone, in or upon which it is naturally situated, the accident is termed a *dislocation* or *luxation*.

In some dislocations, the head of the bone is thrown at once into the situation in which the surgeon finds it; in others, a further displacement is produced by the action of the muscles; hence, the distinctions of *primary* and *secondary dislocations*, or, as it ought rather to be expressed, of *primary* and *secondary displacements*, resulting from these accidents.

Dislocations are either *simple* or *compound; simple*, when there is no external wound penetrating the synovial membrane and communicating with the cavity of the joint; *compound*, when the injury is attended with a wound of this description.

Another difference in dislocations arises from the circumstance of their being *complete* or *incomplete;* according as the articular surfaces are entirely separated, or not. Dislocations are also divided into *old* and *recent* ones; the former not admitting, after a certain period, of successful treatment; while the latter may be generally rectified with greater facility in proportion to their recency, or the shortness of time that has transpired since their occurrence. When a dislocation arises from disease of the bones, or from elongation or any other morbid change of the ligaments of a joint, it is termed *spontaneous*.

Those dislocations of the hip, which are termed by Dupuytren *original*, or, as others would name them, *congenital*, are not the consequence either of disease or accidental violence, but of original imperfection, or malformation of the acetabulum. Dupuytren had seen about twenty-six cases in the course of twenty years; and all, excepting three or four, were in females. These congenital dislocations were first noticed by Paletta, and afterwards by Dupuytren and Delpech; and the subject has since been followed up, with reference to such dislocations of the elbow by Mr. Adams, in the ninth part of Todd's Cyclopædia; and, with reference to others of the shoulder, by R. W. Smith, in Vol. XV. of the Dublin Journal of Medical Science.

The most important differences of dislocations, depend, 1. *Upon the kind of joint in which the accident happens.*

2. *Upon the extent of the dislocation.*

3. *Upon the direction in which the bone is displaced.*

4. *Upon the length of time which the displacement has continued.*

5. *Upon the absence or presence of such a wound as makes the dislocation compound.*

6. *Upon the complication of the case with a fracture.*

7. Upon the *causes* by which the articular surfaces are separated from each other.

1. Now *with respect to the kind of joint,* we do not always estimate the seriousness of a dislocation by the size of the articulation, as we do with respect to fractures, and diseases of the joints in general. In a simple dislocation, this is not always the criterion of the difficulty of reduction; and it is only when the accident is attended with a wound, communicating with the cavity of the joint, that the size of the articulation then becomes a consideration of primary importance. In fact, some dislocations of the thumb are infinitely more difficult to rectify, than luxations of the head of the thigh bone, or shoulder.

Every kind of joint is not equally liable to dislocation. In the vertebral column, if we except such dislocations as happen between the atlas and dentata, they are hardly possible. The pieces of the spine are articulated together by extensive and numerous surfaces, so diversified in their form and direction, and so powerfully bound together by ligamentous and elastic substances, that the motion between any two vertebræ, is very trivial. At all events, we cannot have dislocation without fracture except in the cervical portion of the spine. The strength of the articulations of the bones of the pelvis hardly ever yields so as to allow of the occurrence of a dislocation, or separation of the articular surfaces, unless the force applied be of that irresistible kind, which causes also at the same time a fracture of this strong and thick part of the skeleton; at once strengthened by its shape and structure, and protected by large masses of muscle arranged over a considerable portion of its exterior surface. Those joints, which are contrived for the performance of extensive and very diversified motions, are generally the most exposed to dislocations. Hence the orbicular ones furnish by far the most numerous examples of dislocations.

The ginglymoid joints perform motions resembling those of a hinge; while the orbicular admit of motion in every direction, for which purpose the bones entering into their formation have the ball and socket construction. Their ligaments must also necessarily be loose, in order to permit this free range of motion. Hence their dislocations are more frequent than those of ginglymoid joints, which move only in two directions, and are strengthened both by their more numerous ligaments and the conformation of the bones themselves. In fact, in consequence of the great breadth of the articular surfaces of several of the ginglymoid joints, the mutual correspondence of their eminences and depressions, and the number and strength of the ligaments by which they are bound together, they cannot be so easily dislocated as the orbicular ones; and, when the accident does take place, the articular surfaces are in general not wholly separated; the case being what is termed an *incomplete dislocation.*

In the orbicular joints, or those of the ball and socket kind, a dislocation is not only more frequent than in the ginglymoid ones, but it presents another difference, which is, that it is almost always *complete.*

With the exception of partial or incomplete dislocations of the astragalus from the os naviculare, two bones of the tarsus, and a rare partial displacement of the head of the humerus, we scarcely ever meet with *incomplete* luxations in any other joints, than the ginglymoid. In the ankle, knee, and elbow, however, examples of *incomplete* dislocation are

common enough. For instance, in the ankle, the lower end of the tibia is sometimes partially dislocated, one portion of it continuing on the astragalus, but a larger portion of it resting upon the os naviculare.

While dislocations of the orbicular joints are generally produced by force applied to *another part* of the limb, those of the ginglymoid ones are often, but not invariably, caused by *direct violence*, applied to the joints which suffer dislocation. Hence, luxations of the hinge-like articulations are frequently attended with severe contusion, and followed by a great deal of inflammation and swelling of the soft parts, by which much obscurity in the nature of the case is sometimes occasioned, especially to a person who has not a correct knowledge of the anatomy of the particular joint that is injured.

2. *With respect to the extent of the dislocation.* The extent of the displacement, as I have said, makes the case *complete* or *incomplete;* the latter expression signifying that the articular surfaces are *partially in contact.* On this part of the subject I have little to add. Though the dislocations of orbicular joints are almost always *complete*, and those of ginglymoid ones *incomplete*, we have the exceptions which I have already specified. The head of the humerus sometimes rests upon the edge of the glenoid cavity, from which position it readily slips back again into its proper situation; and sometimes the astragalus is partially dislocated from the navicular bone. What have been described as partial dislocations of the head of the humerus, I may here take the opportunity of stating, are considered by Mr. R. W. Smith to have been in many instances congenital dislocations of the shoulder, from imperfect formation of the glenoid cavity of the scapula.*

The lower jaw is subject to what is sometimes termed a *partial* or *incomplete* luxation, in a different sense from that usually conveyed by this expression, namely, to a dislocation of one of its condyles, while the other remains in its right place.

3. *Direction in which the heads of the bones are displaced.* In the orbicular joints, the head of the bone may be dislocated at any point of their circumference; and the dislocation is named accordingly *upwards*, *downwards*, *forwards* or *backwards*. In the ginglymoid joints, a dislocation may take place to either side, or backwards or forwards.

4. *The time that has transpired since the accident* makes the case, as I have explained, either a *recent* or an *old* dislocation; an important consideration with respect to the prognosis. In general, recent simple dislocations may be easily reduced; but, when the head of a bone has been out of its place several days, the reduction becomes difficult, and, in older cases, very often impossible. The muscles have now adapted themselves to the altered length of the limb and changed position of the bone, the head of the bone is fixed in its new situation, and the cavity, originally destined for its reception, becomes more or less obliterated.

5. *The absence or presence of such a wound as makes the case simple or compound.* The degree of danger is much altered by the accident being *simple* or *compound*. *Simple* dislocations, when *recent*, may generally be reduced with facility and cured without danger; but *compound* dislocations of the large joints are frequently a source of severe and extensive inflammation and suppuration of the parts, and of such constitutional disturbance as may endanger life. The degree of risk, however, will depend very much upon the *size of the joint*, the *extent* of the *laceration*

* See Dublin Journ. of Med. Science, vol. xv. p. 257.

in the *synovial membrane*, the *direct* and *free* or the *indirect* and *limited exposure* of the articular cavity; the *degree of contusion, laceration*, or other mischief done to *the soft parts;* the *great* or *little* chance of healing the wound by the *first intention;* the patient's state of health, kind of constitution, and his youth or advanced age.

The same nicety of judgment is required in deciding about the attempt to save the limb in bad compound dislocations, as in bad compound fractures.

6. *Complication of dislocation with fracture.* That a dislocation must be rendered a more severe and even a dangerous accident by this complication, is self-evident. We often meet with cases of this kind in the elbow and ankle, and sometimes in the hip.*

A dislocation of the humerus, or femur, may be complicated with fracture, in consequence of a fall directly after the bone is out of its place; there may also be a complication with fracture of another limb. Generally speaking, however, dislocations joined with fracture terminate favourably, except, when in addition to the fracture, the soft parts are violently contused and torn, and there is a wound rendering the accident *compound* as well as *complicated.* Even then, many cases end well.

In luxations of the hip, the acetabulum may be fractured; in those of the ankle, the fibula is mostly broken; and in dislocations of the upper part of the ulna, the coronoid process of that bone is often fractured. Other complications are œdema and paralysis of the limb from pressure of the head of the bone on the veins and absorbents, and on the axillary plexus of nerves.

7. *Causes of dislocations.* The natural *predisposing* causes are the great latitude of motion which a joint admits of; the small extent of the articular surfaces; the looseness and fewness of the ligaments; the shallowness of the articular cavity, as of the glenoid one of the scapula; the action of the muscles in particular positions of the joints; and lastly, the great length of the lever represented by the cylindrical bones of the limbs.

But, besides these natural predisposing causes, there are other circumstances, which facilitate the occurrence of these accidents, and consist of deviations from what is to be regarded as healthy and natural.

Thus *paralysis of the muscles of a joint*, and *an extraordinary looseness of the ligaments*, may become predisposing causes. Now, to understand why this state of the muscles should have the effect here mentioned, we are to recollect, that the strength of some orbicular joints depends very little either upon ligaments, or the conformation of the bones; but principally upon the support which they derive from the muscles and tendons which pass over them. This is exemplified in the shoulder. Here if we except the muscles, we find little to strengthen the joint, or hinder dislocation. The capsular ligament is too loose and yielding; the glenoid cavity too shallow to form much resistance to the displacement downwards and in some other directions. Hence, when the deltoid is affected with palsy, the mere weight of the arm will sometimes cause such a lengthening of the synovial membrane, that the head of the humerus descends two or three inches below the glenoid cavity.

Sir Astley Cooper mentions the case of a young naval officer, whose foot had been placed on a small projection of the deck of a ship, while

* See Thornhill's case of dislocation of the femur into the ischiatic notch, with fracture, reduced after six weeks; reported in London Med. Gaz. for July 1839.

his arm was kept extended for an hour with a rope fastened to the yard-arm. Whenever this person afterwards raised his arm to his head, a dislocation was produced. The muscles of the shoulder were wasted and weakened, so that they could neither prevent the luxation, nor resist the reduction, which was perfectly easy. The same tendency to dislocation is illustrated also by Sir Astley Cooper in a case of paralysis of one side from dentition, where a young gentleman had the power of throwing the head of the humerus over the posterior edge of the glenoid cavity, but it could be most easily replaced again.

When the ligaments are preternaturally loose, dislocations will arise from very slight causes. Hence, some persons cannot yawn, or laugh, without the risk of a dislocation of the jaw. Sir Astley Cooper speaks of a young girl, brought up to tumbling, whose patella used to be brought flat against the outside of the external condyle, whenever the rectus muscle was put in action. Collections of fluid in the knee, by causing an elongation of the ligaments of the patella, give a tendency to dislocation of that bone. Whenever a bone has once been dislocated, the production of the displacement again is more readily effected, than in the first instance.

Such diseases as destroy the cartilages, ligaments, and more or less of the articular surfaces, often cause dislocations, which, as I have stated, then receive the name of *spontaneous* or *consecutive ones*. We meet with them frequently in the hip, and sometimes in the knee. There used to be a specimen in the museum at St. Thomas's, in which the bones of the leg were so displaced from the knee by disease, that the leg formed a right angle, directly forwards from the condyles of the femur. I have also seen the head of the tibia drawn quite up into the ham from disease of the knee-joint; also another case in which the tibia could be moved, and this, even when the limb was extended, very far towards either side. Bones are sometimes dislocated by the effects of the growth and pressure of tumours on the ligaments, and parts of the articular surfaces; also, by the contraction of burnt parts, of which there is a remarkable example described by Cruveilhier, where the carpus was thus displaced from the radius. The change in the shape of the bones, produced by rickets, will sometimes cause a dislocation. The clavicle has been dislocated inwards at its sternal end, in consequence of disease and deformity of the spine. Dislocations, however, are most commonly occasioned by external violence.

In the ginglymoid joints a dislocation is usually produced altogether by external violence; but, in the enarthrosis, or orbicular joints, the action of the muscles may have a share in promoting the accident. We have one ginglymoid joint, however, in which a dislocation is commonly the result of the action of muscles, viz. the articulation of the lower jaw.

When a person falls on his elbow, while the arm is separated from the side, the force thus applied tends to throw the head of the humerus down into the axilla; but the dislocation is much promoted by the action of the pectoralis major, teres major, and latissimus dorsi, which, during the alarm, contract, and pull the head of the bone downwards, and inwards.

When the articular surfaces are in particular positions, with respect to each other, a dislocation may arise entirely from the action of the muscles, as is exemplified in the jaw, also in the enarthrosis joints, when the axis of the bone is oblique, with respect to the surface, with which it is articulated.

With respect to the injury done to the parts about dislocated joints,

such ligaments are torn as naturally keep the heads of the bones from being thrown in the particular directions, in which we find them displaced in the various examples of the accident. Even tendons in the vicinity of the joint are frequently lacerated. The capsular ligament and synovial membrane are torn; in the hip the ligamentum teres is ruptured; in the shoulder the tendon of the biceps is occasionally, but not generally, broken; Sir A. Cooper in his dissections never having noticed it. When the head of the bone is thrown into the axilla, the tendon of the subscapularis is ruptured. Even the muscles themselves are sometimes lacerated, as the pectineus, and adductor brevis in luxations of the thigh: and while some muscles are stretched, others are shortened. From this account, it must be manifest, that a dislocation in its most simple form is rather a complicated injury.

*General symptoms of dislocations.* Pain in the joint, and great difficulty or absolute impossibility of moving it. These are *equivocal*, belonging to other cases, as a bruise, a fracture or a sprain.

We may say, however, that the symptoms generally consist of an interruption of the functions of the joint. The head of the bone can often be felt in an unnatural situation, and amongst parts which it compresses and renders painful. Hence, there is a diminution or loss of motion in the joint, the limb or part is either shortened, lengthened, or distorted, according to the kind of dislocation. When there is an elongation of the limb, it removes all suspicion of fracture, and this view is confirmed by the circumstance of there being no crepitus. The axis of the dislocated bone is changed, the shape of the joint is altered, the natural prominences of bone either disappear or become less conspicuous, as the trochanter does in dislocations of the hip, or the reverse may occur, as is the case with the olecranon in dislocations of the elbow, and the acromion in dislocations of the shoulder, these processes projecting more than usual. In many cases the head of the bone may be plainly felt in its new situation, and then the nature of the accident is readily detected by rotating the limb, as the head of the bone then also rotates.

The pressure of the head of the bone on the surrounding parts causes severe pain, which is much increased when the limb is moved. When a large nerve is thus compressed and injured, an obstinate, and even an incurable palsy may be the result. Nay, the pressure of a dislocated bone upon important organs may endanger life, as has happened from the pressure of the dislocated sternal end of the clavicle upon the œsophagus.

In subjects who are not too fat, and in whom inflammation and swelling have not had time to come on, the head of the dislocated bone may sometimes be distinctly felt, forming a preternatural tumour or projection; while, in the situation of the articular surface, there is an unusual depression, or a want of fulness.

A dislocated bone cannot be so easily moved about as a fractured one, yet, for a short time after the accident, a considerable degree of mobility sometimes remains. In one case, the head of the thigh-bone was thrown upon the obturator foramen, the femur could at first be moved about with freedom; but, in less than three hours, the head of the bone became firmly fixed by the contraction of the muscles.

Dislocations are generally followed by swelling, which comes on quickly and to a considerable extent, when the violence has been great—the joint is a ginglymoid one—and blood extravasated. Such swelling often con-

ceals the displacement of the bones, and hides the change in the relative situations of certain processes of bone, so that it becomes less easy to make out the nature of the accident.

In simple dislocations which have been reduced, the ensuing inflammation rarely terminates in suppuration, though two fatal instances of it, after the reduction of dislocations of the hip, are recorded by Sir Astley Cooper.

The *prognosis* depends upon several considerations. The increased trouble and danger of compound and complicated dislocations I have already mentioned. Old luxations can hardly ever be reduced after a certain time, for not only the muscles become permanently shortened, and the articular cavity more or less obliterated, but the head of the dislocated bone acquires adhesions to the parts in its new situation, and is sometimes confined by a new bony socket, which must be broken ere the head of the bone can change its situation again.

When a dislocation of an orbicular joint is left unreduced, nature will sometimes make vast efforts to restore to the limb some degree of the power which it has lost. She does this occasionally by forming a kind of new joint, and, as I have said, even sometimes a new socket, for the displaced head of the bone. In the generality of cases, if the head suffer pressure, it undergoes a change in its shape, and becomes lessened. New ligaments are sometimes produced, calculated for holding the head of the bone in the best situation which circumstances will allow, with a view to the restoration of some use in the limb. Thus, when the head of the humerus has continued long unreduced, the cup of the scapula becomes filled up, a new cavity may be formed on the concave surface of the scapula for the head of the humerus, and new ligaments produced, adapted to this substitute for the original joint.

In the hip, a new cavity is sometimes formed for the head of the femur near the anterior and superior spinous process of the ilium, or the head of the bone may lie upon the dorsum of the ilium, or upon the foramen ovale, and there have a new kind of joint with a socket and ligaments produced around it.

In the ginglymoid joints, however, nature has much less power of lessening the evils of a neglected and unreduced dislocation. The shape and breadth of the articular surfaces readily explain why this should be the case. Circumstances are very different from those of an enarthrosis joint, where the displaced head of the bone is more or less globular, a configuration which qualifies it admirably for motion in every direction. In fact, in the ginglymoid joints, the dislocations of which we know are generally incomplete, the neglect to reduce the displacement is often followed by anchylosis. By referring, however, to Cruveilhier's great work on Pathological Anatomy, we may find cases and engravings illustrative of the efforts which nature sometimes makes, even in an unreduced dislocation of the elbow, to form new articular cavities for the displaced ends of the humerus and radius. Many years ago, I saw a case, in which a lad about sixteen years of age dislocated the upper head of the ulna into the place of the radius, so as to displace the head of the latter bone from the lesser articular surface of the humerus. The accident had not happened more than between three and four weeks, yet two of the late surgeons of St. Bartholomew's, namely, Mr. Abernethy and Mr. Ramsden, with every means they could devise, were not able to reduce the ulna into its right place again.

Notwithstanding the partial improvement in the state of the limb, ac-

complished by nature, in unreduced luxations of the ball and socket joints, it may be observed generally, that she can never of herself rectify these accidents; and the patient, if his case be mistaken or neglected, will be for ever afterwards a cripple—a monument of surgical ignorance—the disgrace of the practitioner originally consulted.

With respect to the question, what ought to be done for old unreduced dislocations? the answer is, that *after a certain time nothing can be done.* Attempts to reduce the shoulder after it has been dislocated three months have rarely succeeded in this country; and if conducted with too much violence, they may cause serious mischief, rupture of the axillary artery, paralysis from injury of the axillary plexus of nerves, laceration of the soft parts, gangrene, and death. If the head of the bone should have formed an accidental connexion with the axillary artery, the rupture of this vessel may happen in the attempts to reduce the bone, as exemplified in two cases under Professor Gibson.*

On the other hand, Baron Dupuytren, some time ago, had reduced twenty-three dislocations of the hip and shoulder, which had remained unreduced from fifteen to eighty-two days. In all old cases, if an attempt is to be made to reduce the bone, the patient's muscles should be first weakened by means of the warm bath and bleeding; plans which Dupuytren always practised. As for the emollient and oily applications to the parts, employed by Dupuytren, I cannot suppose that they could have had any real effect on the nature of the resistances which were encountered. Pulleys were not employed, but gradual extension was made by the assistants, while the patient was engaged, as much as possible, by conversation, and his mind diverted from the case.

The dislocations, named by Dupuytren *original*, or *congenital*, depending upon the imperfect formation of the acetabulum, are of course incurable. The same remark applies to other congenital dislocations.

### TREATMENT OF DISLOCATIONS.

1. The first indication is *to reduce*, or *replace the head of the bone*, or *articular surface* that has been removed from its natural situation.

2. The second is to *prevent all movements of the limb, or part likely to bring on a return of the displacement, or a disturbance of the torn synovial membrane, ligaments, muscles, and tendons.*

3. The third is to *endeavour to render the inflammation* following the accident as moderate as possible.

1. *Reduction.* In order to be able to judge of the principles by which we should be guided in the fulfilment of this first indication, we should consider what are the resistances likely to be encountered.

*The chief impediment to the reduction generally arises from the resistance of the muscles*, and becomes greater and greater in proportion to the length of time which the bone remains unreduced. The business of the surgeon is to counteract this resistance. If the attempt at reduction be made immediately after the accident, the resistance of the muscles is then more easily overcome than afterwards; and, very often, if the operation be deferred for only a few days, the utmost difficulty is experienced.

That the action of the muscles forms the principal impediment to reduction is proved, first, by the *facility of replacing the head of a dislo-*

* See Gibson's Institutes of Surgery, vol. i. p. 324. ed. 5. Philadelphia, 1838.

*cated bone when the muscles are paralytic:* secondly, by the same facility which occurs *when the patient happens to faint*, or *to be debilitated by bleeding, sickness, intoxication*, or any other cause.

Another proof of the muscles being the powers resisting the surgeon's endeavours to reduce the bone, is the ease with which a luxation may often be reduced when the attempt is suddenly made *while the patient's mind is directed to another subject*, and the muscles are unprepared for resistance. These facts furnish useful suggestions in practice; teaching us, not only how to avail ourselves of any accidental swoon, or syncope, as an advantageous moment for the reduction; but also, how, in cases attended with difficulty, to adopt means for the express purpose of inducing faintness, great temporary debility, and universal muscular relaxation. The means alluded to are, *bleeding from a large orifice, nauseating doses of the tartrate of antimony*, the *warm bath*, and the exhibition of *opium*.

I do not mean, however, that such means should be employed in every case of dislocation; — certainly not; only in those where great resistance is to be overcome owing to the strength of the muscles, or to the time the bone has been out of its place.

The reduction of a dislocated bone requires, of course, the employment of mechanical force in some way or another, to bring the head of such bone back into its proper situation again.

It is chiefly the orbicular joints, whose dislocations are liable to the *primary* and *secondary* displacement already referred to. The luxations of ginglymoid joints are generally incomplete; and no secondary displacement from muscular action usually follows the first immediately occasioned by the violence itself.

In fulfilling the first indication, we are to consider what *course the head of the bone has taken to reach its present situation, and make it return, as nearly as possible, by the same track.* If it be the upper head of the humerus, or of the thigh-bone, that is dislocated, and it should appear to have undergone secondary displacement, by the action of the muscles, we are then to direct our first interference to the removal of this secondary displacement. In short, extension is first to be made for the purpose of dislodging the head of the bone from the situation into which it has been retracted by the muscles. It is therefore generally made in the direction, which the dislocated bone has assumed. Now, in many cases, no sooner has this been done, and the head of the bone been a little inclined towards its articular cavity, by giving the bone a particular direction, than it is drawn into its place again by the muscles themselves, a snap being heard at the moment of its gliding into the socket.

If, however, we were merely to make extension, we should not generally reduce the dislocation, but pull the patient off his chair or bed. The *extension* must therefore be accompanied with some plan for fixing the bone or bones with which the luxated one is naturally connected: it must be combined with *counter-extension.* In the reduction of dislocations of the hip and shoulder, *counter-extension* is usually made by means of a girth, or sheet, with which the pelvis or chest is fixed. The girth, or sheet, may be held by the assistants, or be fixed to a post, or iron ring screwed into the wall, or floor.

On the Continent, many surgeons *apply both the extension and counter-extension, as far from the dislocated joint as they can.* In dislocations of the hip, they make extension at the ankle, and counter-extension by fixing the pelvis; in dislocations of the shoulder, they make extension at

the wrist, and counter-extension by fixing the scapula and chest. In dislocations of the forearm, instead of making counter-extension at the humerus, as is done in England, Baron Dupuytren makes it by fixing the chest and shoulder just as we do for the reduction of the head of a dislocated humerus. The necessity of fixing the scapula and chest in dislocations of the shoulder, and the pelvis in dislocations of the hip, is so obvious as to require no comment.

In this country, in compliance with Pott's advice, *extension* is most commonly made by applying the force to the lower part of the dislocated bone itself, and *counter-extension* by fixing or applying the counter-extending force to the bone or part with which the dislocated one is naturally articulated. In dislocations of the shoulder and hip, the French plan affords the advantage of a longer lever, whereby additional power is gained, not merely in the extension itself, but at the important period when, by making use of such a lever, as a means of inclining the head of the bone towards its socket, we give the muscles the opportunity of drawing it back into its right place again.

The principle *of using the dislocated bone*, or *even the whole limb, as a kind of lever* for the accomplishment of the reduction, is one of the highest importance, perhaps of as much practical utility as *that of relaxing the muscles* concerned in making the greatest resistance to the completion of this first indication.

In certain dislocations, the reduction cannot be accomplished merely by *extension* and *counter-extension*. When the head of the thigh-bone is thrown upon the obturator foramen, these means are useful when carried to a moderate extent; or, in other words, when practised just so far as to dislodge the head of the bone from that situation; but the limb not being shortened, nor the bone truly retracted, further extension will do no good. The object is now to incline the head of the bone outwards towards the acetabulum, by carrying the knee and leg inwards; while a kind of fulcrum for the lever, which the femur now represents, is sometimes formed by placing a band or piece of cloth upon the inside of the thigh a little way below the groin, and drawing it outwards at the moment that the lower part of the bone and limb is moved inwards.

This *principle of using the dislocated bone as a lever* for the reduction of its displaced head, or articular surface, is illustrated in the treatment not only of luxations of the hip, but in those of the shoulder, jaw, and other parts.

In the hip, indeed, it is necessary on another account, viz. the acetabulum is surrounded by a high ridge, which makes it necessary that the head of the bone should be lifted over it. Nothing has a greater effect in facilitating the reduction, than attention to this principle.

The *relaxation of the muscles* was insisted upon by Pott as much in the treatment of dislocations as in that of fractures, and when it can be practised with due attention to other principles, it cannot be too much commended; but, in the reduction of some dislocations, the position of the limb must occasionally be regulated by other considerations, as, for instance, *the advantage of making the first extension in the direction calculated to remove the secondary displacement;* in other words, for dislodging the head of the bone from the situation into which it has been drawn by the muscles subsequently to its first displacement. Neither is the *advantage of the lever* to be sacrificed altogether to the plan of relaxing the most powerful muscles.

In a dislocation of the lower end of the tibia from the astragalus, relax-

ing the powerful muscles of the calf of the leg has very great effect in facilitating the reduction.

The extending force may be made either with towels, sheets, a table-cloth, or any other piece of strong linen, folded and applied round the limb, and drawn by assistants, or else with a multiplied pulley; while the counter-extension is made with a girth or cloth, by which the shoulder or pelvis is fixed.

In dislocations of ginglymoid joints, however, it is seldom requisite to use any folded sheets or cloths either for the extension or the counter-extension, as both can be effectually performed with the hands of the surgeon and his assistants.

In France it is customary, for the purpose of preventing the soft parts from being chafed and hurt by the pressure of the extending means, to cover the part of the limb to which they are applied with a piece of linen smeared with ointment. In this country, we frequently apply a wet roller round the part, which not only protects the skin, but will not slip, like any greasy application. Flannel or buskin has likewise been occasionally employed.

It is a rule always to let the extension be made unremittingly and increased very gradually. Sudden violent efforts will be resisted by the muscles, and are more likely to cause laceration of the soft parts than the return of the bone into its place. Moderate extension, slowly increased and incessantly maintained, will soon tire the strongest muscles.

When the resisting muscles are very powerful, or there is additional difficulty on account of the length of time which the dislocation has continued, we may let the attempts at reduction be preceded by means calculated to bring on temporary weakness or fainting.

The *return of the bone into its right place* is indicated by the snap heard at the instant of its slipping into the socket, by the restoration of the proper shape of the joint, and by the recovery of its original motions. No snap is audible, however, if the patient be very faint, or weakened by intoxication; for then the muscles do not generally act with sufficient vigour to occasion a sudden return of the bone into its socket. That part of the process of reduction, which consists in putting the head of the bone in its place, is termed *coaptation*. In the orbicular joints, when extension and counter-extension are made, the muscles sometimes replace the head of the bone by their own action, without the surgeon troubling himself much about coaptation; but, in dislocations of the ginglymoid joints, the coaptation, or pressure of the head of the bone towards its right place, is frequently even more essential than extension and counter-extension, of which a very moderate degree is sufficient.

2. The second indication is *to prevent all movements of the part or limb likely to produce disturbance of it, or to bring on a return of the displacement.* The rupture of the ligaments, and sometimes of tendons, which naturally strengthen the joint, render this precaution necessary.

The reduction having been accomplished, our next object is to confine the part or limb in a posture in which the luxation cannot return. For instance, the head of the thigh-bone cannot be thrown out of the acetabulum while the limb is in the state of adduction, with the knee close to its fellow. Hence, after the reduction of such a dislocation, the knees are to be confined together with a slack roller. The shoulder cannot be dislocated while the humerus is kept near the side: after the reduction, therefore, we confine the elbow in that posture with a sling, aided sometimes by a roller. The lower jaw cannot be dislocated unless the mouth

be widely opened. After the replacement of the condyles, therefore, we put on the four-tailed bandage, by means of which we keep the bone quiet, and hinder the mouth from being opened.

This prevention of motion of the dislocated bone, and confinement of it for a few days in a particular position, determined on the foregoing principle, are also useful in promoting the union of the torn ligaments, tendons, and muscles. It is one of the best things likewise with the view of preventing the inflammation from attaining a severe degree.

The *third indication*, or *the prevention and removal of the inflammation and its effects*, sometimes requires, besides quietude of the part, other antiphlogistic means, such as cold evaporating lotions, leeches, and purgative medicines, and, in severe cases, venesection, fomentations, and poultices. One might expect, that the consequences of the inflammation would be more serious after a dislocation, where ligaments, muscles, and tendons, are actually torn, than after sprains, where they are only violently stretched. But experience proves the contrary, and that, if the reduction be skilfully performed, the inflammation and swelling commonly subside in the most favourable manner.

## COMPOUND DISLOCATIONS.

Here the severity and danger depend upon various circumstances: —

1. The size of the joint.

2. The extent of the laceration in the synovial membrane, and of the injury of the ligaments and tendons.

3. The degree of contusion and laceration in the soft parts.

4. Several complications, as fracture and comminution of the bone, rupture of large blood-vessels, considerable effusion of blood in the cellular tissue, paralysis, &c., bad health, extreme old age, and general debility.

The ankle-joint is perhaps more exposed to compound dislocations, than any other joint in the body, which are also, for the most part, complicated with a fracture of the fibula. Compound dislocations of the thumb are remarked to be followed by tetanus with extraordinary frequency; and hence some writers, but not good practitioners, as I suspect, advise, in these cases, amputation, as a preventive of that fatal disorder.

Compound dislocations are to be treated very much on the same principles as compound fractures. The first thing for decision is, whether the circumstances of the accident justify the attempt to save the limb.

If the joint be the knee, the laceration in the capsular ligament extensive, several other ligaments torn, and the integuments and soft parts considerably injured, amputation should be performed without delay.

In compound dislocations of the elbow, wrist, and ankle, amputation is less frequently performed at the present day than formerly. After the reduction, appearances are much changed for the better; and these accidents, unless accompanied by an extraordinary degree of laceration and contusion of the soft parts, and complicated also with fracture, generally terminate well.

When an attempt is made to save the limb, the bone or bones are first to be reduced. The next object is to heal the wound, if possible, by the first intention, so as to convert the case, as it were, from a compound into a simple dislocation.

If the head of the bone should protrude, and much difficulty be experienced in the reduction, some practitioners would adopt the plan of sawing it off; but, if it can be returned into its proper place again, this

seems to me to be the best practice. The cases published by Mr. Hey, of Leeds, are certainly but little in support of the other suggestion, though intended to convey the most favourable view of it. The edges of the wound, having been brought together with sticking plaster, the joint may be covered with linen, wet with a cold evaporating lotion, and kept steady and motionless by means of splints duly applied, and lined with soft pads.

In the early stage, venesection, leeches, purging, low diet, and other antiphlogistic means will be requisite.

At present, limbs are not so frequently amputated for compound dislocations as they used to be thirty or forty years ago; the right principles of treatment being now better understood. Cases, which have an alarming appearance, while the bones protrude, and the external wound is unclosed, look very differently after the reduction of the bones, and the dressing of the wound.

However, examples do occur, in which the propriety of amputation is unquestionable, and it must be judged of by reference to some of the considerations already mentioned.

When from the first no chance presents itself of ultimately saving the limb, the knife should be employed without delay. If we lose time, we only give an opportunity for inflammation, suppuration, and even gangrene, to arise, attended with such disturbance of the whole constitution as may neither admit of being controlled, nor afford another period sufficiently tranquil for the successful performance of the operation. All the considerations already specified in this work, with regard to severe gunshot-wounds of the limbs, and the worst kinds of compound fractures, are equally applicable to bad compound dislocations.

## CONTUSIONS.

A *contusion* or *bruise* is a mechanical injury of the soft parts, produced by the blow of some obtuse body or weapon, or the collision of a hard blunt substance against them, without, however, any breach taking place in the integuments; which, technically speaking, would make the accident rank as a *contused wound*, and not a simple bruise. A contusion varies in degree, from a very trivial injury of the parts which have received the blow, to their complete disorganisation, as exemplified in those dreadful forms of mechanical violence, erroneously termed *wind-contusions*. In all severe contusions, besides the sudden forcible compression of the parts, besides the inflammation necessarily following the injury of various textures, there is a rupture of an infinite number of minute blood-vessels, and the knowledge of this fact will account for the rapidity with which the swelling frequently comes on. It also explains to us the cause of the black and blue, or livid, discolouration following ordinary bruises, and well known amongst surgeons under the name of *ecchymosis*. Of this effect of a contusion, what is called a *black eye* is a familiar example. An ecchymosis depends then upon the escape of blood from the minute vessels into the cellular tissue. Numerous small arteries and veins are burst by the violence of the blow, and blood and serum are immediately effused into this texture. However, the reason of the various shades of red, purple, green, and yellow, which present themselves in the different degrees and periods of an ecchymosis, is not entirely ascribable to the extravasation of blood, but to other changes, the nature of which has, perhaps, not been made out. Dr. Macartney's explanation of it is, that the absorbents first take up the

colouring matter; and hence, says he, the colour of bruised parts is, in the beginning, a dark purple, or black colour, because the effused blood soon acquires the venous character, and, as the colouring matter is absorbed, the part becomes yellow.

When the skin is unbroken, the extravasated blood may accumulate in considerable quantity; and it is a remark made by Dr. Macartney, that, unless it be wanted for reparation, as in fractures, it usually does not coagulate, and is removed by the absorbents.

Contusions sometimes produce the rupture of more considerable vessels, and then the hemorrhage, in particular situations, may have fatal consequences. Thus, when a contusion of the head occasions the rupture of one of the arteries of the brain, or of the dura mater, the pressure of the effused blood upon that important organ will give rise to the most urgent danger. Here the peril is not from the quantity of blood abstracted from the circulation, but from its pressure on a certain part, whose functions cannot bear it without life being endangered. In other instances, however, we find enormous collections of blood, vast extravasations arising from contusions, but not attended with any serious degree of danger, though productive of an immense degree of swelling, and much disfigurement. Thus, a contusion of the head, instead of rupturing one of the arteries of the brain, or dura mater, may only burst a considerable arterial branch under the scalp. In this circumstance, the scalp will sometimes be raised up from the skull several inches; and were the degree of danger to be estimated by the degree of swelling and deformity, a very erroneous prognosis might be delivered. In fact, experience proves, that most of these collections of blood in the cellular tissue from contusions admit of being dispersed by proper treatment, and this generally without making any opening for the discharge of such blood. The absorbents are for the most part competent to bring about its removal.

The severity of a contusion depends, not simply upon the violence with which it is occasioned, but upon the nature of the parts affected by it. Thus contusions of the skull, on account of the mischief, likely to be produced by them within the head, are always perilous accidents. A contusion on the hypogastric region, at a period when the bladder is distended with urine, will easily rupture that organ; a contusion on the abdomen, when the bowels are distended, will sometimes burst them, and cause a fatal effusion of their contents in the cavity of the peritonæum. A contusion of the integuments, situated directly over the hard surface of a bone, will often cause them to slough, whereas similar violence applied to the skin, not so situated, would not lead to equal mischief.

Contusions are sometimes dangerous, from the effect they have on parts more or less remote from those on which the violence has immediately acted. This effect is termed by the French a *contrecoup:* Pott mentions an illustration of it in a man, who fell with great force on the tuberosities of the ischium without striking any other part of the body; yet the result was a concussion of the brain.

In the treatment of contusions, the *first indication* is to *prevent and diminish the inflammation* likely to follow the accident. For this purpose, rest, fomentations, or cold evaporating lotions, and, in severe cases, venesection, purgative medicines, leeches, and antiphlogistic treatment in general are proper. Bruised muscles are to be relaxed. Cold applications have a useful effect in checking the further effusion of blood into the cellular tissue.

The *second indication* is to *promote the absorption of the extravasated*

*blood and serum* by employing (after the tendency to inflammation has subsided) means calculated to quicken the action of the absorbent vessels; lotions containing hydrochlorate of ammonia, diluted acetic acid, and camphorated spirit of wine; and, when the case is chronic, camphorated liniments, and the pressure of bandages.

*The third indication is to restore the tone of the parts*, and remove any disposition to œdema. This object requires more stimulating liniments, containing iodine, or iodide of potass, or a good proportion of camphor or ammonia; pumping cold water on the parts, champooing, passive motion, and a bandage.

When, notwithstanding the means here recommended, the absorbents appear incapable of dispersing the swelling caused by a copious effusion of blood, and matter forms, it becomes indispensable to make an opening, remove as much of the blood as possible, and treat the case like a common abscess.

## SPRAINS.

When a joint is forcibly moved, or twisted, in any direction further than the natural conformation of the bones and arrangement of the ligaments will properly allow, yet without the degree of displacement amounting to a dislocation, the accident is termed a *sprain*. In every sprain, then, the ligaments are violently stretched, and no doubt, sometimes, partially torn. This is not, however, all the mischief attending such an accident. The violent wrench, or twist of the joint, extends its action to all the surrounding soft parts; the tendons and their thecæ, the integuments, and even the muscles themselves, through the medium of their tendons. All these parts are sometimes stretched with a degree of violence, that must involve them in the consequences. The ginglymoid joints chiefly suffer from sprains, especially the ankle, the wrist, and articulations of the fingers and thumbs. A ginglymoid joint is more liable to a sprain than an orbicular one, because its movements are naturally very much restricted to two directions, so that any accidental twist, or forced movement of it in another direction, cannot happen without the ill consequences being produced to which I have adverted. If it could move in every direction, like an orbicular, or ball and socket joint, then it would suffer a sprain only when the movement were forced in any direction beyond a certain point; but the movement, if not carried too far, might be made in any direction without mischief. The observation, that an orbicular joint cannot be sprained, does not appear to be altogether correct; for the shoulder is sometimes sprained by the arm being carried too far behind the trunk, and, as Sanson remarks, the hip may be sprained by the extreme abduction of the femur. As for the general symptoms of a sprain, they consist of pain, faintness, or even sickness, inability to use the joint, more or less swelling, and a degree of ecchymosis. The effects of sprains in elderly persons are often tedious, disabling such persons for weeks and months. These accidents, indeed, frequently require a longer time to be cured, than the complicated injury left in the textures about a joint after the reduction of a dislocation.

*The first indication is to keep the sprained joint perfectly quiet, and adopt measures to prevent inflammation.* At first, we may apply cold evaporating lotions, or fomentations, and have recourse to leeches, purgatives, and in severe cases to venesection. Fomentations often give more relief than cold applications.

When all disposition to inflammation is past, and merely a degree of stiffness and a tendency to œdema remain, the *second indication* is to aim at the removal of these consequences, by means of liniments, bandages, the pumping of cold water on the joint, straps of soap and adhesive plaster applied circularly and perpendicularly in an alternate manner, so as to form an efficient support for the joint and neighbouring parts, champooing, &c. In scrofulous persons, sprains frequently lead to disease of the joints; and whenever there is reason to suspect, from the tediousness of the case and the general appearance of the patient, that any danger of this kind is present, the part ought to be blistered without further delay.

## DISEASES OF THE BLOOD-VESSELS.

The diseases of arteries and veins constitute one of the most interesting departments of surgery. In the remarks on hemorrhage, and on the principles which should guide us in the choice of means for its stoppage, I have indeed already touched upon the subject; but various parts of it still remain to be explained.

1. *Diseases of arteries.* The participation of arteries in the general organisation of all other living parts of the body must render them susceptible of *inflammation*, *suppuration*, *ulceration*, and *sphacelus*. They are also liable to a *deposit of earthy matter between their internal and middle coats; to a steatomatous thickening; to dilatation; to obliteration;* and to several other deviations from their healthy condition.

The two great arterial trunks, the aorta and pulmonary artery, differ remarkably in two respects. The branches of the aorta unite and anastomose freely with other branches derived from that vessel or its continuations; but the branches of the pulmonary artery remain separate and unconnected from their origin to their very termination. A thin transparent pellicle is found to line the interior of a large aortic artery. Externally to this is a dense hard brittle tissue, which can be separated only in scales, forming in reality a distinct tunic composed of several layers, situated between the fibrous and serous coats. This structure, which Malgaigne has named the *sclerous* coat, is that which renders the aortic branches stronger than those of the pulmonary artery; so that if branches of equal diameter be cut through, that from the aorta will present an almost circular opening, while that from the pulmonary artery will be evidently collapsed. When any species of concretion, or any point of ossification, occurs in the aorta, it is almost always in this tunic; and it is remarkable that, in the pulmonary artery, where this coat is not found, no well-attested case of ossification is on record.

The coats of the aorta are often the seat of disease, and the branches arising from many of the trunks which it gives off frequently wounded; while those of the pulmonary artery rarely undergo any morbid change, are seldom wounded, and, when they are so, admit of little being done. Hence, with reference to surgery, the aortic system of arteries is by far the most interesting.

The *internal coat of an artery is more subject to inflammation*, than either its middle or its external coat. This is proved by the frequent and copious effusion of lymph upon the inner surface of an artery, in conse-

quence of the inflammation of contiguous parts, the application of a ligature, the effect of a wound, the pressure of tumours, or any irritation in the vicinity of the artery affected. Sometimes the inflammation thus excited spreads to a great distance from the point at which it commences, even up to the heart itself. Such a case receives the name of *arteritis;* a formidable complaint, rapidly producing great irritative fever, an extremely quick pulse, collapse, low delirium, and generally death.

*Chronic inflammation of the arteries* is frequently met with, especially as a cause or effect of calcareous deposit. An appearance, similar to that produced by inflammation, often presents itself upon the internal surface of arteries; viz. a *vivid redness* or *scarlet tinge.* This is not, however, always the result of inflammation; for it may not be accompanied by an effusion of fibrine, or any thickening of the vessel. Arteries exposed in the dissecting room to the air for a few days, and in which a degree of putrefaction has taken place, invariably assume the same colour.

Although large arteries resist *ulceration* for a long while, they are sometimes involved in it. When healthy, and not placed under circumstances peculiarly unfavourable to their own nutrition, they seem to be capable of resisting its destructive effects more powerfully, than when their external surface has been separated from its surrounding connections, or their coats are the seats of previous morbid alterations.

Considerable arteries not only pervade the generality of diseased structures for a long while without being attacked by ulceration, but preserve themselves in the midst of the worst tubercular and cancerous affections. This indisposition of arteries to suffer from the ravages of surrounding diseases, is strikingly illustrated in the extensive cavities sometimes formed towards the roots of the lungs in tubercular phthisis; all those fræna or bands, extending across such cavities, being only arterial branches, which have escaped the work of disorganization. Sometimes, however, the arteries are attacked by ulceration, in consequence of certain forms of disease around them. We know that this frequently happens in phagedenic ulceration, cancer, and hospital gangrene.

The *internal coat of the arteries may also be attacked by ulceration, primarily beginning in it.* The ulcerations are generally of a roundish shape; sometimes only one exists in the whole arterial system; sometimes the aorta is studded with them. In proof of the arteries being liable to *suppuration*, I may mention, that Andral once found the lining of the aorta raised up by six abscesses, each of which was as large as a nut, and situated between the internal and middle coats. Pus is also occasionally noticed within certain arteries, either blended with the blood, or contained alone within the vessels. The same pathologist has seen most of the branches of the pulmonary artery in this remarkable condition.

Pus is not, however, so often found between the internal and middle coats of arteries, as a peculiar matter, that is not precisely like any other production in the animal economy, and has long been described under the name of a *pultaceous* or an *atheromatous substance.* Blended with it, are frequently noticed particles of earthy matter, which feel like sand. When they are abundant, they form, within the texture of the vessel, a sort of *concretions more like mortar* in their appearance than bony formations. These *calcareous deposits* are so common in elderly persons, that they are calculated to exist in seven tenths of all individuals whose ages exceed sixty. This was the observation of Bichat, which agrees with that

of Dr. Baillie, who represents the change as being more frequently seen in old persons, than the natural or perfect state of the arteries.

However, young subjects are not completely exempt from such ossifications. The temporal artery has been found ossified in a child only fifteen months old; and the late Mr. Wilson met with an ossification of the aorta in a subject aged only three years. In one girl, eight years old, and in four or five other young persons between eighteen and twenty-four years of age, Andral saw the aorta studded with calcareous deposits; and in another person under forty, there was a considerable ossification of the superior mesenteric artery.

Strictly speaking, the *internal coat is never the seat of these earthy deposits*, though it is frequently raised up by them, thinned, and even cracked, or more or less absorbed, so that they are then actually in immediate contact with the blood itself.

While these earthy deposits are forming in the arterial texture, the *middle or fibrous coat* undergoes a morbid change, sometimes becoming *thickened*, and in other instances *wasted*, and its place occupied by the calcareous matter. An analysis of these earthy concretions of the arteries proves their usual composition to be phosphate of lime, and animal matter, in the proportion of about sixty-five of the former to thirty-five of the latter. Such concretions are nowhere more frequent than in the aorta, and they have been met with in every one of its branches. In its abdominal branches, there is some diversity in this respect; for, while the splenic artery is frequently ossified, the hepatic and coronary stomachic are rarely found in this condition. The arteries of the limbs are well known to be often affected in this manner; and every man of experience in the habit of feeling the pulse, must have occasionally perceived the radial artery to be ossified. However, the coats of the arteries of the upper extremity are much more rarely the seat of any diseased alteration, than those of the arteries of the lower limbs.

Sometimes an artery is completely incrusted with earthy matter, so as to form an entire rigid cylinder; and, in other instances, the phosphate of lime is blended with an atheromatous substance. This condition of an artery often lays the foundation for the disease, called *aneurism*. It also sometimes makes an artery incapable of bearing a ligature, which either breaks through the vessel at once, or causes ulceration of it without adhesion. In the Med. Chir. Trans. of London, is a case by Mr. Langstaff, illustrating the inefficiency of the ligature on the ossified arteries of a stump; with another by Mr. Lawrence, proving that an ossified artery may sometimes be tied with success.

*Aneurism* is defined to be a tumour formed by arterial blood, and communicating with an artery; or it may be said to be generally a pulsating tumour, arising from a dilated, ruptured, or wounded artery, and filled with blood, which, while the disease is recent, and of trivial size, is in a fluid state, but afterwards, when the swelling is larger, and has existed a considerable time, is found partly arranged in the form of solid concentric layers upon the inner surface of the cavity or sac. Some forms of aneurism arise either from an alteration of structure, and a consequent dilatation of all the coats of the affected part of the artery, or from a dilatation of the external coat alone, the inner coats having previously given way in consequence of disease or violence.

So long as the boundary of the tumour is formed by all the dilated coats of the vessel, the disease is termed a *true aneurism;* but, when the coats of the artery are wounded, or some or all of them have given way,

in consequence of disease, the tumour receives the name of *false or spurious aneurism.* When all the coats of the artery have given way, the blood may be injected extensively into the cellular tissue, so as to make a *diffused false aneurism;* or collecting in one mass, it may soon become bounded by a kind of cyst formed around it by the adhesive inflammation, so as to constitute, what is termed, a *circumscribed false aneurism.* *

Another rare variety of aneurism is that where, in consequence of the destruction of the outer coats of the aorta by disease, the internal coat yields to the impulse of the blood, and becomes dilated into an aneurismal pouch.

This form of aneurism has hitherto been noticed only in the aorta, the lining of which is more loose and elastic than that of the rest of the arterial system. Some unequivocal specimens of it were collected by Dubois and Dupuytren, and an excellent illustration of it is contained in Mr. Liston's museum. What is termed the *aneurismal varix,* or *venous aneurism,* is a dilatation of part of a vein, from the gush of blood into it from a neighbouring artery. Of course, the existence of such a disease implies a preternatural communication between the two vessels.

The *aneurism by anastomosis,* as it was called by Mr. John Bell, ought not properly to be arranged with aneurisms, as it is of a totally different nature, being the growth of a new tissue, which is compared to what the French term the *erectile tissue,* abounds in blood, and, when wounded, pours it out so profusely from every point, and even from its smallest vessels, which seem to have no disposition to close, that the hemorrhage is truly alarming.

We are then to understand, that aneurism may be produced either by the rupture, or the dilatation of the coats of an artery, or by a combination of both these circumstances, the dilatation having preceded the rupture. The truth of the doctrine of aneurism by dilatation of all the arterial coats, unattended with ulceration, or laceration of the middle and internal ones, was disputed by Scarpa; but, the correctness of that view, as first taken by Morgagni, and subsequently confirmed by the valuable researches of Mr. Hodgson and others, is now universally admitted. The dilatation of all the coats of an artery may then precede the rupture of the vessel, as is often illustrated in the aorta, where the coats of the vessel can sometimes be traced throughout the whole extent of the expansion, while the inner surface of the sac at the same time presents appearances peculiar to the coats of arteries. But the state of dilatation, preceding rupture, is not confined to the aorta; it has been noticed by Mr. Hodgson at the bifurcation of the carotid and iliac arteries, and also in those of the extremities. In the cases to which I refer, all the coats were dilated and extended over the aneurismal swelling, and not merely the external coat.

Notwithstanding these facts, the most common form of aneurism undoubtedly corresponds to Scarpa's description, and is attended with a disease and giving way of the internal coats of the artery, followed by the

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* M. Lisfranc recognizes but two forms of the disease, the *traumatic* and the *spontaneous. Des différens Méthodes et des différens Procédés pour l'Obliteration des Artères,* &c. 8vo. Paris, 1834. Rejecting from aneurismal diseases mere extravasations of blood, usually described as diffuse false aneurisms, he confines the name of traumatic aneurism to a tumour produced by blood escaping from an opening in an artery, and forming for itself a sac at the expense of the surrounding tissues. These views seem correct.

dilatation of the outer tunic, which, after a time, may also burst, and allow the blood to be effused.

When the disease consists of dilatation only, without any rupture, or ulceration of the inner tunics of the vessel, the swelling is generally of an oval shape; but when the internal coats have given way, a lateral prominence is formed, which gradually increases in size. Scarpa considers the morbid dilatation of an artery, unattended with rupture of its coats, as a disease totally distinct and different in many particulars from aneurism. He represents the root of an aneurism of the aorta as never including the whole circumference of the tube of the artery, but as occupying only one side of the vessel, from which the aneurismal sac rises in the form of a tuberosity appended to it, and of various size and extent, according to its situation, and the stage of the disease.

On the other hand, he describes the dilatation of the artery, as constantly affecting the whole circumference of the tube; the blood is yet within the proper cavity of the vessel; no layers of coagulated blood are ever found in the cavity of the dilated portion of the artery, as in aneurism; and, so long as the continuity of the proper coats of the vessel remains entire, the circulation is not perceptibly affected. In aneurism, as defined by Scarpa, the blood passes into a cavity, which is, as it were, out of the track of the circulation; there its motion is necessarily retarded, and there it invariably deposits lamellated coagula, and sometimes in such quantity as entirely to fill the cyst. If any solutions of continuity happen upon the inner surface of a morbid dilatation, it is only within the cavities and inequalities of such parts that lamellated coagula are deposited, and all the rest of the inner surface of the disease is entirely free from them. These solutions of continuity are looked upon by Scarpa as the beginning of aneurism, formed subsequently to the simple dilatation. These facts are worth recollecting, whatever view we may be inclined to take of the usefulness of discriminating the mere dilatation from aneurism.

Whether an aneurism begin with dilatation, or not, a rupture, or ulceration of all the coats of the artery, usually follows in a more advanced stage of the disease. In most instances, the aneurism is formed by a destruction of the internal and middle coats of the vessel, and the expansion of the external one into a sac, which at last, giving way, the sheath of the artery, and the surrounding parts, whatever they may be, form the boundary of the tumour. The rupture, or ulceration of the internal and middle coats, is not, however, always followed by aneurism of the kind just now described. Laennec met with a case, in which the internal and middle coats had been divided by a narrow transverse fissure, extending over two-thirds of the circumference of the artery; and the blood, instead of distending the external coat into a sac, had insinuated itself between it and the middle fibrous coat, and dissected them from each other, through more than half the circumference of the artery, from the arch of the aorta down to the common iliacs. Fissures of the kind described result from cracks, or lacerations occasioned by calcareous deposits; but the case reported by Laennec, and another by Mr. Guthrie, are the only instances on record, where such a fissure was followed by more than a circumscribed effusion of blood around it.

In the Dublin Hospital Reports (vol. iii.) is the history of another new kind of aneurism related by Mr. Shekelton: the blood had forced its way through the internal and middle coats, dissected the middle from the external one, to the extent of four inches, and then burst again through the internal and middle coats into the canal of the artery; thus forming a

new channel, which eventually superseded the old one, the latter having become obliterated by the pressure of the tumour.

The sac, formed by the dilatation of the arterial coats, as it increases in size, acquires firm adhesions to the parts in its immediate vicinity, so that when the external coat gives way, the effusion of blood is often still restrained by these adhesions, and the extent of the aneurismal cavity then goes on increasing only gradually. Sometimes, however, the aneurismal sac bursts, or rather is lacerated, so suddenly that there is not time for the adhesive inflammation to circumscribe the blood, and an aneurism with extravasation in the cellular tissue is the consequence, generally accompanied by a great increase of danger.

Aneurisms are divided into *external* and *internal;* the former taking place in the arteries of the neck, head, or limbs; the latter in the aorta, or some of its branches within the chest or belly.

*Symptoms of true aneurism. A true aneurism,* when not situated within the chest or abdomen, commonly begins in the form of a small pulsating tumour, which subsides under pressure, and immediately becomes prominent again, when the pressure is discontinued. It also diminishes, becomes less prominent, and beats feebly or not at all, when the artery, leading to it from the heart, is compressed; but directly the compression is removed, the swelling becomes as full and conspicuous as ever again, and pulsates with its original force. At first, there is not much pain; and as in this stage the blood in the tumour is all fluid, and no lamellated coagula are deposited on the inside of the sac, the swelling throbs distinctly and forcibly.

In a more advanced stage, the tumour is larger and more solid, and the sac cannot be completely emptied by pressure. A part of the blood in it is now in a solid state, and the sac and the adjoining cellular tissue are much thickened. The size of the swelling and its pressure on the surrounding parts next begin to give pain, and obstruct the circulation. The pulsation, however, though not so strong as at first, is yet distinct. In a still later stage, the size and solidity of the aneurism are more increased, and the pulsation is so weak that it can only be felt at that part of the swelling which is directly opposite to the communication between the artery and the sac. The sac is now almost full of lamellated coagula, and contains but a small quantity of fluid blood. If the case be a popliteal aneurism, the pressure on the posterior tibial nerve causes severe pain in the foot and toes; and the nerve itself may at length become as flat as a riband, and its texture scarcely recognizable. The pressure may also obstruct, or even obliterate, the popliteal vein; and these effects, and the pressure on the lymphatics, will account for the œdematous swelling of the leg in the advanced stage of the disease. As soon as the tumour has filled up the popliteal space, the patient cannot completely extend the leg, nor place his heel on the ground. In the diagnosis it is important to remember, that pulsation is by no means a certain proof of a disease being aneurism, and also that a tumour may be an aneurism, though it may be destitute of pulsation. I was once sent for to Egham to give my opinion on an enormous tumour in the epigastric region, attended with pulsations as strong as those of the aorta itself. The patient, under the care of Mr. Gilbertson, was a young man about twenty, and one protuberant part of the swelling was on the point of giving way. Now, a correct judgment was formed of the nature of the case, which was only a large chronic abscess, by the consideration that, if the disease had been an aneurism of this magnitude,

the patient would have suffered not only excruciating pain from its pressure, and the action of the diaphragm would have been more obstructed, but the functions of the stomach and bowels would have been seriously interfered with. In fact, the swelling had formed in the quiet and insidious manner that many chronic abscesses do arise, and had attained a large size before it attracted notice. Some useful light was also thrown on the case by the fact of the patient having had, when a boy, a scrofulous abscess of the hip.

I once had an opportunity of seeing another considerable abscess between the quadratus lumborum muscle and the peritonæum, where the tumour was so affected by the pulsations of the aorta that the tumour, which was of immense size, throbbed with surprising force, so as to assume very much the external character of an aneurism of that vessel. The discharge of the contents of the tumour by puncture manifested the true character of the disease.

Pulsating tumours, not of the aneurismal kind, may sometimes be known by their not pulsating equally in all directions as aneurisms usually do. The two abscesses, which I have mentioned, could not, however, be discriminated by this criterion. Every part of them within the reach of examination throbbed with equal force. Besides, we know that, in aneurisms attended with much deposit of lamellated blood in the sac, the pulsation is often much more distinct at one point than another.

Another better criterion, if the tumour be moveable and admit of partial displacement, is to press it to one side, or raise it from the artery near it, when, if it be not an aneurism, it will be found to possess no pulsation. If it be an aneurism, its pulsation will not be lessened by any change in its position.

We have also one valuable source of information in the stethoscope; for, if the case be an aneurism, we may, with the assistance of this instrument, and sometimes without it, if the ear be applied close to the swelling, be able to hear distinctly the passage of blood into the sac, causing a sound compared to that of the working of a pair of bellows.

If it be a fact, as it certainly is, that many pulsating tumours are not aneurismal, it is quite as well established that a swelling may be of this nature, though unattended with any kind of throbbing whatsoever. When aneurisms change from the circumscribed to the diffused state, and the blood rushes from an aperture in the sac extensively into the cellular tissue, the pulsation generally undergoes a considerable diminution, or even a total cessation.

The same things often happen when an aneurism attains a large size, for then the sac is thickened, and much or even the whole of the sac may be occupied by considerable masses of pale-coloured firm coagula, arranged in concentric layers.

The absence of pulsation may lead to serious and fatal mistakes in practice: aneurisms have often been mistaken for abscesses and opened, and the patients destroyed by hemorrhage. I once saw a case, where a popliteal aneurism, which was undergoing a spontaneous cure by the deposit of firm layers of coagulated blood in the sac, was amputated under the idea that the swelling, which had no pulsation in it, was remarkably hard, and extended far forwards over each side of the knee, was an osteo-sarcoma, or some other anomalous incurable swelling. A puncture was first made in it; but, as the contents of the sac were solid, the hemorrhage was not such as it would have been in a less advanced period of the disease.

*Symptoms of diffused false aneurism.* In this case, the pulsations are generally feeble and indistinct; the part or limb is cold; and, in consequence of the extensive injection of the cellular tissue with blood, the skin is more discoloured than in a circumscribed true aneurism, unattended with inflammation.

The form of aneurism, produced by the bursting of the sac of a true one under the skin, or even more deeply from the surface, is termed a *secondary false one.* When this happens, the patient is sometimes conscious of a laceration or giving way of something within the limb; the tumour frequently undergoes a great and sudden change in its shape, and there is a rapid increase in its size; it spreads all at once over a greater extent of the limb or part, or becomes *diffused.* At the moment when these changes commence, the temperature of the limb falls, and there is a material decrease in the force of the pulsations, which in two or three days are entirely lost. Some time ago, I had a patient, in whom several of these facts were illustrated; but a degree of ambiguity was created by the circumstance of no particular change in the shape of the limb having followed the bursting of the sac. This was owing to its having given way in a very deep situation at the back of the head of the tibia, whence the blood escaped into the cellular tissue under the gastrocnemius muscle down to the tendon of Achilles; and, as the œdema had been previously considerable, if any sudden increase of the swelling did occur, it was concealed. Doubts were therefore entertained whether the reduction and stoppage of the pulsation arose from the deposit of lamellated blood in the sac, or from the change of the aneurism from the circumscribed into the diffused state. I then held a consultation with Mr. Lawrence; and the latter gentleman thought he could distinguish the bellows sound, proving that there was yet a jet of blood into the sac, and that the communication between it and the artery could not be entirely closed.

The sudden diminution or cessation of pulsation, and an equally sudden change in the shape and extent of the tumour, accompanied by a rapid fall in the temperature of the limb, and more or less discolouration of some part of it, resembling that of ecchymosis, seem to be the circumstances indicating the change of the aneurism from the circumscribed to the diffused state. This occurrence, instead of lessening the danger, always greatly increases it, by bringing on a disposition to mortification.

When all the coats of an artery have given way, and the arterial sheath contributes to the formation of the aneurismal sac, it becomes thickened, partly by a condensation of the surrounding cellular tissue, and partly by the deposit of fibrine upon its inner surface.

The lamellated blood, within an aneurismal sac, is always arranged in concentric layers, the furthest of which from the centre of the swelling acquire surprising firmness, and are so adherent to the inside of the tumour, that they seem as if they were confounded and blended with the parietes of the sac itself.

The commencement of the deposit of fibrine upon the internal surface of an aneurismal sac, soon follows the origin of the disease, and seems designed by nature as some protection against hemorrhage, and as a means of strengthening the boundary of the aneurism, and resisting the impulse of the blood against it. Sometimes, by filling up the whole cavity of the sac, it becomes, indeed, the means of a spontaneous cure.

This deposit of fibrine takes place, as I have explained, in successive

concentric layers, which have a different aspect according to the date of their formation. The most central consist simply of blood more or less firmly coagulated, and sometimes probably formed after death. A little farther from the centre, the coagulum is drier, paler, and evidently composed of a large proportion of fibrine. Lastly, in contact with the cyst, are layers of the same substance, but completely opaque, of a somewhat friable consistence, and very closely resembling meat deprived of its red colour by boiling. The most recent layers adhere to one another but slightly; the old ones very firmly.

It appears, then, that these lamellated coagula are formed by successive deposits of the fibrine of the blood; and their production seems to be owing, in a great measure, to the retarded motion of the blood in the sac. Hence, they are more readily produced in false than true aneurisms, because, in the former cases, the communication between the canal of the artery and the sac of the aneurism is narrower. This deposit of lamellated blood is not vascular and organised, and the pus sometimes found within it, is, according to Cruveilhier, secreted by the inner surface of the sac, and then insinuates itself between the concentric layers. While these changes are going on within the sac, its outside becomes connected to all the adjacent parts by the adhesive inflammation. Nor do those parts themselves remain unaffected. Sometimes they are simply displaced, or compressed by the aneurismal swelling; sometimes they are more or less absorbed and destroyed from the effect of its throbbing and pressure. In certain cases, ulceration is produced; in others, sloughing.

Thus, in aneurism of the aorta, large portions of the ribs and sternum are destroyed, and the tumour protrudes externally. If the swelling should make its way through the ribs in the direction backward, it may then come in contact with the scapula, and occasion a remarkable displacement of that bone, as occurred in a patient some time ago at the Bloomsbury Dispensary. Frequently the bodies of the vertebræ suffer, and the aneurism may even penetrate the spinal canal, so as to press upon the medulla, and occasion a sudden paralysis. This last effect of aneurism, however, is exceedingly rare. It is curious to observe, that, while the bodies of the vertebræ are thus more or less destroyed by absorption, the intervertebral substance itself frequently remains perfect.

Sometimes an aneurism of the aorta produces serious effects upon the organs contained in the thorax, or abdomen; compressing, or even making its way by ulceration into the pulmonary artery, or right auricle of the heart, or by a kind of lacerated fissure into the pericardium; by ulceration, into the œsophagus, the trachea, the bronchi, the lungs, stomach, or some part of the intestinal canal. The vena cava, the subclavian vein, and even the thoracic duct, may be obliterated by the pressure of aortic aneurisms. In one case of aortic aneurism in the abdomen, paralysis was brought on by the pressure of the swelling on the nerves of the lower extremity, and not by the effect of the disease of the spine itself and spinal cord.

The tumour may also burst either into the pleura, or the peritonæum. Just in the same manner as the lungs may be compressed, and altered in their shape by the pressure of an aneurism within the chest, the kidneys, and other viscera may be similarly affected by the pressure of an aneurism of the abdominal portion of the aorta.

In the vicinity of certain aneurisms, we not only often find the veins obstructed, or obliterated, but the large nerves converted into flat expan-

sions like ribands, the muscles singularly wasted, and the bones either deprived of their periosteum and carious, or else that membrane thickened, and osseous matter so profusely thrown out, that it extends more or less around the aneurismal swelling. Sometimes the sternal end of the clavicle is dislocated by aneurismal tumours. The absorption of bone, produced by the pressure of aneurisms, is different from ordinary caries in not being accompanied by the formation of pus; and experience proves, that, if the aneurism be cured, the state of the bones rarely gives any future trouble.

An aneurism, having made its way through all the coats and the cellular sheath of the vessel, becomes bounded by whatever parts or textures happen to lie near it. Thus, in aneurisms of the aorta, a portion of the cyst may be composed of the side of the œsophagus, the trachea, the substance of the lungs, or even the bodies of the vertebræ deprived of their periosteum.

When an aneurism is about to burst externally, a conical inflamed prominence forms on the swelling, and here a small slough is produced, on the loosening of which the effusion of blood takes place, which destroys the patient either in a few seconds, or by repeated returns of hemorrhage. The process by which such an aneurism gives way, then, is neither laceration nor ulceration, but the production of a slough, which becomes loose, and the fatal bleeding ensues.

When an aneurism extends into a cavity lined by a mucous membrane, as the œsophagus, intestines, or bladder, the process by which it bursts may be similar, namely, a small slough may be formed on the mucous membrane; but generally the rupture takes place by ulceration. When, however, the tumour makes its way into a cavity lined by a serous membrane, the process is different; for a crack or fissure is then produced in the latter texture after it has been rendered very thin by the effect of distention, and the blood is discharged into the cavity of the pericardium, pleura, or peritonæum, according to the circumstances of the case. An aneurism of very moderate size, situated at the root of the aorta, within the pericardium, will frequently give way, and prove immediately fatal.

Sometimes aneurisms prove fatal by their pressure on important organs, and the patient is destroyed neither by internal, nor by external hemorrhage. A patient, from whom one of Cruveilhier's engravings was taken, was destroyed by the compression of the trachea. What is remarkable, also, is the total disorganisation, produced in a portion of the pneumogastric nerve, by the pressure of one of the aneurismal swellings. It was flattened and converted into a fibrous substance for some extent, without any vestiges of nervous tissue. The patient had had continual vomitings, rigors, swoons of considerable duration, general coldness of the body, and inability to keep any solid food on his stomach.

*Causes of aneurism.* If we exclude from consideration those cases, in which an aneurism arises from the wound of an artery by a sharp or pointed instrument, the spicula of a fractured bone, or the laceration of the axillary artery by the employment of great force in the attempt to reduce dislocations of the shoulder, we rarely meet with aneurisms, which can be positively referred to external violence, unless the artery affected should have been previously in a diseased state. Thus, if the popliteal artery be in a healthy state, no forced extension of the leg will produce a laceration of its coats. To have such an effect, the leg must be extended in a degree that would first rupture the ligaments of the knee-joint.

A predisposition to aneurism seems to depend upon: 1. The large size of certain arteries. 2. The force with which the blood is propelled

into them, and against certain parts of them. All these facts are illustrated in the frequency of aneurism of the arch of the aorta. From what has been already stated, the reason why aneurism appears to be frequently combined with hypertrophy of the left ventricle of the heart, must be manifest. 3. Such a situation of an artery that it is left very much unsupported by muscles, and exposed to continual motion and disturbance in the exercise of the part, as exemplified in the popliteal arteries of post-chaise drivers and others.

The atheromatous and calcareous deposits which occur between the internal and middle coats of the arteries, or in the sclerous tunic of Malgaigne, and are often the forerunners of aneurism, sometimes pervade a considerable extent of the aortic system. Pelletan met with sixty-three aneurismal swellings, from the size of a nut to that of an egg, in one subject, from such disease of the arterial coats.

If an artery be sound, mechanically weakening it either by stripping off the outer tunics, or by cutting through the inner ones, by the application of a ligature, and then immediately removing it, so as to let the blood flow through the vessel as usual, will not lead to the formation of aneurism. *Spontaneous* aneurisms are almost exclusively confined to the aortic system; for, of three hundred cases referred to by M. Lisfranc, only two or three were in the pulmonary artery, and these not free from ambiguity.

Aneurisms of the brachial artery and its branches are rarely combined with disease of the coats of those vessels; but arise from wounds, while axillary, aortic, popliteal, and most other aneurisms are generally preceded and accompanied by a morbid change of the arterial coats.*

Men are more frequently the subjects of aneurism than women; according to Mr. Hodgson's calculation, in the proportion of fifty-six to seven; and according to Lisfranc's estimate, founded on a list of one hundred and fifty-four cases, in the proportion of one hundred and forty-one men to thirteen women.

The period of life between thirty and fifty is most liable to aneurism; and, before twenty and after sixty, the disease is very rare. Sir Astley Cooper has known it arise in one person who was eighty, and in a boy of eleven. Lisfranc refers to an aneurismal patient, only thirteen years old, and to three between seventy and eighty, in a list of one hundred and twenty cases. Popliteal aneurism is rare in females, who, when they become the subjects of the complaint, mostly have it either at the bend of the arm from a wound, or in the ascending aorta, or the carotid artery from disease.

*Prognosis.* An aneurism, left to take its own course, would generally destroy the patient either by hemorrhage, gangrene, or the interruption of the functions of the viscera by the pressure of the tumour. For the most part, internal aneurisms either gradually make their way outwards through the parietes of the chest, or abdomen, and at length prove fatal by external hemorrhage, or else they burst in the cavity of the chest, or abdomen, or within various organs with which the swelling happens to become connected, as the pericardium, œsophagus, trachea, intestines, &c.

On account of the impossibility of practising any surgical operation

* One aneurism of the brachial artery, from disease of the arterial coats, is recorded by Pelletan, and another by Mr. Hodgson, but the occurrence is rare.

for the cure of various internal aneurisms, and also because such diseases affect vessels into which the blood is propelled by the heart with extraordinary force, the prognosis is infinitely more unfavourable, than in external aneurisms. The danger is often likewise seriously increased by the mechanical effect of the swelling upon important organs. Thus the pressure of aneurisms of the aorta upon the œsophagus, trachea, lungs, pneumo-gastric nerve, and other parts, whose functions are highly important to life, adds considerably to the risk, and sometimes has such an effect upon the health, that the patient even dies before the aneurismal tumour bursts. This happened in the case recorded by Cruveilhier. The prognosis will be much more unfavourable, when the patient has more aneurisms than one, a circumstance showing a tendency to disease in the arterial system at large. Sometimes, in such cases, soon after an operation has been performed for the cure of an external aneurism, the patient dies of the rupture of an internal one of the aorta. Indeed, it is always a requisite precaution to ascertain, if possible, whether an aneurism on which we are about to operate, be the only one. If there be any internal aneurism, besides another situated in one of the limbs, we should not be justified in operating upon the latter. In one case of this description, operated upon by Sir Astley Cooper, no sooner had the first incision been made, than the patient fell back, and died in a few minutes. On examination of the body, the pericardium was found distended with blood, which had escaped from an opening in an aneurism, seated at the beginning of the aorta, immediately above the semilunar valves.

Supposing there were two aneurisms on the same limb, for instance, one of the femoral and another of the popliteal artery, but unattended with any signs of internal aneurism, we ought to tie the artery in the groin, or the external iliac, by which means we might accomplish a cure of both aneurisms at once.

The prognosis in aneurism depends also in some measure upon the *size,* as well as the *situation* of the tumour. Generally speaking, the larger the aneurism is, the more tedious and uncertain is the cure. The magnitude of the swelling materially prevents the establishment of a collateral circulation, for its pressure may have obliterated the principal anastomosing branches. It not only has this effect, but it produces a total change in the large nerves, flattening them into the shape of ribands, and rendering the great veins impervious. In addition to such mischief, which necessarily creates a tendency to gangrene, the pressure causes vast disorganisation of all the other neighbouring textures, muscles, bones, and joints.

If a popliteal aneurism be suffered to attain an enormous size, under the erroneous notion of affording time for the anastomosing vessels to enlarge, we not only incur the risk of the aneurismal sac bursting under the skin, and of the aneurism changing from the *circumscribed* into the *diffused* state, a serious change indeed for the worse; but such disease of the head of the tibia, condyles of the femur, and all the adjacent parts may take place, as will render the patient for a long time, or even permanently, a cripple, notwithstanding the cure of the aneurism itself.

In the case of a diffused aneurism, following a circumscribed one of immense size, and accompanied by enormous extravasation of blood in the cellular tissue, mortification will frequently follow, whether the

artery be now tied or not, and if the patient be then saved, it is only by amputation of the limb.

In the case of a single aneurism so situated, that the artery leading directly to it can be readily secured, and occurring in a person otherwise healthy, and not too far advanced in years, the prognosis is favourable, provided the operation be done according to the right principles.

An oval dilatation, extending to the whole circumference of an artery, is set down by Scarpa, as incurable. At the same time, this form of disease may remain stationary for a great number of years, and often has no decided influence in shortening life.

*Spontaneous cure of aneurism.* Aneurisms, even when not submitted to surgical treatment, do not always terminate fatally, but in a small proportion of cases undergo a *spontaneous cure*, which may be brought about in various ways.

1. The most common mode of cure is such an increase in the quantity of lamellated blood in the aneurismal sac, that its cavity becomes filled up, and then of course the circulating blood no longer passes through the aneurism, but is conveyed to the parts beyond the disease through the collateral vessels. The pulsation of the tumour ceases, the sac is gradually diminished, the solid layers of fibrine are in time absorbed, and the whole of the tumour is, by degrees, nearly or entirely obliterated.

Not only is the sac filled up by successive deposits of laminated blood, but the artery itself becomes blocked up with the same substance, both upwards and downwards, to the places where the next large collateral branches are given off above and below the tumour.

Now this desirable accumulation of laminated blood in the sac, is denoted by the cessation of the bellows' sound; by the tumour becoming more solid, and its pulsation being stopped, without any sudden increase of its size, or fall in the temperature of the limb, circumstances attending that stoppage or reduction of the pulsation of an aneurism, brought on by the change of the disease from the circumscribed to the diffused state.

2. Another mode of spontaneous cure is that in which the aneurismal tumour presses upon the portion of artery leading directly to it, so as to produce inflammation of the vessel, followed by an impervious state of it. Here the accidental shape, position, and direction of the tumour, do nearly the same thing, as is accomplished by the most approved surgical treatment.

3. A third manner, in which a spontaneous cure happens, is when the whole aneurismal swelling inflames, and sloughs away, attended with such an effusion of fibrine in the adjoining portion of the aneurismal artery as renders it completely impervious. When the sac inflames deeply, and abscesses form in an aneurism, the same consequences ensue. But, when the inflammation and sloughing do not reach to a sufficient depth, the communication between the artery and aneurismal sac may not be obliterated with fibrine, and the patient may then die of hemorrhage on the detachment or loosening of the sloughs.

4. A fourth mode of spontaneous cure happens when the pressure of one aneurism extends its effects to the artery leading to another, so as to cause an obliteration of such vessel. Of this variety of spontaneous cure, Mr. Liston mentions one remarkable instance: the patient had an aneurism of the subclavian artery which had attained a considerable size, but afterwards gradually subsided and disappeared. When the patient died, the cause of death was found to be the rupture of an aneurism of the arteria innominata, which had made such pressure on the subclavian

artery as to have obliterated it, and produced a cure of the aneurism in the axilla.

In whatever manner the cure is effected, the artery is almost constantly transformed into a kind of dense impervious chord in the situation of the disease. Scarpa lays down this as an invariable and essential circumstance, without which an aneurism cannot be cured. Perhaps, the only exceptions to this statement are some examples of aortic aneurism, where the sac is of moderate size, and completely filled with the fibrinous part of the blood, at the same time that the canal of the aorta remains perfectly unobstructed. Some cases of this description are recorded in Hodgson's Treatise on the Diseases of Arteries.

*Treatment of aneurism.* As the enlargement of every aneurism and its ultimate rupture, depend upon the force with which the blood is thrown into the swelling, the most important principle in the treatment must necessarily consist in lessening the impetus of the circulation, or even in preventing the entrance of the main current of blood into the aneurismal sac altogether. The latter of these plans is the only one, upon which much dependence can be placed. Unfortunately, however, it is quite inapplicable to certain aneurisms, the situation of which renders it totally impracticable to adopt the necessary proceedings for the accomplishment of the principle in question. Under these circumstances, we are obliged to be content with the employment of means calculated to reduce the general impetus of the circulation, and to maintain it in as quiet a state as possible.

In aneurisms of the aorta, a low diet, abstinence from animal food, occasional venesection, the exhibition of digitalis, and the avoidance of much exercise and of all laborious pursuits, are the means commonly recommended; rather in the hope of retarding the progress of the disease, than of bringing about its cure. By means of such treatment, however, the suggestion of which originated with Valsalva, who also applied ice and other cold applications, when there was an external tumour, the success has sometimes exceeded the expectations formed of it; and if we are to believe the histories of some cases recorded by Pelletan in his Clinique Chirurgicale, and by other writers, aneurisms of the aorta, so large that they protruded through the absorbed ribs and sternum, have thus been reduced and cured. I saw a case, in which the external swelling subsided in consequence of the aneurism bursting into the œsophagus, and a profuse bleeding taking place, which brought on syncope, and then stopped. The patient lived a quarter of a year after this first rupture of the aneurism, and then fell a victim to the return of hemorrhage.

One caution is necessary, with respect to bleeding in cases of aneurism of the aorta, namely, to avoid producing syncope, as it is attended with considerable risk of the circulation not being restored again. Hence, the blood should be taken away slowly from a small orifice in the vein, while the patient is in the recumbent position, and only in the quantity of a few ounces at a time.

Sometimes also the attempt to cure external aneurisms on the principle of lessening the impetus of the circulation has been made, though not with much success. In Pelletan's Clinical Surgery, may be found one or two instances of a cure of subclavian aneurism, on Valsalva's plan, but they are very rare; and as they sometimes happen from other causes, some doubts may be entertained, respecting the share which the treatment had in bringing about the desirable event. I have seen one example of spontaneous cure of an axillary aneurism.

We have, however, one means which can be tried in cases of external aneurism, which is not applicable to internal ones; namely, pressure, which operates on the principle of checking the impetus of the blood in two ways. Thus, when a bandage is applied with the nicest equality over the whole limb and tumour, as advised by Scarpa, it can only do good by retarding the circulation in the limb generally, and thus promoting the coagulation of the blood in the sac. The plan does not appear to contemplate the interruption of the main stream of blood to the aneurism, as is aimed at when the surgeon tries pressure in another way, and directs it against the portion of artery near the swelling, and through which the blood is conveyed into the sac.

Whenever pressure is tried, whether in one manner or in the other, the plan should be combined with Valsalva's treatment, especially a low regimen, perfect quietude, occasional venesection, the administration of digitalis, and the application of ice, or cold evaporating lotions to the tumour.

Pressure made on the artery, with the view of obstructing the passage of blood into the sac, rarely answers. Few patients can bear the pain which arises from it, and it is exceedingly difficult to make it operate effectually.

There is indeed but one method, on which a reliance can be placed as a means of fulfilling the great principle of cure, namely, *that of preventing altogether the continuation of a powerful stream of blood into the aneurismal sac.* The method alluded to consists in cutting down to the principal artery, by which that fluid is conveyed into the aneurismal sac, and then applying a tight ligature round it, by which means we not only immediately stop the main current of blood to the aneurism, but excite such changes in the tied portion of the vessel as lead to its permanent obliteration. The pulsation of the swelling directly ceases; what fluid blood may be in the sac being now in a more or less stagnant condition, gradually assumes a solid state; the portion of the artery between the sac and the ligature becomes filled with coagulum, and a gradual obliteration of the aneurismal swelling is the result; the artery itself is converted into an impervious cord; the lamellated and coagulated blood in the sac is by degrees absorbed; and at length the tumour dwindles entirely away, or is quietly reduced to one, the size of which is so inconsiderable as to create no inconvenience. The artery is generally rendered impervious, not only for some way above the tumour, but also for some way below the sac down to the giving off of the first large collateral branches. There are cases, however, in which a diminished circulation in the sac goes on after the operation, and even a degree of pulsation may either continue or return, in consequence of the blood finding its way by anastomoses into the portion of the artery immediately above the tumour, which, for some time at least, remains pervious.

The old method of operating consisted in opening the tumour, taking out the lamellated blood, finding out the communication between the sac and the artery, and applying a ligature above and below it, the cavity being then filled with lint, and left to suppurate. Instead of this practice, modern surgeons avoid opening the tumour, and content themselves with the more simple and better plan of exposing the artery at some convenient point of its course toward the aneurism by an incision, from two to three inches in length, and then tying the vessel with a smallish but strong ligature, calculated to divide the inner coats of the vessel, and to bring about its closure by the adhesive inflammation.

In the observations, delivered on the subject of hemorrhage, I have explained the principles to be observed in the choice and application of ligatures. A few maxims require particular attention in operations for aneurism. 1. We should always *make a sufficient incision in the skin;* for, if it be too small, all the rest of the operation will be tedious and difficult; the artery will not be found and tied without a good deal of handling of the parts, and the patient, instead of being saved from pain, will suffer much more, than if the external wound had been made of proper size. 2. *Avoid the inclusion of any large nerve or vein in the ligature.* 3. In order to avoid more certainly the inclusion of the vein, or the wound of it, *the point of the needle is generally introduced between the artery and vein,* and brought up on the side of the former, away from the latter vessel. 4. A free external opening in the integuments would be useless if not followed by *a free incision in the fascia.* I am glad to find Dupuytren joining in this doctrine, which I have always inculcated. "The external incision (says he) must be sufficiently large to admit of free manipulation, with respect to the vessel, and *the aponeuroses must be more extensively divided, than the skin.*" 5. *Never tie the arterial sheath,* as such practice would not only render the ligature less likely to produce a proper effect on the artery itself, but make the completion of its detachment tedious and protracted. *The sheath* ought to *have a very limited opening made in it,* for all that is required is room for the passage of the needle round the artery; and a larger division of the sheath than is necessary for this purpose, will only lead to disturbance of the artery, or even a detachment of a larger portion of it, than is advisable, from its cellular and vascular connexion with the interior of the sheath. At all events, the artery should be fairly tied by itself, without any unnecessary separation of it, or of its sheath, from their surrounding connexions. Hence, the practice of insulating the artery for some extent, so as to be able to put the finger under it, deserves reprobation. All we have to do is to pass a small ligature, by means of an aneurismal needle under the vessel, and this may be done, after the arterial sheath is opened, without any rough handling of the vessel, or any material separation of it from its natural connexions. If we were to separate the artery from those connexions, which supply its vasa vasorum with blood, how could we expect any healing process to take place in it? Ulceration or sloughing would certainly occur, instead of the adhesive inflammation, and, after a short time, profuse and fatal secondary hemorrhage, instead of the cure of the aneurism.

The knowledge of the value of the principle, which dictates the avoidance of the detachment of the portion of artery which we are about to tie, from its natural connexions — which points out at the same time the prudence of not disturbing such portion of artery any more than can be avoided — will enable us immediately to make a due estimate of various ingenious, but unsafe contrivances, intended to render the obliteration of the artery more certain, but which have in reality quite a contrary effect. Another frequent cause of hemorrhage, in former times, was the employment of thick clumsy ligatures, which also were not applied with due tightness, lest they should injure the coats of the artery.

As a guard against secondary hemorrhage, the old surgeons sometimes had recourse to *ligatures of reserve;* one or more ligatures were put loosely round the vessel above that which was tightened, so that if the latter failed, the others might be immediately tightened.

But it is manifest, that these ligatures of reserve were the very things

likely to produce a risk of hemorrhage. They were objectionable as extraneous irritating substances in contact with the artery; they were objectionable as requiring for their application a more extensive denudation and a considerable disturbance of the vessel. In short, their employment was entirely repugnant to those wise maxims in the treatment of wounded and aneurismal arteries, which should ever be our guide. The fear of tying the arteries with proper firmness, and the use of irregularly shaped broad clumsy ligatures, sometimes occasioned bleeding in another way, namely, by the noose changing its position, and becoming loose. Thus bleeding came on, almost as soon as, and even sometimes before, the patient had been put to bed. Hence arose the absurd scheme of passing the ends of such a ligature, through the artery, directly below the noose, in order to keep it from slipping.

This suggestion was intended as an improvement of Mr. Abernethy's plan of applying two ligatures, one to the upper part of the exposed portion of the artery and the other to the lower, and then dividing the vessel at the mid-point between them.

With respect to this latter plan, it was founded upon the ingenious comparison of the state of the ends of the arteries thus treated in aneurism, with the condition of the extremities of the arteries upon the face of a stump after amputation. Hemorrhage was formerly found to be much less frequent after amputation, than after an artery had been tied for the cure of aneurism. Mr. Abernethy conceived, that as the ligatures, when this plan was followed, were put on the artery close to the points, where it lay amongst its natural connexions, it would be less likely to ulcerate, and that, by dividing the artery in the interspace between them, its ends would retract, and lie still more perfectly protected by the surrounding parts.

No doubt if, in the operation, a large portion of the artery were detached from its connexions, this practice of applying two ligatures, and dividing the intervening portion of the artery, would be the best, as it would enable us to avoid tying the vessel in the middle of its separated and disturbed part, which is the point most likely to ulcerate or slough, and to apply the ligatures at two points close to where the artery retains the advantages of its natural connexions. But in all other cases, the simple application of a single ligature, with due attention to the rule of making no unnecessary detachment of the artery from its surrounding connexions, is the practice, that now receives the general approbation of all the best modern surgeons.

Having secured the artery with a ligature of proper construction, for instance, with one made of thread, or strong dentist's silk, passed under the artery with an aneurism needle, the point or edges of which should not be so sharp as to endanger the vessel or neighbouring vein, nor yet so blunt as to be incapable of going round the artery without the employment of too much force; we are then to cut off one half of the ligature, on the principle of lessening the quantity of extraneous matter in the wound. The other end of the ligature is then to be brought out and fixed at the nearest part of either side of the wound, which is to be closed with adhesive plaster, so that it may have the best opportunity of uniting by the first intention.

The limb or part is then to be kept perfectly quiet, and every thing avoided, calculated to retard the circulation through the collateral vessels, or reduce the temperature of the limb. With respect to the proposals of cutting off both ends of the ligature, of taking away the ligature after

it has remained a given time, and of endeavouring to obliterate the artery by the graduated pressure of particular kinds of forceps, and other inventions, after the exposure of the vessel by an incision; I shall merely mention them in this work, as liable to objections, which prevent them from receiving general approbation.

When an artery is tied for the cure of an aneurism, according to the principles which have been recommended, hemorrhage after the operation is a rare event, unless the artery happen to be diseased where the ligature is applied to it, or some considerable branch arise close above the point at which such ligature embraces the vessel, in which case, we know, that the formation of a clot within it is likely to be prevented.

When hemorrhage does follow an operation for aneurism, it is not always necessary to cut down to the artery and tie it again, as a matter of course, because experience proves, that in a certain number of these cases, the hemorrhage either stops of itself after six or eight ounces of blood have been lost, or else is readily suppressed by the employment of cold and moderate compression. No doubt, the partial closure of the end of the vessel, sometimes effected, will suggest an explanation of these circumstances. However, if the bleeding were not to be easily controlled, the tying of the vessel higher up would be indispensably requisite to save the patient's life.

In some examples, the aneurismal swelling, instead of being quietly and gradually removed by the absorbents after the successful obliteration of the artery by the ligature, is attacked with inflammation, and a considerable abscess forms, attended with severe constitutional disturbance. No sooner is an opening made, than a copious discharge of fetid matter takes place, blended with coagulated blood. Various cases prove, that under these circumstances, there is generally no bleeding from the opening in the sac. For besides the security, arising from the obliteration of the artery by the ligature, there is the additional security resulting from the changes produced in the sac itself by inflammation, which, if they had occurred sooner, would probably have led to a spontaneous cure, and rendered the use of the ligature needless.

In the St. Marylebone Infirmary, however, Mr. Perry had a case, in which, after the rupture of the aneurismal sac in the state of suppuration, subsequent to the ligature of the femoral artery, the patient fell a victim to returns of profuse hemorrhage.

*Of Brasdor's method of operating upon certain aneurisms.* When a carotid, femoral, or subclavian aneurism leaves no room for the safe application of a ligature between the tumour and the heart, Brasdor conceived, that if the artery were tied on the other side of the swelling, a cure of the disease might be the result, because, though the sac would probably become even more distended for a time than it was previously, yet the transmission of blood through it being more or less impeded, and its motion stopped or retarded, its coagulation would be promoted. The experiment was first imperfectly and unsuccessfully attempted by Deschamps. It was completely executed, perhaps for the first time, by Sir Astley Cooper, who took up the femoral artery below the groin, in another case of inguinal aneurism; but the patient died some time afterwards of the bursting of the tumour. To Mr. Wardrop belongs the merit of having brought the value of this practice to the test of careful examination, and he reports several cases in which the operation proved successful. The examples alluded to were chiefly aneurisms of the carotid artery, situated very low down. Some instances, however, of aneurism of the arteria innominata are

reported to have been cured by the application of a ligature to the subclavian. Dr. Mott's case, which is amongst them, is free from all ambiguity, and the occasional success of the practice is on the whole satisfactorily established.

But, with respect to the value of this method, it cannot be precisely estimated without additional cases. One would expect the plan to be more suited to carotid aneurism, situated very low down, than to any other forms of this disease, because one advantageous circumstance would be the current of blood through the aneurism thus being completely stopped, which object the ligature would effect in few instances, except carotid aneurism, owing to the origin of arterial branches between the ligature and the sac. But as the common carotid gives off no such branches, it seems to be well suited for this operation. In axillary and inguinal aneurisms circumstances are very different; for, with respect to inguinal cases, unless we could tie the femoral artery above the profunda, the circulation through the sac would go on so freely, that any favourable change in the disease would certainly be much less likely to result from the operation, than in the instance of a carotid aneurism. And, as for axillary aneurism, several large branches arise so near the tumour, that a ligature could not be placed between them and the *distal* side of the swelling, and through them so free a circulation of blood would be maintained in the sac, that the prospect of success from the operation must be less encouraging than in a similar operation on the carotid. Further experience must, however, decide the question of the fitness of the method for various cases. The fact, that the ligature of the subclavian has already cured aneurism of the arteria innominata certainly proves, that sometimes a reduction of the motion of the blood, far inferior to its complete stagnation, will have the desired effect. We know that, in the generality of popliteal aneurisms, a retarded passage of blood through the sac continues for a certain time after the operation, and that even a degree of pulsation will occasionally return; but that these circumstances do not usually prevent the progressive increase in the quantity of coagulum from terminating in a cure.

The operation may be calculated for one case, and not for another; whether it will ever be the means of curing an inguinal or a subclavian aneurism, remains to be proved. One interesting case was under the care of Mr. Lawrence, where the pressure of a femoral aneurism obliterated the artery below the swelling, yet such change had not the effect of curing the disease. The same thing was here accomplished as is aimed at in the operation, but without any useful result.

*Of the anastomoses after operations for aneurism.* It might be supposed that the anastomosing vessels would become more numerous and conspicuous, in proportion to the length of time from the operation. But the researches of Sir Astley Cooper prove, that the reverse of this is the fact; for, at first, a great many vessels convey the blood originally conducted by the principal artery, and, after a time, their number diminishes, only a few vessels, conveniently situated for carrying on the new circulation, and adequate to this purpose, remaining in an enlarged state. The method of taking up particular arteries will be noticed in the third section of this publication.

## DISEASES OF VEINS.

The difference of texture between veins and arteries; the more moderate impetus of the blood in the former vessels; the presence of valves

in many of them; their greater tendency to inflammation; and the higher degree of danger attending that inflammation; are circumstances at once apprising us, that the diseases of the venous system cannot correspond in every respect to those of the arterial system. Thus the veins are not liable to aneurism, in the common acceptation of this term, or the formation of a tumour upon them produced by the impetus of their own blood, and preceded either by a wound, or a morbid alteration of their coats. The so-called *venous aneurism*, is indeed a swelling of a vein, filled with blood, and accompanied by pulsation, but it is occasioned not by the force of the venous, but of the arterial blood, which, in consequence of an accidental communication existing between a large vein and a neighbouring artery, gushes into the vein, and causes a pulsatory swelling of it.

In or between the coats of arteries, *calcareous deposits* are particularly common, more especially in elderly persons; but in the veins they are very unusual. Indeed, in every part of the sanguiferous system where black blood circulates, the same fact is exemplified. Thus, in the pulmonary artery, and in the right cavities of the heart, ossifications are far more rarely met with than in the aorta and left cavities of the heart.

Small bodies, termed *phlebolites*, and composed of phosphate and carbonate of lime, are occasionally met with in the veins of the uterus, bladder, or testes, varying in size from a millet seed to a pea, and in number from two to twelve. They are situated in dilatations of the veins, and loose enough to let the blood pass between them and the interior of those vessels.

The veins are more frequently *blocked up with coagulated blood* and *lymph* than the arteries.

*Pus is also more frequently met with in veins* than arteries, a fact which Andral refers to its being sometimes conveyed into veins from other parts by absorption, and sometimes to its being formed in them; whereas, in arteries, pus has only one mode of production, namely, it must be formed within these vessels themselves. The greater disposition of veins to inflammation, must here also be taken into the account.

While the wounds of large arteries give rise to hemorrhage, which is often either directly fatal, or cannot be suppressed without the ligature, those of veins are followed by bleeding, which is of a much more controllable kind. We purposely open veins of considerable size, in order to take blood from the system; yet we seldom find any difficulty in stopping the bleeding, which ceases of itself as soon as the removal of the fillet allows the stream of blood within the vessel to pursue its course towards the heart. But even when venous hemorrhage is more troublesome, it may almost always be suppressed by means of moderate pressure; and, I believe, that when a vein is so situated that it will conveniently admit of compression, a wound of it need not produce any alarm, so far as hemorrhage is concerned, which may thus be readily commanded.

In general, the right method of suppressing venous hemorrhage is pressure; and, as tying a large vein is now known to be frequently followed by a dangerous, extensive, and often fatal inflammation of such vessel, and other parts of the venous system, it certainly ought never to be done, except under circumstances which render the other plan inapplicable or ineffectual.

*Of inflammation of veins, or phlebitis.* *Phlebitis* is regarded by Cruveilhier as intimately connected with the whole range of pathology.

Surgeons should always be apprehensive of it after operations, and physicians in every organic disease that reaches the stage of softening, or that of ulceration. Sometimes phlebitis is restricted to the great veins and their principal branches; this is *ordinary phlebitis;* in other instances, it is seated in the capillary veins, when it is termed *capillary phlebitis*, which seems to Cruveilhier to constitute one essential part of the process of inflammation. Occasionally it affects both the capillary veins and the ramifications connected with them.*

The veins are particularly prone to inflammation, which frequently spreads with considerable rapidity along their internal surface, and this so far as to extend from the point where the affection first commences up to the very heart itself, bringing on a train of formidable and often fatal consequences. We are not, however, to consider the mere redness of the lining of these vessels, often met with in the dead subject, as a proof of their having been inflamed during life: for, after a body has been kept a few days, the inner coat of a vein imbibes and becomes dyed with the red particles of the blood, even more readily than the lining of an artery. The inflammation of a vein is always disposed to extend itself in the course of the circulating blood, but frequently also in the opposite direction. Sometimes it produces an effusion of fibrine, by which the tube may be obliterated, and a more or less extensive portion of it converted into a solid chord. In phlebitis, the great source of danger is the formation of pus within the vessel: in this event, the matter is either mixed with the circulating blood, or the inflammation having produced adhesions, at certain intervals, boundaries are formed for the collections of pus, which then represent a single abscess, or a chain of abscesses in the course of the vessel. If phlebitis advance not beyond the effusion of fibrine, it is termed *adhesive*, which is not productive of the serious risk always resulting from the *suppurative.*

When phlebitis is of trivial extent, and in the adhesive stage, its symptoms merely resemble those of any other common local inflammation of equal extent; but, when it ascends into the principal venous trunks, and pus begins to be formed and circulated with the blood, the disorder is accompanied by violent constitutional disturbance, a quick, small, irregular pulse, hurried respiration, a white dry tongue, which afterwards turns brown; thirst, nausea, sometimes bilious vomiting, pain, and severe oppression about the region of the heart, and a countenance indicative of the utmost distress and suffering. In this aggravated form of phlebitis, the depression of spirits, and prostration of strength, are extreme. Low delirium generally follows, and death in the short space of from three to six or seven days.

The inflamed veins are exceedingly hard, and painful when pressed upon, or kept in an extended state. The skin over them is often of a dark red colour, and sometimes the whole limb becomes œdematous and prodigiously swelled, this state being followed by the formation of unhealthy matter diffused in the cellular tissue, or lodged in numerous small collections in the muscular tissue, and attended with sloughing of the cellular and other textures. When inflammation stops at any point within the vein, the line of its boundary is often determined by the entrance of a branch of the vessel, or the junction of two veins together.

What is the principal cause of the dangerous effects of phlebitis?

* See Cruveilhier, Anat. Pathologique, liv. ii.

Experience proves, that inflammation of a vein is often followed by the rapid formation of pus in some other part of the body, external or internal, and more or less remote from the inflamed vessel. Thus in phlebitis of the arm it is not unusual for an abscess to be suddenly formed in the axilla of the opposite side of the body; and when the femoral vein inflames after amputation, the patient is often affected with symptoms of disease in the chest, and on examination after death, abscesses are discovered in the substance of the lungs. Sometimes there is a deposit of sero-purulent fluid in the pericardium; sometimes in the pleura; sometimes in the liver or other abdominal viscera; and occasionally in the synovial membranes of the joints. No doubt, these secondary effects of phlebitis, the causes of which have, until lately, baffled every attempt to explain them, are principally concerned in bringing on the fatal termination of the disease. The deposits of pus in remote parts seem to arise from the passage of pus from the inflamed vein into the circulation, as is argued by Breschet, Andral, Dupuytren, and Cruveilhier.

Any extraneous substance in nature, introduced into the venous system, when it cannot escape from it by some of the emunctories, is apt to bring on visceral abscesses, completely like those which follow wounds, or surgical operations, and these abscesses are the result of *capillary phlebitis* in these same viscera.

If ink, or any stimulating substance, be injected into the femoral vein of a dog, in the direction from the heart toward the extremity of the limb, and the collateral veins should not convey the ink into the general circulation, so as to prove at once fatal, the limb in thirty-six hours swells, and if the animal be killed, small collections of effused blood are found in the cellular tissue and the substance of the muscles. The large veins are distended with solid adherent blood; and the venous ramifications connected with the effusions of blood are also similarly filled, while the rest of the veins in the healthy parts are free from such coagula. Cruveilhier introduced a thin long piece of wood into the femoral vein of a dog down to the ham, and another piece upwards into the vena cava. Death followed on the sixth day. All the veins and venous branches of the lower extremities were filled with pus, and here and there were small abscesses. It is estimated by Cruveilhier, that the majority of persons who die of wounds, are destroyed by these internal deposits of pus. Velpeau, Marechal, and Cruveilhier, found pus, not merely in the inflamed veins, but in the right cavities of the heart, and in the centre of coagula of blood. Cruveilhier observed it in the lungs, liver, brain, spleen, muscles, and synovial cavities, without any manifest appearance of a general previous inflammation of those organs. The lymphatic vessels and heart were also similarly circumstanced.

Pus, circulating with the blood, is stopped in different parts of the capillary system: wherever this happens it gives rise to *capillary phlebitis*, or circumscribed inflammations, which rapidly lead to abscesses. The pus, like mercury, is most frequently stopped in the lungs; then in the liver or spleen; or it may produce circumscribed inflammations in any part of the body.

Why do not these multiplied abscesses of the viscera follow extensive abscesses of the common kind? why should it be a suppurating wound, that is generally necessary to bring on capillary phlebitis of the viscera? is there absorption of pus in the latter, and not in the former cases? The difference seems to be explained by the pus in one instance being acted upon and changed by absorption; while in the other it is formed in

the veins, and is already in the circulation unmodified and unprepared by any previous influence of absorption on it. In France, phlebitis of the medullary texture of bones is found to take place with remarkable frequency after amputation, and to give rise to visceral abscesses.

Phlebitis is mostly occasioned by accidental wounds, or by those of venesection, amputation, and other surgical operations. A prick of the femoral vein in the operation for the cure of popliteal aneurism, has been known to bring on inflammation and suppuration within that vessel, extending thence to the external and common iliac vein and vena cava, so as to destroy the patient. The application of a ligature to the femoral vein in amputation, has also been followed by a fatal inflammation of that vessel, and of the external iliac vein, with traces of diffused inflammation up to the right auricle. It is true that the same consequences sometimes arise from amputation, when the femoral vein is not tied; but though the wound alone may excite the mischief, a wound and the ligature together, are much more likely to do so; and, on this account, all good practical surgeons make it a rule to abstain, as much as possible, from applying ligatures to veins. Numerous patients have died of phlebitis, brought on by the ligature of the vena saphæna major for the cure of varicous veins of the leg.

What Cruveilhier calls the *adhesive stage of phlebitis* is less dangerous than its other forms; the inconveniences of it are entirely local, merely those of obstruction of the vessel; and hence this pathologist regards uterine phlebitis in its early stage, as more curable than has generally been represented.

The peculiar, œdematous, painful enlargement of the lower extremity, called *phlegmasia dolens*, sometimes occurring in women two or three weeks after parturition, frequently depends upon obstruction of the iliac veins, in consequence of the effects of inflammation. This fact was satisfactorily proved by Dr. Davis, of University College. In several women who had been afflicted with phlegmasia dolens, Velpeau also found the iliac and femoral veins full of pus. Sometimes, in women, who die shortly after childbirth, the veins of the uterus, ovaries, and the iliac veins, are the only ones containing pus; but sometimes, besides abscesses, in these vessels, there are others in the lungs, spleen, liver, muscles, synovial membranes, and various cavities lined by a serous membrane. Puerperal fever itself is only the constitutional disturbance attending uterine phlebitis.

A coloured engraving in Cruveilhier's great work on pathological anatomy gives a correct view of various circumstances characteristic of phlebitis. The patient from whom it was taken died of the consequences of that disease on the fifth day from its origin, after a gunshot injury of the biceps muscle, received about five weeks before the fatal result. The cephalic, basilic, ulnar, median, and radial veins, and their ramifications, are large, cylindrical, tense, and knobby, giving an appearance as if they had been injected with wax. Fig. 2. represents the veins opened: their coats are as thick as those of arteries. The cephalic vein is full of pus, as well as the median and radial veins. On the contrary, the basilic vein exhibits all the stages of phlebitis: thus its lower part contains pus; and its middle, a coagulum, in the centre of which is pus; while its upper portion is entirely filled with coagulum. In the substance of the deltoid muscle, may be remarked numerous small abscesses; some consisting of veins distended with matter, and others of pus effused around the ruptured veins. Two considerable abscesses were formed, one under the deltoid, and the other in the

shoulder joint, which was completely full of purulent matter: both quite distinct, and without communication. As the original injury was in the centre of the biceps, this case proves the extension of phlebitis both upwards and downwards.

With respect to *the treatment of phlebitis*, in the early stage, leeches may be freely applied over the inflamed vein. Owing to the quickness with which the symptoms assume a typhoid character, venesection is not generally considered advantageous: it may however, sometimes, be tried at the commencement of the case. The limb is to be kept in a perfectly quiet state; and purgatives and antimonials may be prescribed. Fomentations relieve the pain; but, whether they are more effectual than cold applications in checking the inflammation is questionable. I should rely chiefly on calomel and opium, with local bleeding and fomentations.

When the vein becomes much distended, and pus is manifestly confined in it, the case should be treated as a common abscess, the matter let out, and a poultice applied. We know that, in such a case, the matter is bounded by the adhesive inflammation. Whatever treatment is chosen should be actively pursued in the beginning of the disease; for, after the formation of matter in remote organs, and after the commencement of the serious indisposition, resulting from such collections of pus, all prospect of recovery has vanished. Cruveilhier considers, that the treatment can only be successful in the stage of the coagulation of the blood, and that, when once pus has formed and entered the circulation, every plan fails.

*Varicous veins*, or *varices*. A *varix* is usually described as a dilatation and thickening of a vein, which becomes at the same time elongated, tortuous, and knotty. It occurs chiefly where the blood has usually to ascend against its gravity. Thus the veins of the lower extremities are often the seat of varicous enlargements, with chronic thickening of their coats, and a tortuous knotty appearance. If every enlargement of a vein, whether attended with thickening of its coats or not, be regarded as a varix, then we shall have several varieties of the disease, as pointed out by Andral.

1. One is a simple dilatation of the veins, without any other particular change in them, but a lengthening and tortuosity, and may accompany the chronic inflammation of any organ. What Cruveilhier denominates *hypertrophy* of veins, differs from varices, inasmuch as these vessels are only enlarged, not diseased, nor imperfect; so that the blood flows well through them; but, in varices, the coats of the veins are diseased, and their channel more or less obstructed. They are dilated into little cells, in which the blood coagulates, fibrine is deposited, and in the centre of the clots there is sometimes osseous matter. Hypertrophy of veins is noticed wherever the regular or morbid nutrition of a part takes place, with increased energy, as is exemplified in the uterine veins during pregnancy, and in the growth of considerable tumours, fibrous, medullary, &c., in that organ. One cause of hypertrophy is an impediment to the return of blood.

2. Another dilatation of veins is attended with a thinner state of their coats, than natural, and it may be either an uniform or an irregular dilatation.

3. The third variety is dilatation, with thickening of the vessel, projections of certain points of it in the form of knobs, and a tortuous appearance of it.

4. In a fourth variety, septa or partitions are produced in the vein,

whereby its cavity is divided into small cells, in which the blood accumulates and coagulates.

5. In the last form of dilated veins, besides these septa, there are irregular perforations in the veins, so that these vessels communicate with the surrounding cellular tissue, which is generally more or less diseased. This state is frequently exemplified in varicous veins about the anus, which receive the name of *piles* or *hemorrhoids*. Some hemorrhoids seem to be the smaller branches of the hemorrhoidal veins dilated, and forming tumours covered by the mucous membrane, skin, or the intermediate cellular tissue. Others resemble dense cysts, containing a coagulum of blood, with lymph around it.

Some of the forms of varices here described, when situated in superficial veins, must necessarily render their valves inefficient; and, no doubt, these are frequently in a diseased state, and more or less destroyed, or impaired. In this state, they may even be concerned in producing an impediment to the return of the venous blood, and operate as a cause of the varicous dilatation. Frequently varicous veins seriously affect the capillary circulation in the lower limbs, so as to give rise to a tendency to chronic inflammation, followed by ulcers, which are incorrectly named *varicous*, and very difficult to heal. Varicous veins also frequently occasion a great deal of weakness and pain, the latter of which symptoms generally extends over a great part of the leg, and is remarkably severe. The diseased vein itself is also particularly subject to chronic inflammation, ulceration, and the consequent production of copious hemorrhage. It would be therefore incorrect to say, that varices are unattended with danger. Chaussier records an instance in which a pregnant woman died of hemorrhage from a varicous vein. Murat gives a similar case in a washerwoman. Velpeau, in 1819, saw a countryman die of the loss of blood, twenty-four hours after the rupture of a varix.

The veins, most liable to become *varicous*, are the great *saphænal* and its *branches*, the *spermatic*, and the *hemorrhoidal*. The disease rarely occurs in the veins of the lower extremities of very young persons; but, in the other veins, which have been specified, it often comes on at an early period of life.

Tall stature, and the large size and long perpendicular course of the veins, predispose to the disease, the commencement of which is often dependent upon constipation and a loaded state of the bowels, the pressure of the gravid uterus on the iliac veins, and sedentary occupations, and certain employments, in which the standing posture is long maintained without exercise Any mechanical impediment to the return of the blood will bring on the disease. Hard drinkers are well known to be often the subjects of varicous veins.

In the *treatment of varicous veins*, one principal indication is to remove the exciting cause. Thus, in pregnancy, little effectual amendment can take place till after delivery. In every case, remove constipation; and when the disease is situated in the leg, a bandage, elastic-gum roller, or laced stocking, should be worn, and the limb kept as much as possible in the horizontal position.

When varicous veins are inflamed, leeches, fomentations, cold lotions, mild purgatives, quietude in the horizontal posture, and a temporary discontinuance of the bandage, until the inflammation ceases, and the patient can safely get up again, form the right practice. The inflammation of a vein, arising from a varix, is not commonly of that rapidly-spreading, and fatal kind, which I have described under the name of

*phlebitis.* It extends rather to the skin, than to any considerable portion of the vessel.

When a varix bursts, and much bleeding comes on, cold applications, and, if necessary, pressure, are the best means of relief. When varicous veins of the leg are not relieved by pressure, rest, &c. and the severity of the case justifies the practice, the surgeon may try to obliterate some of the principal and most conspicuous of the diseased veins. The danger of the ligature, or even simple division, of the vena saphæna is now generally acknowledged. The division of its branches is not, however, so likely to be followed by such danger; a fact, adverted to by Sir Benjamin Brodie. Many individuals who come to hospitals with wounds in the leg must have varicous veins, yet such wounds rarely bring on phlebitis. Neither does the excision of varicous veins, forming piles, induce this perilous consequence. When all the veins of the leg are in a state of morbid dilatation, and the distress is not restricted to any point, uniform pressure should be tried. When an ulcer was irritable, and difficult to heal, on account of its connexion with varicous veins, or when, without any ulcer, there was a painful varix, disposed to bleed, while the other veins were not the source of particular uneasiness, Sir Benjamin Brodie formerly applied potassa fusa, so as to make a slough of the skin and veins beneath it; but he found the practice objectionable, as leading to a tedious ulcer. The method is still, however, pursued, with some modification, by Mr. Mayo, who aims not at producing a slough of the vein, but only such a degree of inflammation in the portion of it adjoining the part of the skin, touched with caustic, as shall be followed by its obliteration with fibrine. In other cases, Sir Benjamin Brodie made an incision through the varix and skin, a method less painful than caustic, and the cut sooner healed than the ulcer left by the slough. Abandoning all these methods, he next tried the plan of dividing varicous veins, and leaving the skin over them entire. Having ascertained the precise situation of the vein, or cluster of veins, he introduced the point of a bistoury through the skin on one side of the varix, and pushed it on between the skin and vein with one flat surface turned forwards, the other backwards. The cutting edge was then turned backwards, and the vessel divided by withdrawing the instrument. Moderate pressure was then made with a compress and bandage to stop the bleeding, and the patient kept in bed four or five days. Although this practice was not found so liable to excite phlebitis, as the division of a varicous vein and the integuments together, or the ligature of the trunk of the vessel, Sir Benjamin Brodie informs me, that he now rarely or never resorts to it, as he finds that rest, bandaging, and other proper means obviate the necessity for it. In University College Hospital, the twisted suture has of late been tried in numerous instances as a means of curing bad varices of the lower extremity, and the ulcers connected with them. A steel pin, about three inches long, is thrust under each of the venous trunks adjoining clusters of the varices, until the point protrudes through the skin on the other side of the vein. Silk or thread is then tightly twisted round the projecting ends of the pin, and thus the vessel is constricted. The point of the pin is next removed with a pair of cutting forceps. Sometimes pins are thrust under the veins in this manner in several places, including the trunk of the great saphenal vein. I have known severe pain, abscesses, and erysipelas follow in some cases; and, in one of my patients, there was a fatal attack of phlebitis. I therefore recommend this practice not to be adopted, without some previous consideration of the kind of constitution which the surgeon has to deal with. Perhaps, also, the plan of introducing more than one or two

pins at a time ought to be renounced, and care taken to withdraw all of them directly any unusual suffering begins to be experienced. The method also of removing them, as soon as ulceration commences, and not leaving them to make their own way out through the ulcerative process, seems entitled to commendation.

The varicous enlargement of the spermatic veins, called *cirsocele*, and that of the veins of the rectum, constituting *piles* or *hemorrhoids*, will be noticed in our second section.

*Venous aneurism, aneurismal varix*, or *varicous aneurism*. This is a pulsatory swelling of a vein, arising from a preternatural communication, formed between such vessel and a neighbouring artery. The situation, in which this peculiar disease ordinarily presents itself, is the bend of the arm, where it is produced by the unskilful performance of venesection, the lancet completely transfixing the median basilic vein, and piercing the subjacent artery.

The venous aneurism may occur, however, in any situation, where a large artery and vein lie near one another. Hence, examples of it are recorded by Larrey and others, in which the disease took place in the ham, thigh, and upper part of the arm, in consequence of gunshot and other wounds. When it arises from venesection, or a punctured wound, there are two wounds in the vein, and one in the artery, besides the puncture in the fascia. The external opening in the vein heals up, but the internal remains permanently open; thus allowing the blood to gush directly from the artery into the vein, which becomes dilated sometimes to the size of a pigeon's egg; the two vessels and intervening fascia becoming connected by the adhesive inflammation. However, instead of the artery, fascia, and vein, being always thus connected by the adhesive inflammation, so as to afford a direct passage for the blood out of the artery into the vein, an interspace is sometimes produced between the vessels by a part of the blood being effused in the cellular tissue, under the fascia, where a sac is formed; and this being placed between the two vessels, the blood is first discharged from the artery into it, and afterwards into the vein. It is to the latter form of the disease that Mr. Hodgson restricts the term *varicous aneurism*, while the case in which the blood flows directly into the vein, he calls *aneurismal varix*.

These modifications of the disease certainly appear to me sufficiently different to require different appellations; because one is really a false aneurism conjoined with a venous dilatation; and what proves the truth of this observation is, that the communication between the sac and vein may close, and then the aneurism of the artery take its usual course.

In the museum of University College is a specimen of a varicous aneurism, with a bifurcation of the brachial artery high up the arm: it was taken from a subject, in whom the radial division was punctured in bleeding. It was a double aneurism, one being formed under the fascia, with a communication kept up between the arterial aneurism and the vein, through an opening in the fascia. The anastomosing branch, between the radial and ulnar arteries, is as large as either of them.

When an aneurismal varix arises from a gunshot wound, in which the ball has passed between a large artery and vein, so as to open a direct communication between them, there is of course only one opening in the vein, and not two, as after venesection. A few years ago, I knew but of a single example of the *spontaneous* production of an aneurismal varix; and the case, which is related by Mr. Syme *, is a very remarkable one,

* Edinb. Med. and Surgical Journal, vol. xxxvi.

for the aorta and vena cava communicated by a large aperture, a little above their bifurcation into the iliac vessels. Since then several other instances of the same form of disease have been recorded: one by Mr. Robinson, where an aneurism of the abdominal aorta communicated by two openings with the vena cava. The same gentleman, also, briefly alludes to an aneurism of the arch of the aorta, which was in St. Bartholomew's Hospital, and opened into the vena cava.* Another, by Mr. Perry, which I saw in the St. Marylebone Infirmary, arising from an opening formed between the femoral artery and vein; or rather, I should state, that at the spot in the thigh, where the communication had been presumed to exist between the artery and the vein, there was an aneurismal sac, about as large as half a walnut, firmly ossified within, which, by the pressure that it had exerted upon the vein, had caused the absorption of the coats of the latter, so as to form a circular opening about two lines in diameter, into which the aneurism had burst; thus producing a free and permanent communication between the vessels. The ligature was applied to the artery, but the patient died of hemorrhage on the sixth day after the operation. One circumstance, particularly explained by M. Breschet, as common in varicous aneurism, was noticed in this case, namely, the remarkable thinness of the coats of the artery, which were scarcely thicker than those of a vein.† Dr. J. Proud Johnson, of Belmont, Shrewsbury, lately favoured me with some account of a varicous aneurism in the leg, where "the internal malleolar branch of the anterior tibial artery was the chief cause of the venous sac anastomosing with the posterior tibial." If I understand Dr. Johnson's communication correctly, this example is unique, inasmuch as I know of no spontaneous aneurismal varix, arising from a communication between so small an artery as the internal malleolar branch of the anterior tibial, and a neighbouring vein, which, in this instance, is stated to have been the internal saphœnal. Without having seen the parts, however, I can offer no positive opinion on the nature of the disease. At the same time, I trust that Dr. Johnson will take an early opportunity of publishing the particulars of the case, and a description of the disease, as it appeared on dissection. It was a case of spontaneous formation. The patient was afflicted with scrofula and epilepsy. The limb was amputated. The patient has recovered from the operation, the fits have left him, and his general health has improved.

In the common form of the aneurismal varix, a communication is established between the median basilic vein and the brachial artery. The consequence is, that the vein becomes large and tortuous. The tumour gives a jarring thrilling sensation to the hand which examines it, and a peculiar hissing sound is heard, when the ear is applied to the part. After the swelling has attained the size of a pigeon's egg, it usually becomes stationary. If the artery be compressed above the swelling, the latter becomes flaccid, and the blood may be pressed from it. In general, a slight weakness of the arm is the worst effect of the disease. Sometimes, however, it becomes cold from the want of its usual supply of arterial blood, a great part of which, instead of proceeding to the forearm, flows at once into the vein, and is carried back to the heart again. Hence, there is only a weak pulse at the wrist: but the brachial artery, above the tumour, is larger than natural, and pulsates with uncommon force. The observations of Breschet prove, that some of the venous blood passes into the artery, the coats of which gradually undergo such a change, that they are more like those of a vein than of an artery.

* Lond. Med. Gazette, vol. xiv. p. 462. † Perry, in Med. Chir. Trans. vol. xx.

A case of this description was brought to my house a few years ago. The patient was a washerwoman, who had imprudently allowed some unprofessional person to bleed her. The hissing noise, thrilling sensation in the tumour, and vibratory motion in the adjoining veins were well exemplified. As the case was recent, I recommended pressure, and as the woman did not continue her attendance long, I conclude that she was either cured, or so far relieved, that the inconveniences of the tumour were not very great to her. In general, the aneurismal varix requires no operation, as it becomes stationary, and does not produce any severe annoyance. But if it were to be conjoined with an aneurismal sac between the two vessels, so as to constitute what Mr. Hodgson proposes to call the *venous aneurism*, then an operation might become necessary in the event of the sac showing a disposition to enlarge and become troublesome. Here, the right practice is to tie the artery above and below the opening in it; for Dupuytren refers to no less than three examples, in which the application of one ligature did not cure the disease. We should not, however, resort to the operation without a real necessity for it, because in one instance, the particulars of which were given me by Mr. Atkinson of York, it proved fatal, the limb having mortified; and such was also the result of the case from which a preparation at University College was taken. The ligature of the femoral artery in Mr. Perry's case, as already stated, was followed by hemorrhage on the sixth day after the operation: whether the alteration in the texture of the artery in this disease would generally create an increased risk of this event, future experience must determine.

In the early stage, pressure, by means of a graduated compress, is the right treatment, or else with an instrument calculated to compress the swelling, as was once successfully employed by Sir Astley Cooper, in the case of a young lady who had this affection. In the museum of the University College, is a specimen of varicous aneurism presented to it by Mr. Oldknow. Pressure was made on it with an instrument; the tube of the vein obliterated; and the puncture in the artery closed: the remains of a sac between them is evident.

## DISEASES OF BONES.

In noticing the question how far lost substances, or portions of the human body can be reproduced, I explained, that the osseous texture is one of those in which the greatest power of regeneration is exhibited. In all general circumstances, the texture of bones resembles that of other organised parts of the body, being supplied with arteries, veins, absorbents, and nerves. Its chief peculiarity is that of containing the phosphate of lime, which communicates to it that rigidity, strength, and solidity, so essential to the purposes and uses of the various parts of the skeleton. The changes which the bones undergo in the commencement, progress, and decline of their diseases, are generally marked by a slowness of character, much more remarkable than what attends the processes of disease in the soft parts. We have seen an analogous circumstance in relation to the cure of fractures, as compared with the cure of wounds. No doubt, these facts are connected with the introduction into the osseous tissue of the lifeless inorganic calcareous matter, which I have specified, and perhaps, also, with the inferior supply of nervous energy in the bones at large. Under such circumstances, we should not have expected, that

the bones would be endued with even a greater power of repairing the losses and injuries which they suffer from disease, or accidental violence, than is manifested in any other texture of the body. For this purpose, however, it is their nature to require time, — frequently a considerable time.

One remarkable circumstance, ascribed to the peculiar vital properties of bone, is that its injuries and diseases generally affect the constitution much less than those of soft parts*: we know, that the severe effects of certain fractures truly depend, not on the injury of the bone, but on the manner in which they are combined with other mischief, done to the soft parts, or the important organs, which the bones support and protect.

*Inflammation of bone, termed ostitis*, may be either *acute* or *chronic; simple* or *specific;* either produced in a single bone through some local impression, or in several as the result of a general disposition to inflammatory enlargement in the osseous system. Pathologists distinguish inflammation of the periosteum and medullary membrane from that of the proper osseous tissue; for each of these membranes is liable to be attacked with inflammation independently of the bone; though it is true, that it sometimes extends to them from the osseous tissue itself, when this is primarily affected.

It has been well explained by Mr. Stanley, that a constant correspondence may be remarked between inflammation of the medullary membrane, and of the periosteum, and of the substance of the bone itself, so that it is difficult on looking at a bone, in which there has been for some time a diseased process carried on, to determine in which tissue the affection first commenced, and the order in which it has supervened in the others. For instance, if an abscess form in the medullary tissue, the irritation is speedily propagated to the corresponding part of the periosteum, in which ulceration may occur, or suppuration take place between it and the bone. So, also, venereal nodes, beginning with inflammation of the periosteum, soon produce irritation of the bone itself, causing increased thickness and density of its walls, and sometimes even obliteration of its medullary cavity. †

In *chronic* cases, the enlargement or swelling comes on with remarkable slowness, and the hardness is quite incompressible. The pain is also subject to variety; for, when the case arises from an accidental blow, the pain may be inconsiderable, and unaccompanied by any constitutional disturbance; but when a bone inflames, in consequence of syphilis, the abuse of mercury, and other causes extending their influence throughout the system, the pain is often remarkable for its severity, and its periodical exacerbations, which usually come on in the night.

Inflammation of a bone sometimes produces an enlargement of it, by what is termed interstitial deposit, or by the deposit of an extraordinary quantity of the phosphate of lime in its texture. Frequently, however, instead of having the latter effect, it produces an absorption of the calcareous matter, so that at the same time that the bone is enlarged, it becomes porous and lighter than natural; its surface presenting numerous foramina, occasionally described as apertures through which the vessels of the inflamed bone took their course.

Scrofulous inflammation of a bone does not make it more solid or heavier, but the reverse. On the contrary, in syphilis, the enlargement of bones may be attended with increased weight of them.

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* E. Stanley, in Med. Gaz. vol. xx. p. 421. † Id.

Inflammation of bones often renders their surface rough; we see this effect produced both by syphilis and scrofula, though with a diversity in the appearances.

The following are described by Mr. Mayo, as the different appearances, found on making sections of inflamed cylindrical bones: — 1. A growth of porous bone, superimposed upon the cortex. 2. A growth of compact bone in the same situation. 3. An expansion of the cortex through its conversion into porous bone. 4. An expansion of the cortex through its apparent separation into an outer and an inner layer, with porous or cancellous structure between them; or the expansion consists of an outer part, compact; an inner part, porous. 5. Expansion of the cortex, with compactness of texture throughout. 6. The medullary cavity more or less diminished, either by the encroachment of the cortex inwards, or through the solidification of the cancellous structure.*

While either a slow enlargement, with increased weight and solidity, or a porous alteration of structure and caries, attended with greater lightness, and a loss of the phosphate of lime, are not unfrequent consequences of chronic inflammation of bones, *suppuration in the medullary texture*, and mortification, or *necrosis*, are more commonly the effects of acute inflammation of the osseous texture, or injury of the medullary part of the bone. This statement is liable, however, to exceptions; for, in persons of a scrofulous constitution, a slight disturbance in the nutrient processes of a bone by a trivial blow, or exposure to the influence of a damp cold atmosphere, will bring on suppuration in the cancellous texture.

It is only the cancellous texture, or medullary cavity of a bone, that is liable to suppuration; or, at all events, suppuration cannot take place in the solid parts of a bone, unless their tissue be previously expanded and loosened by the effect of chronic inflammation. Whenever a bone suppurates, there is generally more or less absorption of it; and sometimes while the interior texture is removed by the absorbents, so as to leave a considerable cavity, the external shell is expanded, constituting the case technically named *spina ventosa*. Many inflammations of bone, followed by caries, or necrosis, and by separation of the periosteum originate from inflammation, disease, or injury of the medullary membrane. At length, the matter makes its way under the skin, by causing the absorption of parts of the most superficial side of the bony cavity; then a soft swelling and fluctuation occur; and the abscess in time bursts, attended with great diminution of suffering.

A collection of pus may continue, however, for a surprising length of time, within the texture of a bone, and keep up very perplexing symptoms. In one of the volumes of the London Med. Chir. Trans., there is a paper by Sir Benjamin Brodie, on small abscesses in the cancellous structure of the tibia, attended with enlargement of the bone, which continued for many years to distress the patient, until the matter was discharged with the trephine. In the writings of the late Mr. Hey, are some other cases of this kind, which were treated in a similar way. When a cavity, or cyst in a bone is full of purulent matter, the making of a prompt and free outlet for it is generally the principal indication; but, this rule is not always applicable, where the matter is the product of a specific disease, as such operation would often render the patient's condition worse.

With respect to the osseous cysts, termed by the older surgeons,

* Mayo's Pathology, p. 23.

*spinæ ventosæ*, their formation, perhaps, cannot always be referred to the mechanical expansion of the bone; or, at all events, while absorption is going on inwardly, increased deposit is taking place outwardly. Hence, as Mr. Stanley observes, the bone is sometimes increased in size. In some instances the walls of the cyst are not thicker than paper; in others, they are fully an inch in thickness. In the former case, the tumour may present a sensation to the touch, compared to the crackling of parchment; in the latter, the feel of a solid bony swelling, or exostosis. The contents also vary, being either a serous or purulent fluid, or the products of specific disease, as scrofulous, or medullary matter.

*Acute inflammation of bone*, taking place as an effect of idiopathic periostitis, requires leeches, fomentations, poultices, calomel, and opium, saline purgatives, and other antiphlogistic means, including quietude and low diet. When the inflammation is chronic, the treatment must be chiefly regulated by the consideration of its cause, whether syphilitic, scrofulous, or the joint effect of mercury, cold, excesses, and irregularity of diet and regimen, and an impaired constitution. I believe, that we do not frequently meet with nodes in syphilitic patients, unless these individuals have been using mercury in an injudicious manner, that is to say, irregularly or immoderately, and without keeping themselves in a proper uniform temperature at home, during the mercurial course. Under such neglect, the united influence of the original disease, and the mercury itself on the constitution, thus unfairly dealt with, seems to produce a considerable tendency to inflammation of the periosteum, or even of the osseous texture itself. Hence nodes, caries, and necrosis, as complications of the venereal disease.

*Simple absorption*, or removal of *bone*, unattended with any formation of pus, or ichorous matter, should be discriminated from *caries*, as it is completely a local affection, caused by the pressure of aneurisms, and other swellings on the osseous texture. It is sometimes accompanied with an effort, on the part of nature, to repair the injury of texture; for which purpose, she throws out new bony matter near the chasm that has been produced.

*Caries* or *ulceration of bones*. Some years ago, *caries* and *necrosis* were not duly discriminated from one another, though the former is as different from the latter, as *ulceration* of the soft parts is from *mortification*. While *caries* is one of the consequences of an inflamed or irritated state of a bone, some of whose texture becomes absorbed, so that a chasm is produced in it, without its vitality being destroyed; *necrosis* is another condition, involving the complete or partial death of the original bone, and often followed by the formation of a new one, or by the more or less complete repair of the part that has been destroyed.

The points of resemblance between *caries* of bones and *ulceration* of soft parts are striking. Each affection is preceded by *inflammation;* each is attended with the *formation of matter;* each may be followed by the *production of granulations;* each may arise from *local* or *constitutional causes;* and each may be combined with the total extinction of vitality in certain points of the textures affected. Thus, precisely in the same way, as we often see ulceration and sloughing exhibited together in the soft parts, we also frequently find *caries* and *necrosis prevailing together* in the bones. Some portions of the osseous texture seem to perish, and to be detached from the living parts of the bone, while, in other places, caries is making its attack and producing its usual effects.

The venereal disease is sometimes a cause of caries, but more frequently of necrosis; and very often of both affections together. On other

occasions, it leads to the production of nodes and other changes in the osseous system hereafter to be considered.

The bones are all liable to caries, though the soft or spongy portions of them are most commonly the seat of it, especially the bodies of the vertebræ, the sternum, the upper heads of the femur and tibia, and the bones of the pelvis, tarsus, and carpus.

Sometimes the disease may be traced to the effect of local injuries, followed by considerable inflammation and abscess; but it is still more commonly seen as the consequence of scrofula and syphilis. In whatever manner occasioned, it is at first attended with some pain in the bone, and inflammation and swelling of the neighbouring soft parts. Generally, an abscess of a more or less chronic nature is formed over the diseased bone, breaking and discharging a thin ichorous bloody matter, of a peculiarly offensive smell. The integuments around the opening, assume a dark, unhealthy livid tinge. If a probe be introduced, the surface of the bone will be felt to be rough and bare, and if the disease be seated in the head of a bone, a probe will sometimes pass into the cancellous texture, without any material resistance. There is a softening and partial absorption of the bony texture, some of which crumbles away on the slightest touch.

The disease is accompanied by the production of pale fungous granulations, and the discharge of a thin, fœtid, dark coloured, or bloody matter, which blackens a silver probe. The aperture, formed in the skin, does not heal, but becomes what is termed a *fistula*, through which the matter, and sometimes little particles of the diseased bone, find their way outwards.

The *worm-eaten caries*, as it is called, which perforates a bone at innumerable points, and in an infinite number of directions, and which used formerly to be so common in syphilis, as then treated, would appear to begin with disease and suppuration in the diploe, the worm-eaten appearance being afterwards caused by the pus causing numerous apertures to be formed in the skull for its escape.

Around the carious part of a bone, from scrofula, may frequently be noticed new bony deposits, in the form of spiculæ, or tubercles and projections, sometimes extending to a considerable distance from the diseased joint. These productions may be the result of periostitis. As Mr. Stanley observes, generally around an ulcer in bone, there is found a heaping up of osseous matter, proportioned to the activity of the process, and analogous to the thickening, which occurs around an ulcer in soft parts. This fact is well represented in one of Weidmann's excellent plates. Its presence Mr. Stanley considers to be characteristic of the inflammation by which the ulcer was formed; for a similar thickening and increased density is believed by him not to exist around bone, which has been progressively absorbed in consequence of the pressure of a tumour; nor around some specific ulcers of bone, as those occurring in scrofula, syphilis, and lupus. With respect to scrofulous disease of bones, however, nothing is more common than the rough deposits in its vicinity, which I have described, and of which there are several fine specimens in the Museum of University College. The bone in the immediate vicinity of a carious part of it, if injected, appears to be exceedingly vascular.

Caries may occur at any period of life; but is most frequent in young subjects. This fact may admit of explanation by the consideration, that scrofula, which is one of the most common causes of caries, principally affects children and young persons. Syphilitic caries, and caries from the effects of external injuries, are met with in individuals of every age.

The *treatment of caries* is to be regulated by the view entertained of its causes. If the disease should have arisen from a local injury, and have followed the inflammation and suppuration resulting from the violence, without being accompanied by any marks of general disorder of the system, any traces of syphilis, scrofula, or scurvy, we should then be justified in regarding the affection of the bone as completely local. In the early stage, we could only employ such treatment as the state of the soft parts might require; generally antiphlogistic treatment until the inflammation had subsided. Afterwards, we should aim either at removing the carious portion of bone, or at stopping the morbid action, in which caries consists, and exciting such a change in the bone, as will lead to a cure. Mr. Stanley lays it down as a remarkable fact, however, that, after ulceration of the osseous tissue, or caries, as it is termed, the lost bone is never reproduced. The utmost reparation, he finds, is the cicatrization of the parts around it. In ulceration penetrating the shaft of the tibia, however, he has seen the vacancy filled up by a gristly substance, with osseous points scattered through it, but never sufficiently to render it a mass of bone. In the cure of caries of the vertebræ, the deficiency is not filled up with new bone, but the surfaces, above and below, approximate and unite.

With respect to the removal of carious portions of bone, the practice is sanctioned by some surgeons of eminence, who think that more good may be done in a few minutes by cutting instruments, than will generally be accomplished in as many years by nature, even when aided by medicines and local applications. This is sometimes true; for, even when the disease arises from constitutional causes, and requires internal remedies, accordingly, such remedies may stop the progress of caries, but are frequently quite inadequate to bring about a new healthy action in the part, sufficient to lead to a cure: this, however, is not always the case. The caries produced by syphilis, and scurvy, may be completely stopped, and cured by remedies adapted to those particular states of the constitution. And even the caries arising from scrofula, though less under the control of internal medicines, may sometimes be checked by counter-irritation, and the administration of iodine, iodide of potassium, the sulphate of quinine, steel, and other medicines required to amend the state of the constitution.

Caries, resulting from local causes, accidental injury, &c. may also get well, without any occasion for the excision of the diseased portion of bone.

But when caries presents no reasonable prospect of cure by any internal plan of treatment, and the part is so situated as to admit of removal, the indication is clear. The requisite denudation of the diseased part of the bone is to be made, and the disease either cut or scraped away. Sometimes, however, instead of this practice, we may try the plan of exciting a new action in the carious part by dressing it with a strong solution of nitrate of silver, or the diluted nitrous acid. Setons, issues, or blisters, near carious bone, are frequently of great service.

*Necrosis* is the death of a portion of bone, sometimes of the greater part of it; for, not unfrequently, the whole shaft of one of the long cylindrical bones is destroyed. Generally, however, the head of the bone escapes; the articular parts are spared; and, when the new shaft is formed, the original portions left, which are commonly the ends of the bone, become grafted, as it were, on the new osseous case.

After a portion of a bone has perished, or fallen into the condition of necrosis, its detachment and removal become as necessary, for the pro-

cess of reparation and the cure of the patient, as the taking away of any other extraneous substance lodged in the body, and keeping up irritation, suppuration, and other effects; indeed, the dead bone is to be now regarded as an extraneous substance, and its removal from the part, either by the action of the absorbents*, or some other natural process, or by surgical proceedings, is absolutely necessary. It matters not, so far as the nature of the disease is concerned, whether merely one layer of the bone is affected with necrosis, or the whole substance of it — the disease is still essentially of the same kind; and the various circumstances of depth and extent, to which the disease may have proceeded, relate only to its severity. In this point of view, they certainly are of great importance in respect to the prognosis, the prospect of cure, and the length of time which will necessarily elapse before this desirable event can be accomplished.

While *caries* mostly affects the spongy parts of bones, and those bones which are of a light texture, *necrosis* is found to attack principally the harder parts of bones, and those bones which naturally contain the greatest quantity of phosphate of lime, and are of a firm compact texture; and this is so much the case, that those circumstances, which would produce necrosis in the harder parts of bones, seem mostly to cause caries when they exert their operation on the softer spongy parts of the skeleton. Among the bones most frequently attacked by necrosis, I may mention, first, the tibia, then the femur, the lower jaw, the clavicle, the radius, and the ulna. The bones of the cranium are also frequently the seat of necrosis. Of all the bones, none so frequently suffers from necrosis as the tibia. The disease is one to which both sexes are liable, and this at any period of life; yet we find, that the disease is more common in children and young persons, and especially in those of scrofulous constitutions, than in other individuals. But this observation must be received with one qualification, namely, that all persons who are exposed to dangerous and laborious employments, or whose pursuits render them liable to suffer from accidental external violence, are frequently the subjects of necrosis, and this, whatever may be their age or the nature of their constitutions.

Although the most extensive forms or degrees of necrosis are chiefly seen in the long cylindrical bones, we do also sometimes meet with them in the flat ones; and even the short thick bones are occasionally quite destroyed. I have, indeed, already explained, that the bones of the cranium are not unfrequently the seat of the disease, and that the lower jaw is often affected. In the records of surgery, many instances are given in which the scapula was attacked. Cases do sometimes happen, but they are uncommon, in which the articular parts of bones are destroyed, or involved in the mischief of necrosis; and, then, as the shaft is more or

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* In cases of necrosis, "the whole of the old bone, *provided it be not exposed*, is carried off by the absorbents, into the system," &c. — Macartney on Inflammation, p. 41. This is the common doctrine. On the other hand, Mr. Gulliver is led to believe, that "if a piece of bone, truly dead, be inclosed within a new osseous cylinder, then it is indeed a bad case of necrosis, which the patient will carry to the grave with him, unless relieved of the sequestrum otherwise than by absorption." (See Med. Chir. Trans. vol. xxi. p. 6.) The experiments and preparations, on which this inference is founded, are admitted, however, by Mr. Gulliver himself, not to amount to a peremptory proof of the impossibility of the absorption of dead bone. (*Op. cit.* p. 18.) I have attended so many patients, in whom the sequestrum has ultimately disappeared, that either its absorption, or dissolution, seems to me a fact admitting of no dispute, difficult and slow as the change frequently is.

less destroyed at the same time, the prognosis is generally unfavourable, and amputation of the limb can scarcely be avoided.

Every thing affecting the periosteum, the substance of the bone, or the medulla in such a way as to interrupt the nutrition of the bone, may conduce to the origin of necrosis. The causes, therefore, of necrosis, may be divided into *external* and *internal*. The *external causes* are principally severe contusions, bad compound fractures, the pressure and irritation of foreign bodies in the substance of the bone itself, or in its cancellous structure, (the lodgment of a musket-ball there, for example, may produce necrosis,) the long-continued exposure of the surface of a bone deprived of its periosteum to the air; or the irritation of it with acid or caustic applications will produce a similar effect. Thus sometimes the free use of strong concentrated acids in the treatment of sloughing ulcers on the shin will, if care be not taken, produce necrosis of the tibia. In University College Museum is a necrosis of part of the cranium from a burn.

As a general rule, when the walls of a cylindrical bone perish in their whole extent, the medullary texture suffers with them; but, Mr. Stanley refers to a remarkable exception, in which, in consequence of the application of nitric acid to a phagedenic ulcer, the whole of the periosteum, covering the tibia, became inflamed; the walls of the bone perished; but the medullary texture escaped.*

Whenever the old surgeons saw a portion of bone exposed to the atmosphere, and deprived of its periosteum, they concluded that a cure was impossible without exfoliation of the part of the bone thus uncovered; they fancied that it would of necessity become attacked with necrosis, and thrown off from the living part of the bone before a cure could be accomplished. But this was taking an erroneous view: it does not follow, that a bone must die and exfoliate under these circumstances. It is true, that if the bone has suffered much contusion, if the patient is old, feeble, and unhealthy, and, especially, if the exposure has been long continued, necrosis will most probably take place. But former practitioners were confirmed in their erroneous opinion by invariably committing two errors in the treatment of these cases; in the first place, they did not take care to cover the exposed portion of bone as quickly as possible with the soft parts, which had been detached from them, and thrown back in the form of a flap; and, in the second place, they commonly dressed the wound with irritating applications, and with what they conceived was calculated to promote exfoliation. Such practice would of course tend to confirm the view which they had taken of the case; for, under the kind of treatment referred to, necrosis would be almost certain to follow: whereas, if they had promptly covered the exposed bone with the soft parts, and had then resorted to proper dressings, they would soon have discovered, that the simple exposure of the surface of a bone is not necessarily followed by necrosis; and that exfoliation is not always to be apprehended as a matter of certainty. We know that the osseous texture does not depend entirely on the arteries of the periosteum for its nutrition; and that those of the medullary membrane are materially concerned in this function; hence, it does not follow, that a bone must perish, because it is deprived of its periosteum. On the contrary, if the patient be young, and his constitution sound; if the bone be not too much contused, and not kept exposed too long to the atmosphere, or dressed with improper drying, astringent, spirituous applications; the production of necrosis

* Med. Gaz. vol. xx. p. 498

may generally be avoided. All this implies, however, that the violence which has given rise to the accident, has not operated too much on the medullary texture. When a limb has suffered such a degree of injury, that the periosteum is detached from the surface of the bone, along with the soft parts, an injudicious method of proceeding will of course bring on necrosis of the exposed bone; but, if the loosened flap of soft parts be immediately laid down again; and no stimulant applications be used, there may be no necrosis at all, and, of course, no exfoliation; granulations will spring up from the surface of the bone; these will unite to those arising from the soft parts, and a complete cure will often follow with extraordinary expedition, particularly in young and healthy subjects.

But necrosis, and the worst forms of it, may proceed from *internal causes*, or from such as affect the bone, through the medium of the constitution. Experience proves that necrosis may follow that deranged and debilitated state of the system remaining after various kinds of febrile disturbance. The origin of some of the worst cases of necrosis may be attributed to the debilitating effects of typhus fever, small-pox, or measles. Scrofula, lues venerea, scurvy, and the prejudicial influence of a badly conducted course of mercury, have all been known, under particular circumstances, to excite necrosis. When mercury gives rise to this affection, it is generally when that medicine is administered for the cure of syphilis, and the patient does not, during such mercurial course, take proper care of himself, being exposed to the vicissitudes of the weather, or incautious in his diet. In many instances, the mischief is brought on by the mercury being given in excess, or by small quantities acting with unusual violence. The bones which most frequently suffer under these circumstances, are the lower jaw, and part of the alveolar processes of the upper jaw. Necrosis and abscesses are frequently combined together; we sometimes find matter on the surface of a bone, part of which has perished; but the latter circumstance is usually in consequence of the very inflammation which gave rise to the abscess, having extended its effects to the bone itself; the bone, therefore, suffers from the same causes as produced the suppuration. It is, however, possible to conceive that an abscess may produce necrosis, when its pressure operates upon the bone in an extraordinary degree; then, indeed, it is possible, that necrosis may be occasioned by an abscess, but certainly not by any corrosive qualities of pus.

The symptoms of necrosis vary in different cases, according to the extent of the disease and the nature of its cause. When it is of limited extent, that is, when it is merely superficial, not extending deeply into the bone, and arises in consequence of external violence, the symptoms will not be very different from those of a common phlegmonous abscess. Suppuration occurs in the soft parts, and, as soon as the matter is discharged, if a probe is introduced, the bare bone is felt. In such a case, unless there be an extensive and violent inflammation of the soft parts, there may be little or no constitutional disturbance; but when the necrosis is more considerable, and the soft parts are more extensively implicated either primarily or secondarily, in the disorder, then there will be a greater, and sometimes a violent derangement of the system. But there is a form of necrosis — one, in which the patient is generally young and of a scrofulous habit of body, and in which the bones of the carpus, or tarsus, or the phalanges of the fingers, suffer. In such cases, an indolent swelling first

forms, unattended with much pain or disturbance of the system; at length a fluid collects in the part, which bursts and pours out an ichorous matter. In this stage, if a probe be introduced, we may feel the bone to be bare and rough — in fact, it is already in the state of necrosis. It is chiefly in individuals, thus predisposed to the disease, that we also meet with those formidable examples of necrosis, in which the whole shaft of a long cylindrical bone perishes. In scrofulous or syphilitic persons, on the application of some exciting cause, the death of the whole shaft of a long bone, or a considerable portion of some other bone, frequently occurs. When the disease arises in individuals, whose state of constitution promotes the origin and wide spread of disease in the osseous system, necrosis generally begins with a deep-seated and excruciating pain in the limb, followed by a general swelling, involving the whole of that part of the member, and mostly including also the two nearest joints. It is, however, much greater about the centre of the limb than elsewhere; and one of its characters is, that it seems to have no definite boundary, presenting every where a remarkably firm unyielding feel. The patient experiences no alleviation of his sufferings till matter forms and the abscess bursts, and then there is generally some diminution of the pain; but it is found that, on the escape of the matter, the tumour does not subside in the degree usually remarked in a common abscess under similar circumstances; there still remains an immense swelling, which is of a firm, unyielding kind, depending upon the great quantity of coagulating lymph effused around the dead bone, the thickened state of the periosteum, and the œdematous state of the cellular tissue. These circumstances explain why there is but little subsidence of the swelling immediately after the matter has been let out, or found an outlet for itself. If a probe be introduced after the bursting of the abscess, it passes onwards till it is stopped by the bone, a portion of which may often be felt to be bare and rough. In all these cases, we should let out the matter early, for the sooner this is done, the sooner will the patient experience a diminution of the agony attending the confinement of deep-seated matter. After the abscess has made its way out, or been discharged by puncture, the opening or openings (for there are sometimes more than one) will not heal up very speedily; in fact, they are converted into fistulæ, and losing all disposition to cicatrize, they emit fungous granulations around their orifices. The indisposition of these fistulæ to heal, however, does not usually depend upon any other impediment than the presence of the dead bone in the limb, the *sequestrum*, which, in the manner of an extraneous body, keeps up irritation and suppuration. Hence, nature seems to maintain the fistulous apertures, in order that whatever pus is formed may flow out, and sometimes, as experience proves, for the passage of the dead bone itself. In consequence of the presence of the sequestrum and the long-continued suppuration thereby produced, the sympathetic inflammatory fever, which attends the first stages of an extensive necrosis, is soon converted into a febrile disturbance of the hectic type; indeed, the disease generally goes on so long, and the discharge sometimes continues for such an indefinite length of time, that the constitution may be reduced to the lowest state of weakness; and, in addition to the hectic, there are occasional attacks of irritative fever, by which the patient is brought into great danger, such danger as admits of no means for its removal, except an operation for the extraction of the sequestrum, the cause of all this suffering and peril; or if the disease be not in a state for such proceeding, we may be called upon to perform amputation

of the limb, in order to save the patient's life. Before we can say positively that necrosis exists, it is necessary to introduce a probe, for until we can touch a portion of dead bone, we cannot be certain that the disease has occurred. Sometimes, however, when the dead portion of bone lies superficially, we may actually see a part of it within the fistula, or at the bottom of an ulcerated chasm.

The colour of a sequestrum is not always the same; it is often perfectly white; and when a portion of bone is whiter than natural, we may be sure that it is in the state of necrosis. Generally when the dead bone has been exposed for some time to the air, it becomes brown or black, and every body knows, that a bone with this appearance has perished. In particular instances, where the whiteness is not much increased, there may be doubt; but if a brown tinge be seen upon the exposed bone, we may conclude that it is dead. Excessive whiteness, or a darker colour than natural, is a sure indication of necrosis. When a sequestrum lies deeply, and is not exposed to the air, it is generally white, or of a light brown colour; but when it has been exposed for some time to the atmosphere, or remained long at the bottom of an open ulcer, it assumes a darkish, or even a black hue.

The process of *exfoliation*, or that process by which the dead portion of bone is separated from the living portion, has a considerable resemblance to the process by which sloughs of the soft parts are thrown off; especially this will seem the case, if we make due allowance for the greater slowness with which all changes in the bones are carried on. In making an issue, the first step is to kill a portion of the skin. Very soon increased vascularity of the adjacent skin is noticed, and a red line forms immediately around the eschar. And so it is with bone; the parts, surrounding the dead portion, directly become preternaturally vascular, or (to use Hunter's expression) inflamed.* A groove is next formed all round the sequestrum, which is generally believed to be produced by the action of the absorbents of the adjoining living bone, or, as Mr. Hunter first demonstrated, the groove is formed by the absorption of that part of the living bone which is contiguous to the dead; its earthy matter being first taken away, and then its animal part. The groove begins on the surface, and extends gradually more and more deeply, until the dead portion is completely undermined and detached; in this respect, we recognise also a correspondence to what happens in the separation of sloughs. As the groove deepens, it is occupied by granulations arising from the living bone; and hence, as Mr. Stanley observes, on removing the sequestrum, we see next to it, not the surface of the living bone, but a layer of vascular granulations. And, in correspondence with the granulations that have sprung up from the living bone, there is the well-known rough surface of the dead, with its multitude of prominences and excavations, fitted to the granulations, which, as it were, push out the dead bone from the cavity in which it is lodged. In the course of time, a sequestrum may be reduced to an inconsiderable size, compared with what it was originally, the greater part being removed, and unless the portion that is lost undergo some unexplained kind of dissolution, as suspected by M. Velpeau and others, or come away in minute particles with the discharge, I know of no agents for the production of this change, but the absorbents. At all events, whatever may be the inability of the absorbents to remove *a loose* and *perfectly separated piece of dead bone*, experience furnishes very con-

* E. Stanley, Med. Gaz. vol. xx. p. 498.

vincing proofs, that dead bone may be absorbed *while retaining its connexion with the living bone.** In University College hospital, I have repeatedly noticed the disappearance of portions of dead bone, which had been plainly felt in wounds and ulcers for several weeks, and interfered with the healing process.

In the earlier stages of the necrosis of the shaft of a long cylindrical bone, the periosteum (if spared), in the neighbourhood of the portion of bone about to be destroyed, always becomes thickened and more vascular than natural, and continues in this state during the formation of the substitute for the old bone; but as soon as this process is finished, and particularly after the detachment of the sequestrum, the periosteum returns to its natural condition, and loses its increased vascularity; its inner surface has no longer the pulpy, granular, highly vascular texture which it had in the early stages of the case, when the office of producing the new bony formation round the sequestrum devolved upon it. After the sequestrum has been completely loosened, it still remains at the bottom of the abscess or ulcer, or within the new bony case, and would sometimes continue there a considerable time, keeping up pain, irritation, and discharge, were we not to introduce forceps and remove it, and even to make such incisions for the purpose, and such removal of a part of the new deposit of bone as may be requisite. Occasionally the sequestrum is not only perfectly loose, but so superficial and exposed, that it can be taken away without any occasion for the knife, trephine, or saw. When an abscess, ulcer, or fistula is complicated with dead bone, it is a rule in surgery always to remove the sequestrum as soon as possible, that is, directly it is loose, and for this purpose to practise such operations as may be necessary. But not only is the sequestrum often loosened and thrown off from the living bone by spontaneous or natural processes, (and I have seen several cases in which considerable portions of the shafts of the humerus and femur have been thus detached, coming out through the integuments without the aid of any formal surgical operation,) not only does nature effect all this, but, when the entire shaft of a bone has been destroyed, she makes wonderful, and generally most successful efforts to form a new bone, that answers almost as well as the original one. When the shafts of the tibia, humerus, femur, or other long cylindrical bones are destroyed, and nothing of the original bone remains alive, except the articular extremities, even when the destruction has proceeded to this extent, nature will form a new bone, and the uses of the part or limb will be restored. In the sides of the new bony formation are openings, termed the *cloacæ*, which serve for the escape of the matter secreted in the interior of the new bone, so long as the sequestrum keeps up irritation there. The cloacæ, in many instances, take an oblique course, and do not pass straight and direct into the cavity of the osseous tube. They mostly have an oval or a round shape. Sometimes, however, they do pass direct into the cavity of the new bone, a fact not agreeing exactly with Weidmann's description. No doubt, the straight direct course of some cloacæ is an exception to the general rule.

The flat, as well as the cylindrical bones, when attacked with necrosis, possess the power of reproduction: there are several cases on record, in which the scapula was reproduced, after having been destroyed by necrosis; and it is known, that portions of the cranium, under particular circumstances, may also be regenerated. Instances are related, where

* E. Stanley, Op. et vol. cit. p. 499

nearly the whole of a parietal bone was reproduced. Considering the little reparation which losses of portions of the skull from the trephine, or external violence, generally undergo, this is what we should not *à priori* expect; yet, in the Museum of University College, there is a remarkable preparation, the skull of a person who had been trephined forty years before his death, and where a considerable portion of bone was taken away, which has been in a great measure restored. Generally, the reproduction of bone after trephining does not happen to any great extent; the pericranium being destroyed, and both the tables of the skull being removed, the reparation is very partial. It appears, therefore, that the dura mater does not possess a power of reproducing bone at all equal to that of the pericranium, or periosteum of the bones in general; however, if only the outer table be removed, the diploe and the dura mater together will effect the reproduction of the lost portion; but, in other instances, we rarely find that any very successful attempt is made by nature for the restoration of the two destroyed tables. Even fractures of the skull unite with difficulty and slowness. The preparation just now referred to, I regard as a particularly interesting one: in all probability, at the time of the operation, the patient was young, perhaps a child; this I infer from the circumstance of his having been trephined forty years before his death; and, in young growing subjects, the power of reproduction in bones is always considerably greater than in older persons.

Though the long cylindrical and flat bones may be regenerated, the short cuboid bones cannot be reproduced. When once destroyed, there can be no restoration of them; this fact is one which all men of experience are fully aware of. In the early periods of life, and in healthy subjects, the power of reproduction in bones is always greater than in old or debilitated persons. It is also seriously diminished in particular states of the constitution, and especially when the individual is under the influence of the worst forms of lues venerea, or of cancer, scurvy, or rickets. However, some of these constitutional diseases do not absolutely prevent the reproduction of bone in every instance; and exceptions are met with, in which broken bones unite more or less completely in spite of them.

The next subject, respecting necrosis, is a curious and interesting one; I allude to the means adopted by nature to bring about the reproduction of bone. Of this part of the inquiry different pathologists give different accounts, proving that further investigations into certain points would be desirable. The questions are, whether nature accomplishes her purpose by means of the vessels of the periosteum? by means of those of the medullary membrane? or in another manner, in which it is supposed, that, when the whole shaft of a bone has been reproduced, the inner portion of the bone alone has perished, and that the outer one has been saved and transformed into the new shaft? This last opinion is maintained by some men of considerable eminence. They assert, that in necrosis, the whole of the bone does not really perish, that the outer portion is preserved; and that, when the whole shaft seems to have been reproduced, it is in consequence of the external layers separating from the inner ones, which alone are truly destroyed. That the latter representation is not applicable to a great number of instances, I consider perfectly certain; but whether it is *ever* the case, is another question.

Dr. Macdonald, who investigated this subject with considerable talent, found, that the new bone actually began to be formed previously to the

complete death of the old one. Both he and Professor Russell observed, that during the formation of the new bone, they could inject the vessels of the old one.* These circumstances, so far as they go, would strengthen the doctrine, that the old bone is the source of the new one. The supporters of this doctrine have recourse likewise to another circumstance, as an argument in favour of their view; they take advantage of the fact, that in all, or almost all cases, where new long cylindrical bones are formed, the articular heads are saved, so that these preserved portions must be regarded as contributing also to the formation of the new bone. But this doctrine certainly cannot apply to other instances, in which the whole shaft of the bone is known to have been destroyed through its entire thickness. Cases are continually presenting themselves, in which from the thickness of the sequestrum, there can be no doubt of the whole substance and diameter of the original bone having perished. Then, how would the suggested theory explain the reproduction of portions of the whole thickness of the tibia sawn away, or lost by the effect of external violence? Indeed, the careful observation and correct examination of the different stages of the process of reproduction, tend to prove that, at all events, in some cases the periosteum has a principal share in the formation of the new osseous matter; for it is found to become thickened and more vascular than natural, to assume a pulpy, granular texture internally, a new kind of organisation, fitting it for its increased duty; the cellular tissue external to it also becoming swoln. In the museum of St. Bartholomew's Hospital, are some valuable preparations put up by Dr. Macartney of Dublin, clearly exhibiting these facts. The periosteum then separates from the portion of bone which is about to perish, and becomes covered internally with a vascular pulpy substance, destined for the secretion of the new bone, the nidus for which is, no doubt, at first coagulating lymph. Such are the processes which usually take place when the whole shaft of a bone perishes. They seem to happen also very early; for, in one instance, which Dr. Macartney had an opportunity of examining in an incipient stage, the separation of the periosteum had taken place, though there was only a small abscess formed in the medullary membrane. These facts admit of demonstration, and completely refute the doctrine, which maintains exclusively, that the old bone is invariably the organ by which all the new shaft is produced. I do not mean to say, that there may not be cases in which the internal portion perishes and the outer portion lives, any more than that there may not be instances in which the destruction is confined to the outer lamina; we know that these last cases are common enough, in relation to the destruction of a certain extent of almost any bone. Experiments have been made on animals, which tend also to prove the fact of the periosteum being fully capable of, and often actively concerned in, the reproduction of bone: every part of a bone has been removed, all the medullary membrane, and the whole of the osseous texture have been taken away, in order to ascertain whether the periosteum was adequate to restoration of the lost substance; these experiments demonstrated, that the periosteum possessed such power in a wonderful degree. Some of them were made by Troja, and others by Koehler. Several have been repeated

* In the museum of St. Bartholomew's Hospital, according to Mr. Gulliver, there is the tibia of a dog incased in a shell of new bone, and partly detached; "but the injection has run pretty freely into the old bone."—(Med. Chir. Trans. vol. xxi. p. 6.) Mr. Stanley, however, considers this to be doubtful.

by Mr. Stanley, who sets down this membrane as the most important agent in the reproduction of bone.

If the surface of a bone has perished to a limited extent, producing a superficial necrosis, the dead bone will exfoliate, or be absorbed, but no reproduction of bone will ensue, the vacancy becoming filled up only with a dense fibrous tissue.

If, from peculiar circumstances, the shaft of a bone die, while the medullary texture is left perfect, and the periosteum is entire, then there may be a complete reproduction effected by the vessels of the periosteum.

In all common instances, however, where necrosis attacks the whole thickness of a bone, the walls and medullary texture both perish. Under these circumstances, the shaft of the bone may be reproduced from three sources. 1. The articular ends of the bone, which are very rarely implicated in necrosis. 2. The periosteum, which invested the dead bone. 3. The soft parts indifferently, whatever their nature may be, which surround the periosteum, supposing this to have been destroyed either simultaneously, or subsequently to the death of the bone.*

Some of Dr. Macartney's views of this subject have been more particularly noticed in his last publication. "The mode (says he) in which the dead bone is removed, and a new one formed, is perfectly consistent with the general laws for the reparation of bone. A vascular substance is created, resembling granulations in structure and offices, for the purposes both of absorption and reproduction, which I have called the *vascular investment.* This new organ *will grow upon whatever tissue lies next the dead bone;* and as the periosteum is usually in that situation, the mistake has arisen of attributing to that membrane the offices of absorption and reproduction; functions, which it would be quite incompetent to perform in its natural state." Dr. Macartney does not agree with those who suppose, that the periosteum, *as such*, is the proper structure for reproducing the new bone.

"The granulation-structure," he observes, "is that which is employed for the separation of different substances that are not fit to remain in contact with the living body. Hence, we find it constitute the organ for this purpose in necrosis; in the process of exfoliating bone that is dead; in detaching sloughs; in drawing the line of demarcation in a mortified limb; and in the removal of deciduous teeth.

"When the principal part of the shaft of a bone is necrosed, the periosteum becomes detached from the bone; and from the number of red vessels it now receives, it is rendered soft, pulpy, and perfectly red on the surface next the bone; and, as soon as the work of absorption begins, this surface acquires the form of granulations. As this vascular investment *proceeds inwards, devouring the dead bone,* the shell of the *new bone is deposited in the back* of the *granulation-structure,* which undergoes the preparatory change into a gelatinous, or cartilaginous tissue, previously to its ossification. The shell is at first of course thin, and with numerous holes in it, for the transmission of red vessels to the vascular structure, and for the exit of a fluid, which hardly deserves the name of pus, in the first instance, if the inflammation be kept down; and as the process advances inwards, the new formed bone becomes thicker and firmer, until at length, when the dead bone is all removed, the regenerated one becomes solid throughout. This description applies to those cases, in which the whole of the middle of a long bone dies and is reproduced; but, when

* E. Stanley, op. et vol. cit. p. 577.

the skin ulcerates, and a certain portion of the sequestrum or dead bone becomes exposed, that portion is separated by the granulations of the ulcer, by the process of exfoliation, if it be not removed by an operation." *

If in a living animal, a portion of one side of the walls of a bone be removed, without much injury to the medullary texture, the lost bone will be reproduced by the vessels of the medullary membrane. If, in a living animal, a portion of the whole thickness of a long bone, *with its periosteum,* be removed, reproduction is not to be expected. But, in man, in consequence of the quietude in which the limb may be maintained, union will take place between the ends of a long bone after such experiment. Here the new osseous matter, which fills the vacant space, is produced at once by the vessels of the medullary membrane, by those of the surrounding cellular tissue, and by those of the walls of the bone. These all produce granulations, which are converted first into fibro-cartilage, and at last into bone.† These facts, and others noticed in the description of the process by which fractures unite, place in a conspicuous view the error of supposing the periosteum to be the sole organ for the reproduction of the osseous tissue.

The sequestrum, when long retained, gradually undergoes a change in its shape and size; but this change is one of considerable slowness; indeed, the total absorption of the sequestrum would sometimes require so long a period, that the patient would hardly live till the completion of the process. In children it goes on more quickly and with greater success. The absorption of the sequestrum is probably effected by the absorbents of the vascular substance between the sequestrum and the new bony tube. In the living subject, the dead portion of bone is not so loose within the new case as it is in preparations; in fact, the space between the old and new bone is completely occupied by the pulpy vascular substance. As the new osseous formation is produced before the removal of the old bone, and is external to it, of course it must be larger and more clumsy than the original one. The old bone appears, then, to serve as a kind of model for the new one, and in time, after the sequestrum has been entirely removed, the irregularities on the surface of the new bone are gradually smoothed down, and its thickness diminishes, so that it becomes as nearly as possible of the size and shape of the original bone. The medullary structure is also formed in the new bone. Dr. Macartney had a preparation in which the disease commenced thirteen years before the death of the patient, and, in this case, the interior was becoming cellular, preparatory to the formation of the medullary structure. He had seen a tibia, in which the medullary reticulated texture had been reproduced, although the medullary cells were irregular.

During the whole of the processes by which an original bone is destroyed and regenerated, it rarely happens, that any want of firmness in the limb is experienced; it is not flexible; there is no shortening of it; and, what is equally remarkable, the attachments of all the muscles are preserved as in their original state. In a few examples, however, the new bone is not thrown out fast enough to prevent shortening of the limb. There was an instance at St. Bartholomew's Hospital, a few years ago, of the femur being destroyed by necrosis, and the new bone not being secreted with sufficient quickness and perfection to prevent retrac-

* See Macartney on Inflammation, p. 73.
† Stanley, in Med. Gaz. vol. xx p. 501.

tion and deformity of the limb. In that case, amputation was deemed necessary. A poor chimney-sweeper had necrosis of the femur with extensive abscess. This went on very well, however, and a large tumour of new bone was felt around the ends of the dead piece; one near the knee-joint, the other about half way up the thigh. An attack of erysipelas came on, and caused the entire absorption of the new bone, with considerable increase in the extent of the dead portion; so that the next time the prominences, formed by the new bone at the ends of the dead piece, were distinguishable, the upper was nearly as high as the trochanters, and the lower one very near the knee. In another case of necrosis of the femur, the patient, in consequence of the limb being attacked with erysipelas, had one or two ill-conditioned abscesses in the leg, and, what was worse, an abscess of the knee-joint, with ulceration of its cartilages. Such complication, added to the disease in the thigh, rendered amputation indispensable.*

In Weidmann's excellent work on necrosis, are representations of several of the most interesting circumstances which take place in this disease. One engraving shows the protrusion of the dead shaft of a humerus through the skin, in such a way that it admitted of being taken out with the fingers, and exhibits the appearance of the sequestrum after its removal. It is curious to notice, that the lower portion of the dead bone is generally more angular and irregular than the upper. In some of these fine and accurate plates, the drawings for which were all taken from nature, are views of the *cloacæ*, or apertures, forming outlets for the matter collected between the sequestrum and new bone. There are also several plates, representing necrosis of the articular extremities of bones, and amongst them is a very remarkable one, in which there are not less than three sequestra, one in the upper head of the fibula, and two in that of the tibia. One of the plates represents a regeneration of the lower jaw; the case was a necrosis of that bone, and we see the degree of reparation effected by nature, the appearances of the new bony formation, and how well it is calculated to be a substitute for the original bone.

In the treatment of necrosis, it is necessary to consider, that the disease presents itself in three different stages. *The first is attended with inflammation, and is that in which the disease is forming.* In the *second stage, the sequestrum, or dead bone, has been produced, but it is still fixed, and firmly connected to the living parts of the bone.* In the *third, the sequestrum is not only formed, but loose.* Now such varieties in the condition of the disease have a considerable influence on the choice of plans, with the view of promoting the cure.

In the *first stage*, supposing the disease to be extensive, and to be accompanied by severe inflammation of the soft parts, while the sequestrum is only forming, we can do little more than endeavour to check and moderate the inflammation of the soft parts. In this stage, recourse may be had to antiphlogistic treatment, especially leeches, fomentations, and poultices; and sometimes we may cup the part with a better effect, than what is obtained from the other form of local bleeding. It is evident from the very nature of the disease, namely, from the circumstance of its unavoidable and speedy complication with a portion of bone, entirely deprived of all vital action in it, which dead piece of bone must then be regarded as an extraneous substance, that the utmost we can do in this

* Cæsar Hawkins, in Lond. Med. Gaz. vol. xii. p. 749.

stage, is to lessen the inflammation and appease the patient's sufferings; the sequestrum will inevitably be produced, and must be got rid of before a cure can be accomplished. In the early stage of the disease, another principal indication is to make free openings for the discharge of abscesses as soon as a fluctuation can be felt.

In the *second stage*, or *that in which the sequestrum is completely formed, yet firmly attached* to the living part of the bone, we are generally obliged to wait, till nature has more or less detached it, before any useful steps can be taken for its removal: we know of no medicines that would certainly have the effect of quickening the process of exfoliation; and even when the whole shaft of a bone is in the state of necrosis, it is by the same process that its separation from the living extremities of it is to be effected.

We may usually recognise this second stage of the disease, by observing the presence of fistulæ, through which some part of the sequestrum may be felt with a probe. Many years ago, the proposal was made to apply diluted nitrous acid to exposed sequestra, for the purpose of dissolving the earthy part of them, and thus getting rid of them with expedition. The fear, however, of injuring the sound part of the bone prevented this practice from being extensively tried. This suggestion merits notice, however, because a report was presented to the Royal Academy of Medicine at Paris, in the year 1835, giving highly favourable accounts of a similar practice followed by Delpech, who employed for the dissolution of the earthy part of the sequestrum, the diluted sulphuric acid. This was applied to the exposed dead bone four or five times in the course of the day, and soon afterwards the animal part of the destroyed bone admitted of being taken away with forceps. I have tried this plan in University College Hospital: the acid of course dissolves the sequestrum, but the subjacent bone seems to be acted upon, and more or less destroyed.

The *process of exfoliation*, or that by which the dead portion of bone is loosened and separated from the rest of it, is a particularly slow one, sometimes requiring months and even years for its completion. Though the process is analogous to that by which sloughs are detached, it differs from it in requiring a much greater time; and, unfortunately, we have few means by which we can influence it in this respect. Some surgeons try counter-irritation; they apply blisters and keep them open with savine ointment, for the purpose of expediting the process of exfoliation; this plan was strongly recommended by the late Mr. Crowther, in a good practical work, which he wrote on the subject of necrosis and diseases of joints, and, at one time, such treatment was extensively adopted in some of the London Hospitals. I believe, that counter-irritation, with blisters, or issues, setons, and the exhibition of tonics, or of the ioduretted solution of the hydriodate of potash, according to circumstances, may tend in some degree to quicken the process of exfoliation. At all events, a blister, seton, or issue, is often beneficial in lessening the disposition to repeated attacks of inflammation in the deeper parts of the limb, the recurrence of painful and profuse abscesses, and all the severe constitutional disturbance which is so liable to arise from these states of the disease. In necrosis, the health suffers, not merely from the discharge which is so copious and long kept up, but from the repeated recurrence of fresh inflammation, and renewed formations of matter after other abscesses have been nearly, or quite cured. Sometimes we may essentially serve the patient by supporting his strength; for, when he is languid and debili-

tated, or much reduced by hectic complaints, the process of exfoliation will not go on so well, as it would do if the actions and functions of the system at large were carried on with more vigour and less disturbance. We know that exfoliation naturally proceeds more quickly in young persons than old ones, which may be regarded as fortunate, because a large proportion of the worst forms of necrosis happen in young subjects. As Mr. Stanley has observed, in some cases, and these in whatever circumstances the death of the bone has taken place, whether from constitutional or local causes, from external violence, or otherwise, the sequestrum will still retain its connexion with the living bone, and no exfoliation ensue. This gentleman had seen cases, where, many years after the death of a portion of bone, it was found to have undergone no change whatever; nor had any separation of it from the living bone taken place. "In many cases, the causes of this failure of separation seem obscure: in some it may arise from simple debility, or a peculiar derangement of the system; or it may be the effect of a diseased condition of the soft parts surrounding the dead bone. This is perhaps capable of illustration by those cases, in which necrosis takes place from the influence of the venereal disease. In these, a portion of the front of the tibia, for example, having perished, and the skin covering it ulcerated, dead bone is exposed, and becomes perfectly black; but it undergoes no further change. At length, after it has remained in this condition for some months, a suspicion begins to be entertained of its syphilitic nature, and mercury is administered: when, as soon as this remedy commences to affect the system, the sore assumes a healthy character, and the process of the separation of the dead bone commences. It may be, however, that the mercury excites the absorbents to action, independently of its influence on the constitutional affection." * Instead of mercury, which often has very pernicious effects on the general health, where necrosis exists in a syphilitic patient, I usually prefer giving the iodide of potassium.

Notwithstanding all that can be done, by means of tonics, iodine, blisters, &c., assisted with an eligible diet, notwithstanding the most judicious support and regulation of the general health, a complete cure of necrosis, in its second stage, by natural processes, that is, by the absorption, or annihilation of the sequestrum, and the subsequent healing up of the fistulous openings, is not frequently accomplished. I have attended several young subjects, however, in whom a necrosis of the upper portion of the humerus terminated in this favourable manner. In the generality of instances, active and sometimes remarkably bold measures become necessary; but these can seldom be adopted with any success during the second stage of the disease. Sometimes, however, in this stage, we are absolutely compelled to amputate the limb; for if the health should be so dangerously reduced and deranged by the pain and irritation, and profuse discharge, that a further perseverance in attempts to save the limb would be more likely to lead to the patient's death than the cure of the necrosis, we should then be called upon to amputate the limb. This necessity occurred in a case, from which one of Weidmann's engravings was taken; there was a necrosis of the condyles of the femur and of the head of the tibia; and the health being so seriously reduced as to render further attempts to save the limb improper, amputation was performed by Siebold. In Mr. Liston's collection is a fine specimen, in which the bones of the knee are not only involved in the ravages of necrosis, but

* Op. et vol. cit. p. 579.

also dislocated. Whenever necrosis involves a large joint, the patient cannot be expected to recover without amputation. Sometimes, patients with necrosis are attacked with erysipelas; and abscess of the knee-joint, with ulceration of the cartilages, is added, perhaps, to necrosis of the shaft of the femur, or tibia: this is a case for amputation, as illustrated in that recorded by Mr. C. Hawkins. When the case is a necrosis of the femur, and the new bone gives way, followed by irremediable deformity of the limb, and profuse abscesses, amputation may be called for. The possibility of such an unfavourable change dictates the propriety of affording, in some instances, the support of a splint, or other mechanical apparatus, for a certain time after the removal of a considerable sequestrum.

In a necrosis of the femur, the sharp point of a sequestrum has been known to open the popliteal artery, and give rise to an aneurism; and the patient, who refused to submit to amputation, died of mortification and hemorrhage.*

In the *third stage of necrosis*, or *that in which the sequestrum is loose*, the dead bone can only be regarded as an extraneous body, keeping up more or less irritation and suppuration. Its removal, therefore, either by natural processes, or by the interference of the surgeon, is now necessary for the cure. Sometimes one end of the sequestrum will actually make its way through the skin, and will protrude, and then it may be easily taken away; but, in other instances, where it is completely surrounded by a new bony tube, an operation will mostly be required, sooner or later, for the purpose of extracting it. In young subjects, the dead portion of bone, even though thus circumstanced, is sometimes removed by natural processes. In general, however, we are obliged to cut away a portion of the new osseous deposit that confines it. *When we find the health good, the discharge lessening, and the fistulous openings inclined to heal*, there is no urgency for an operation. *But when the health is suffering, the discharge copious, and the sequestrum known to be loose, that is, can be felt to be so, it becomes an object to remove the dead bone from within the osseous tube*, which is frequently so hard as to require the cutting pliers, saw, or trephine. Suppose the sequestrum to be surrounded by a bony tube, we should make an incision over that part of the new osseous formation, under which we have ascertained with a probe, that the loose dead bone is situated. Having done this, we may generally see the cloacæ, through which we make another examination of the sequestrum with a probe. Then, by cutting the interspaces, or bridges, between two of these apertures, or enlarging one of them with the cutting pliers, we make sufficient room for the extraction of the sequestrum. At all events, as much of the bony case as will enable us to get at and remove the dead bone within it, must be cut or sawn away. After the dead bone has been exposed to a sufficient extent, it should be cut in half with a pair of cutting pliers, or one of Hey's saws: an elevator is then to be used to force the end of one of the fragments outwards, which being drawn out greatly facilitates the extraction of the other half. We should avoid making several openings in different parts of the new bony case, because it would destroy too much of the new bone, and injure the soft parts to too great an extent. When the new bone is very thick and hard, the application of a small trephine may become necessary.

In many instances, the sequestrum does not extend through the whole length of the tube, only certain portions of the original bone being de-

* W. H. Porter, in Dublin Journal of Med. Science, vol. v. p. 190.

stroyed, and consequently, the new bony formations are then only at particular points.

In unfavourable and extensive cases of necrosis, amputation sometimes becomes indispensable, because the patient's constitution cannot bear the repetition of the operative proceedings necessary to get away every part of the dead bone; for it frequently happens that we cannot remove all the sequestrum at once, and then several operations become necessary. In the course of the treatment, tonic medicines, bark, sulphate of quinine, chalybeates, the carbonate of soda and rhubarb, or the salts of iodine, will usually be needed. Sometimes, however, we are compelled to return to antiphlogistic means. In the course of a year, there may be from eight to sixteen attacks of severe inflammation of the soft parts, followed by new abscesses on each occasion, and under these circumstances, reluctant as we may be to do any thing to weaken the patient further, we are obliged to employ local bleeding and other antiphlogistic remedies in moderation. Then, if we consider the unavoidable irritation and drain upon the system, produced by the long continuance of the disease, we shall not be surprised that, in many instances, the patient should be reduced so low by hectic fever, that amputation is the only chance of preservation remaining for him. We must not, however, take off the limb unnecessarily, but remember that nature will do a great deal for the patient in this disease; and, as I have explained, it is in the osseous texture that she possesses, perhaps, a greater power of repair and reproduction, than in any other tissue of the body.

*Mollities ossium* is a very rare affection, and one that is sometimes erroneously confounded with rickets. In mollities, the bones become preternaturally soft and flexible; those of the lower extremities may indeed, in some instances, be bent in such a degree that the outer ankle can be brought against the temple without the femur being fractured. In the natural state, the bones contain more than half their weight of earthy matter, and I believe that, in some instances, the proportion of it amounts to nearly two-thirds of their whole weight. But, in the morbidly softened state of the bones to which I am referring, the earthy matter is only in the proportion of one-fifth part to four of the animal matter in their composition, and sometimes even less. There are several striking differences between mollities ossium and rickets. The former is a particularly rare disease, whereas rickets is one that is seen daily. Mollities ossium hardly ever takes place except in females, and in those who are above the middle period of life; whereas rickets chiefly attacks children, or, at all events, those who are under puberty. Another distinction is, that in rickets, the earthy matter is originally deficient; the bones have never been properly developed from birth; but, in mollities ossium, the bones attain their full growth; their texture is perfect; and their proportion of earthy matter is quite right, until about the middle period of life, when those peculiar changes in the texture of the osseous system take place, which constitute the disease under consideration. Mollities ossium, appears to arise from some defect in the nutrition of the bones; but the exact cause of it is not understood. Some writers confound *mollities* with *fragilitas ossium;* but the two diseases seem to be the reverse of one another. Thus, when the thigh-bone is so soft, that the outer ankle can be placed against the temple, this must be a different case from fragility, in which the bone cannot be bent at all without breaking. Sometimes in mollities ossium, nearly the whole of the natural texture of the bone is absorbed. A bone in this state is found to

contain cells, filled with a brown or livid substance, and having communications with the cells on the outside of the bone, or, in other words, with the cellular tissue. When the osseous system is thus affected, of course it is disqualified for its functions, as it can no longer support the limbs; nor will the bones, thus altered, serve as levers for the muscles to act upon; neither can they afford that protection to certain important parts which they are designed by nature to give. Hence, in the worst forms of mollities ossium, the stature is so much altered, that persons afflicted with this disease, who were originally five or six feet in height, become not more than two: — thus Madame Supiot, whose case is the most remarkable one on record, was, at the period of her death, only twenty-three inches in height. In her case, there was also such a change in the shape of the bones, that the compression of the thoracic viscera was probably the circumstance which mainly contributed to put an end to her miserable existence. Her limbs could be bent in the extraordinary manner I have explained, without breaking. Mollities ossium, so far as all our present information reaches, is invariably a fatal disease; for there is no instance of it on record in which a cure was effected. It is accompanied by immense disturbance of the constitution; in particular, constant and profuse perspiration; a very copious deposit of phosphate of lime in the urine; and a great deal of fever. Here is another great difference from rickets; in which there is not necessarily any severe degree of constitutional disturbance; the disorder of the bones not being the cause of any fever or pain. But, in mollities ossium, the patient's sufferings are truly deplorable, and the health is universally and totally deranged. In rickets, there are no profuse sweats — no copious deposit of phosphate of lime in the urine. It is not my meaning, that rickets may not be combined with very bad health; but, when this is the case, the complication is only an accidental and not an essential one. There may be marasmus and great constitutional disorder with rickets, or not. In the treatment of mollities ossium, the phosphate of lime has been given, on the supposition that there is a deficiency of that earth in the system. Though an unusual quantity of phosphate of lime seems to be thrown out of the system by the kidneys, it does not follow as a matter of course, that there must be any want of it in the constitution. The fault lies, probably, in some inexplicable derangement in the nutrition of the osseous system, either interfering with the regular deposit of that substance, or causing its too rapid absorption and conveyance out of the system. Acids and tonics have been tried; but every thing has proved inefficient.

*Fragilitas ossium*, consists in an unnaturally brittle state of the bones. In the advanced stages of syphilis, cancer, fungus hæmatodes, scrofula, and scurvy, so great a weakness and fragility of the texture of the skeleton are sometimes occasioned, that fractures take place from trivial causes, and are therefore termed *spontaneous*. In the museum of University College, is a thigh-bone, which broke as the patient was merely turning himself in bed, and the accident happened while he was taking mercury for nodes on the opposite thigh-bone, which is also in the same museum. In the same collection, is another specimen, in which the humerus was broken by champooing; the patient had scrofula, and while the limb was undergoing the champooing process, the bone broke; this first fracture united; but a second fracture happening afterwards in another place, a false joint formed in the situation of the injury. The bone was so brittle, that when the surgeon was dissecting it after death, it broke in a third place.

In old age, there is always a degree of fragilitas ossium, and this is generally explained by the circumstance, that, in the bones of old persons, there is a large proportion of calcareous matter to the animal and vascular matter in them. However, they contain likewise a great quantity of greasy matter; and on this account can never be well cleaned so as to make white good-looking skeletons. The other varieties of fragilitas ossium are attended with a diminution in the quantity of phosphate of lime; and when there is really an increase in its quantity, it is, I believe, only in that form of fragilitas ossium which comes on as the natural effect of old age. In all the other forms of this disease, the bones are generally lighter than natural. The fragilitas ossium of old age is of course incurable. In other examples of it, arising from different diseases of the constitution, the cure will entirely depend on the possibility of curing the original disease; if this can be cured, there will be a chance of the proper texture of the skeleton being restored; but, under other circumstances, no hope of a cure can be entertained.

I was called some time ago to a patient, whose thigh-bone broke as he was turning in bed; it appeared that he had a cancerous disease of the bladder, for after death a large fungous tumour was found in that organ, situated upon so hard a cartilaginous base, that when felt through the bladder, it was at first supposed to be a stone. One of the ribs was also broken, and both this fracture and that of the femur were surrounded by a mass of scirrhous matter.

In some individuals, not beyond the middle period of life, or even considerably below it, the bones are extraordinarily brittle, without any assignable cause. As a stout man, a patient in the Middlesex Hospital, was cutting a slice of bread, the humerus broke. I have heard of young and apparently healthy persons, whose bones were so brittle, that they were continually breaking from very trivial causes. It is remarkable, that in almost all such cases, the fractures unite just as well as in others.*

*Rickets* or *Rachitis*, principally affects children, and mostly between the ages of eight months and three years. Besides the differences from mollities ossium already specified, there is not in this last disorder the same thickness of the cranium, which is commonly observed in rickets; sometimes, indeed, the thickness is immense. As Mr. Shaw has observed, the derangement of the minute textures is exhibited in the skull in a remarkable manner, some parts of the calvarium having an extraordinary thickness, while other parts of it are reduced to the thinness of paper, and the divisions of the tables are lost. Sometimes the parietal bones become seven-eighths of an inch in thickness; while, in the situation of the fontanelle and sutures, the cranium is surprisingly thin. Hunauld presented to the Academy of Sciences a skull-cap, taken from a child, between three and four years old, where the bones were in some places seven or eight lines in thickness, and when squeezed, blood and serum issued from their interstices. Bones, affected with true mollities, never recover their natural texture, and, sooner or later, the disease proves fatal; but, in rickets the bones often acquire a better shape, and a greater degree of firmness, as the child grows; indeed, they often acquire such a degree of firmness as fits them perfectly for the performance of their functions; and some rickety children grow up to be remarkably athletic subjects. When the disease, however, is in an aggravated form, the deficiency of phosphate

* See Mayo's Pathology, p. 18.

of lime is sometimes so great, that nothing but the shell of the bone is left, the internal part being filled with cells containing a red sanious fluid. Although there is in this circumstance a degree of resemblance between rickets and mollities ossium, it is to be recollected, that the bones in the former disease cannot be bent as they can in the latter. With respect to the change in the bones, it does not merely consist in a deficiency of the secretion of phosphate of lime; in addition to the loss of firmness from that cause, there is a disorganisation of the minute textures of the bones—and this is so much the case, that, in aggravated cases, the walls of the long cylindrical bones may be entirely removed, and the whole interior preserves, according to Bichat, a homogeneous appearance, and consists of cellular texture throughout. Perhaps, however, some examples of this description, referred to by writers, might have been true cases of mollities.

In rickets, nature makes great efforts to obviate the effects liable to occur from the weakness of the bones. In a bone, bent by the disease, in proportion as the walls of the larger curvature are thinned, the walls of the lesser one are thickened and strengthened. The reason of this is, that the lesser curvature has all the weight of the body to support, and, if there were not this provision made, the bone would be incapable of supporting any weight. For some valuable observations on this subject, we are indebted to Mr. Stanley.

One effect of rickets is to flatten the long cylindrical bones, and the greater diameter of the bone, when thus flattened, is always from the forepart of the curvature backwards; thus the same result is produced as what arises from the wall of the lesser curvature being thickened—the bone is strengthened by it. When the cylindrical bones are affected with rickets in an extreme degree, even the medullary canal is sometimes obliterated, in consequence of one side of the wall of the bone acquiring an immense thickness. Sometimes in rickets the bones bend laterally, and the convexity of the curve may be on either side of the limb.

It has been supposed, that the heads of rickety bones expand; but this is not usually the case; the joints seem large in this disease; yet this is proved by dissection to depend principally upon the emaciation of the soft parts. Bichat has adverted to a thickening of the periosteum in rickets; but this is not commonly observed.

As it is principally the weight, which the bones have to support, that makes them bend, it follows that those of the lower limbs must be more liable to deformity than the bones of the upper extremities. There is, however, in the museum of University College, a humerus, that has been twisted by the action of the muscles, in consequence of which the ulna has been moved partly into the place of the radius, and the radius displaced. The upper head of the latter bone, no longer having the humerus to play upon, is elongated, and altered in its shape. In the same collection is likewise a skeleton, in which is seen an extraordinary deformity of each humerus produced by the pressure of crutches. The skeleton is that of a boy, about ten or twelve years old, and it shows various other interesting circumstances connected with rickets; for example, it exemplifies the slow development of the teeth, and the imperfect formation of the alveolar processes, occasionally noticed in rickety children. The preparation is interesting on another account; for, here rickets was complicated with a scrofulous caries of the vertebræ. Many writers incline to the belief, that rickets is essentially connected with scrofula; but this is an erroneous opinion. It is true that scrofula

may be accidentally joined with rickets, as in this instance, but we frequently meet with rickets where there is no scrofula in the system. The skull of this subject is also surprisingly thick, more than an inch, I believe, in some places; and many of the bones and their processes are but very incompletely developed. This is certainly the case with the vertebræ.

It was an observation, made by the late Mr. Shaw, that in whatever state of distortion the spine and ribs may be, the bones of the pelvis will not be found distorted, unless there be at the same time marks of rickets in some of the long and solid bones; and it is argued by his brother, that as neither the bones of the upper, nor those of the lower extremities become incurvated, *when the distortion commences near the age of puberty*, it follows, that a cause, totally different from rickets, gives rise to it, and that the pelvis incurs no danger of being implicated in this deformity. Mr. Alexander Shaw, therefore, considers those skeletons only as true specimens of rickets, in which the distortion is exhibited throughout all the osseous system together — in the skull, the cylindrical bones of the extremities, and the large bones of the pelvis, as well as in the spinal column and the thorax. The figure of a rickety skeleton is distinguished by the head, the thorax, and the arms being preponderating and large, while the pelvis and lower extremities are, in a relative degree, diminutive and short. In the skeletons examined by Mr. A. Shaw, all the bones were to a certain degree deficient in size; but such want of development was much more considerable in the lower half of the skeleton, for the vertebral column and arms wanted scarcely one-fifteenth of their natural length, while, in the bones of the lower extremity, one-third of it was deficient. In the pelvis, the bones were nearly a quarter under their natural size. Hence, when the pelvis is deformed by rickets, it is not only those diameters, which are contracted by the thrusting inwards of the bones that are smaller than usual, but all the diameters are less than natural; whereas in the deformity of the pelvis from mollities ossium, in proportion as one diameter is lessened, the other is elongated.

I have stated, that the common period of the commencement of rickets is between the ages of eight months and three years; but the disease may begin in the fœtus, of which fact we have an example in the museum of University College.

There is a deformity of the spine arising in young persons who are growing with great rapidity, especially in females, which does not depend on any disorder of the bones analogous to rickets, but on the circumstance of such individuals not exercising their muscles equally, or on their being prevented from taking the free and unconstrained positions and exercises most agreeable to nature. Under such disadvantages, the spine becomes deformed, without any imperfection in the texture or development of the bones, and consequently there is no rickety disease of them. When the curvature of the spine, arising from such causes, is not too considerable, and the growth of the individual not yet completed, the deformity may be removed by letting all the muscles of the trunk be daily exercised in a free, regular, and uniform manner, so as not to suffer one set to be put more into action than another. It is on these principles that gymnastic feats and manœuvres become exceedingly useful in the treatment of those deformities of the spine, which are so common in girls during their growth. However, if the deformity has been of long standing, it will be impossible to remove it in this or any other way; for the disease then approaches in its nature to that kind of deformity of the

skeleton, which results from old age. When a rickety curvature is in the dorsal vertebræ, the upper part of the spine is usually inclined to the right side, and the consequence of this is, that there is such an alteration in the position of the ribs, that a great convexity of them is produced on the right side, and a flattening of them on the left. Then the scapula is made to project backwards, and the right shoulder is thrown forward. In consequence of the flattening of the left side of the thorax, there is hardly room enough in it for the proper action of the heart and the due expansion of the lungs. In many instances the spinal column is not merely curved, but twisted spirally. In the museum of University College is a preparation affording a fine illustration of such deformity: there is not only a curvature of the spine, but a complete twist of it, insomuch, that, in one part, the spinous processes of the vertebræ are brought nearly round to where their bodies ought to be situated.

In some of these cases, the clavicle may be displaced, in consequence of the alteration in the position of the shoulder, that is, the sternal end of that bone may be thrown inwards so as to press upon the œsophagus. An instance of such displacement of the sternal end of the clavicle is mentioned in Sir Astley Cooper's work on dislocations, and the pressure on the œsophagus was such, that the surgeon, under whose care the patient was placed, was obliged to remove a portion of the clavicle in order to prevent the fatal consequences which would have arisen from the impediment to deglutition. Amongst the preparations in University museum are some showing the alterations in the form of the female pelvis occasioned by rickets. Frequently the sacrum is displaced; and the ossa innominata are thrown inwards, so as to give the pelvis a triangular shape. In rickety females, the bones of the pelvis are not properly developed, and the pelvis is surprisingly small.

When there is a bend of the spine in one direction, there will frequently be another in exactly the opposite direction to counterbalance it, and sometimes there will be even a third curvature, so that the spine will represent an italic *S*, as is illustrated in an excellent specimen in the above-mentioned collection.

*Treatment.* With respect to the causes of rickets, the subject is very obscure. Perhaps the observation of Mr. Stanley is correct, that it is not an affection peculiar to, that is, restricted to the osseous system. The muscles, surrounding the soft rickety bone, are pale and flabby, and probably contain less than their natural quantity of fibrine. It is likely, also, that the deficiency of phosphate of lime, one of the characteristics of a rickety bone, is the result, not of peculiar local action, but of a general and constitutional deficiency of assimilation and nutrition, by which the peculiar character of the muscular tissue is coincidently produced.* As the disease consists either in a congenital defect in the organisation of the bones, or in such defect arising in infancy, it is to be expected that nature must be more confided in than any medicines, or other means, for the removal of the imperfection, which the deformity and bending the bones are only an effect of. We know of nothing that has the direct power of so altering the texture of the osseous system, as to communicate to it a due consistence, to rectify the derangement of its nutrition, and promote its full development. While the bones are under the influence of these imperfections in their texture and nutrition, they gradually yield under the pressure of the

* E. Stanley, in Med. Gaz. vol. xx. p. 641.

parts above them, and to the action of the muscles connected with them; and hence they bend, and deformity ensues. Now, the question is, how can we counteract these two causes of deformity? One would say, of course, by keeping the muscles from acting, and taking off the weight of the parts most liable to affect the bones by their pressure on them. But considerable difficulty is experienced in putting these principles into execution; for, if the individual be confined long in the recumbent position without being allowed to use his muscles, his constitution soon begins to suffer — he loses his strength — and his health gets into a state in which no improvement in the texture and development of the bones can take place. Again, if we attempt to take off the weight of particular parts by the use of machinery, the pressure will only be transferred to other parts; thus, in the application of machinery to take off the weight of the head, chest, and upper limbs, from the spine, we should be obliged to use the pelvis as a fulcrum, and thus deformity of the bones of the pelvis might be produced. I have mentioned a skeleton, in which the humeri have been vastly deformed by the pressure of the crutches on which the individual supported himself. However, it is not my intention to say, that the use of machinery in rickets should be entirely relinquished; perhaps, in some cases, it is preferable to a rigorous observance of the recumbent position, in which the patient always loses his health. Whatever tends to strengthen the constitution, has a decided tendency to promote the removal of the rickety disorganisation of bones; and, as the individual grows and acquires strength, those parts of the osseous system which the disease has deformed, will assume greater strength, and a better shape. In the treatment, therefore, it is always an important object to rectify any manifest disorder in the health, and in particular to keep up the child's strength. Many rickety patients are more or less debilitated, emaciated, or big-bellied, and some of them plainly scrofulous. To these sea-bathing will prove eminently serviceable, care being taken to promote the cutaneous circulation by the use of the flesh brush, or friction with napkins. Tonics, and particularly steel medicines, will also be beneficial. When the curvature of the lower extremities is considerable, machinery may be applied, and when the deformity is conjoined with an inversion of the feet, a great deal may be accomplished by means of mechanical contrivances sold in the shops. But I think that, where machinery is employed, the patient should be allowed to exercise his muscles for a certain period of the day. I have already remarked, that many deformities arising from rickets may be cured entirely on gymnastic principles; that is, the patient is obliged to follow up a certain train of exercises, which put all his muscles into regular and equal action; and one principle is to put into action the antagonists of those muscles, whose preponderating activity and strength have led to the deformity, as well as those muscles themselves. Thus, when the spine is drawn to one side, by the right arm and shoulder being used more than the left, the object is to put the muscles of the left side into regular exercise, in order to counteract the effect of the muscles of the opposite side. The imperfection in the organisation of bones, depending upon rickets, may be removed, and yet such bones never recover their proper shape. They acquire strength, but continue deformed. It is well known, in fact, that in some persons, whose bones are restored to their right texture, though yet bent and disfigured, the muscles acquire remarkable power, and some individuals, so circumstanced, have been distinguished for feats of strength and agility.

An *exostosis* signifies a tumour of a bony nature growing upon and

arising from a bone, or an enlargement or hypertrophy of it. Sir Astley Cooper describes exostosis as having two seats; by *periosteal exostosis*, he means that form of the disease, in which bony matter is deposited between the periosteum and the surface of the bone; but, by *medullary exostosis*, he implies a growth from the medullary texture, by which the bone is expanded and ultimately absorbed and destroyed, so that the tumour protrudes externally. Now, this latter kind of tumour does not consist entirely of bone, and some forms of it are of a malignant character, partaking of the nature of fungus hæmatodes, or medullary cancer. Sir Astley Cooper has also divided exostoses into *cartilaginous* and *fungous*, the former being preceded by a cartilaginous deposit, into which osseous matter is afterwards secreted, while the latter seems to be really fungus hæmatodes, or medullary cancer of the bones.

An exostosis may arise from the periosteum, or from the surface of a bone, or from its cancellous texture. When originating from the first of these situations, it may, in the early stage, be readily separable from the bone, but afterwards become united to it by osseous, cartilaginous, or dense fibrous tissue. At first, it receives an immediate covering from the periosteum, but this soon becomes absorbed, and then a dense cellular tissue forms its investment. And, lastly, when it arises from the cancellous texture, it will gradually extend, and make its way through the walls of the bone and the periosteum.*

The largest *true exostoses* are chiefly met with on the long bones, and if considerable ones are sometimes met with on other bones, they are generally not of the true kind; thus, in the *cartilaginous exostosis of the medullary membrane*, described by Sir Astley Cooper, the shell of the bone is extremely thin, and, within it, there is an elastic, firm, and fibrous substance. In other instances, a medullary substance presents itself, which is known to have the character of fungus hæmatodes; whereas, the fibrous growth is not of a malignant nature. It is universally admitted, that the blending of so many different diseases together, under the name of *exostosis*, creates a vast impediment to a clear view of the subject; and it would be much better, if the term *exostosis* were limited to a bony tumour, growing out of a bone and forming a projection on its surface, or an enlargement of a part of the bone itself, and not consisting in the growth of a soft substance in the interior of the bone, followed by an expansion of its walls, and afterwards of a protrusion of the fungous or fibrous mass itself.

With respect to the physical characters of a true exostosis, it may have the whiteness and density of ivory; or it may be dark coloured, and of a cancellous texture throughout; or it may be made up of a mixture of two such tissues; and again, there may be some cartilaginous matter in it, which may be deposited interstitially with the bone, or may be limited by a well defined line to one part of the tumour, and this is usually the base, which may be movable on the bone from which it has arisen. This diversity of texture has no relation to the size or duration of the tumour.†

Various terms are applied to true exostoses, according to the textures which they exhibit; some are *lamellated*, there being distinct layers observable in their texture; others are *cellular;* while others are so solid and hard, that they resemble ivory, and hence are called *ivory exostoses*. Some are so irregular and angular, that they receive the name of *stalactitic* or *spinous exostoses*. A most extraordinary specimen of this form of

* E. Stanley, in Med. Gaz. vol. xx. p. 643. † Id.

exostosis is described in the Philosophical Transactions; for the whole skeleton was affected; and the bony formations had all the fantastic shapes of coral. One extended from the os coccygis to the femur; and hardly a joint was left, whose motions were not stopped by the bones being connected together with those spinous productions.

*A true exostosis* is always completely fixed and immoveable, and, at first, unattended with any pain or inconvenience; it generally comes on in a very slow and indolent manner, and sometimes remains, for several years, nearly in a stationary condition. Indeed, it is generally some years before it produces much inconvenience, and then it may cause severe agony, and occasion dangerous functional disturbance by its pressure on particular parts. An exostosis of magnitude, situated behind the knee-joint, has been known to interfere with the action of the flexor muscles. The growth of an exostosis from the os pubis has by its pressure rendered the urethra impervious. An exostosis of the thigh-bone, though of small size, has been known, on account of its projecting angular shape, to obliterate the femoral artery; an instance of which occurred in the practice of Dupuytren. An exostosis of the orbit has frequently produced a displacement of the eye. An exostosis of one of the lower cervical vertebræ has been known to press upon and obliterate the subclavian artery. An exostosis, extending backwards from the lower jaw, has produced a fatal impediment to respiration, by its pressure on the larynx. Fixed pain in the head and epilepsy have been produced by the growth of exostoses from the inner table of the cranium. We have, then, numerous examples of the dangerous consequences of exostoses in particular situations; indeed, the prognosis in this disease materially depends on the situation of the tumour, and the possibility of removing it, with due regard to the parts amongst which it is placed. I am here speaking of true exostoses; because others, of a medullary character, are entirely different diseases, the cure of which involves the question, how far it is possible to cure, or effectually remove, fungus hæmatodes by operation.

Exostoses are frequent on the femur, tibia, humerus, and lower jaw; and not uncommon on the sternum, clavicle, and bones of the head and face. There are no bones on which they may not be produced. The upper part of the humerus and tibia, and the lower part of the femur, especially near the insertion of the adductor magnus, are their ordinary situations upon these bones. I was lately consulted for a girl, about thirteen years of age, who has an exostosis connected with the outer condyle of the femur, and interfering with the free action of the biceps. Sometimes an exostosis forms at the insertion of the psoas and iliacus.

The causes of exostoses are involved in considerable obscurity. True exostoses occur most frequently in young persons, but less usually before, than after the age of ten or twelve years. It would appear as if there existed in some individuals a predisposition to the disease, exostoses forming, in such persons, from very slight and trivial exciting causes. A little while before I began my professional studies at St. Bartholomew's Hospital, a youth had been sent into it from Cornwall, the particulars of whose case were always mentioned by Mr. Abernethy in his lectures. In this individual, a trifling blow on any part of his body would invariably lead to the production of an exostosis; and this disposition to form bony tumours was not confined entirely to the skeleton; for, after a blow on the muscles, a sort of osseous deposit would take place in them; in fact, the margins of the axillæ had become ossified; the great pectoral muscle and the latissimus dorsi were

both turned into bone at their edges, so that the patient was completely pinioned. In a preparation in King's College Museum, the femur is immoveably fixed in the acetabulum by ossification of the front of the capsular ligament, and of part of the iliacus internus. Mr. Langstaff has a beautiful specimen of ossification, which appears to have spread from the femur, and involves the vastus internus, the structure of which is converted into bone. * The alliance between ossification of ligament, muscle, tendon, and exostosis, or the origin of the former, from the bones, is well exemplified in Jeff's skeleton in the museum of the Royal College of Surgeons in London. Local irritation of the periosteum, by an external injury, would appear sometimes to act as a cause. In certain examples, where exostoses form numerously and almost without any assignable reason, the state of the constitution is to be suspected; and, as Mr. Stanley has noticed, the disposition to exostoses appears occasionally to be hereditary, as in the instance of a man in St. Bartholomew's Hospital, who had many exostoses, and whose father and children had been similarly afflicted. When pressure is made upon a bone for a considerable time by any kind of mechanical apparatus, a bony swelling is sometimes thrown out. In young persons, whose growth is rapid, nothing is more common than an irregular development, or an hypertrophy of the clavicle, ribs, or sternum.

*Treatment.* — Excluding from present consideration *venereal nodes*, perhaps we possess no means of checking the growth, or preventing the increase, of a true exostosis. I have been sometimes consulted by patients for exostoses, and have tried, as a matter of form, blistering, mercury, and iodine preparations, but have rarely or never seen a case that was materially benefited by them. Sometimes, however, an exostosis leads to inflammation of the soft parts, and then of course we should employ common antiphlogistic plans, viz. local bleeding, cold evaporating lotions, aperient medicines, and perhaps the blue pill, or calomel with opium. The inflammation may be relieved in this manner; but, as for dispersing the tumour by medicine, there is not the slightest chance of it. Yet, in many instances, surgery may be of essential service; for, though we cannot disperse an exostosis by external or internal medicines, we may, when it is producing dangerous effects by its pressure on neighbouring organs, remove it, or cut it away with Hey's saws, trephines, cutting forceps, or saws capable of working by machinery in deep confined spaces. Of course I mean, that an operation is to be performed only when it can be done without danger to the neighbouring organs. In the operation, the first object is to make such a division of the soft parts as will enable us to get at the base of the tumour without difficulty. There will be much difference in the facility of removing the tumour in different instances: its shape is one circumstance that will have influence: when its base is broad the operation will generally be difficult; but sometimes the base of an exostosis is narrower than its body, and then its removal may be easily accomplished with a saw or pliers. Even when we are not able to remove the whole of a true exostosis, we may sometimes do essential good by taking away a part of it; for this kind of bony tumour is not attended with any malignity, and meddling with it will not turn it into any dangerous variety of disease. In some instances, when it was not practicable to saw away the tumour, attempts were made to get rid f it by purposely exciting necrosis of it, by removing the periosteum

* See Mayo's Pathology, p. 15.

from its surface. A few years ago, I was consulted by a woman who had an immense bony swelling on the face. As several medical practitioners suspected that it arose from a fungus in the antrum, a point on which I had doubts, I sent her to Mr. Lawrence for his opinion, who coincided with me, that it was an exostosis of the upper jaw-bone. Now, in this example, after vast suffering, and repeated inflammation, and abscesses of the soft parts, the bony tumour came away spontaneously: it was attacked with necrosis, and exfoliated. The tumour, which was very large, came away by considerable pieces at a time, and the woman is cured, I believe, with the exception of a good deal of disfigurement of the face. After having been removed by operation, exostoses do not generally form again. Exceptions, however, are occasionally met with. A young woman had an exostosis of the humerus, which was sawn off. In a year another exostosis grew, nearly in the same place; but, on a rubefacient plaster being applied, an abscess formed, and the new bone was absorbed.* This proves that suppuration excited contiguously to an exostosis may lead to its absorption; but success of this kind is not common.

An exostosis may be so situated that we cannot prudently attempt any operation upon it; for instance, it may be so near a large joint, that any attempt to remove it would not only endanger the limb, but the patient's life. The exostoses, or abnormal enlargements of the clavicle, sternum, &c. so common during the rapid growth of the body, require no treatment. As Mr. Mayo observes, they are almost sure to disappear after a year or two; either the rest of the bone grows up to the enlarged surface, or the superfluous part is absorbed.

*Medullary tumours*, sometimes injudiciously classed as exostoses, are of the same nature as fungus hæmatodes. The disease is of frequent occurrence, usually begins in the cancellous texture, and, in the majority of instances, is not accompanied by a similar morbid deposit in other organs. Mr. Stanley has never seen a case, in which the disease seemed to have originated in the compact texture, or the periosteum. It generally, though not always, occurs before the age of forty; and its most frequent seat is the head of the tibia, or the lower part of the femur. Mr. Stanley knows of only a single instance, in which it had occurred coincidently in more than one bone; and, in a large proportion of the cases in which amputation had been performed for it, there had been no return of the disease in the stump, or other part of the body. The general result of *post mortem* examinations has been such as to indicate a similar localisation of the disease. The few exceptions to this remark, at all events, do not materially affect the conclusion, that medullary disease, beginning in bone, is less apt to occur coincidently in other organs than when it originates in the softer parts, and that consequently its removal by amputation may generally be undertaken, with a fair probability of permanent benefit.† This last observation seems not to be applicable, however, to medullary tumours of the upper and lower jaw-bones, few experienced surgeons now venturing to undertake an operation for them in these situations, well knowing that a return of the disease would almost certainly ensue.

In relation to exostosis, I may here mention a case, that is sometimes met with, where a considerable swelling of a bone arises from the formation of hydatids in the cancellous texture. In the Medico-Chirurgical Transactions of London, are the particulars of an interesting example of

* Mayo, Op. cit. p. 13.

† E. Stanley, Med. Gaz. vol. xx. p. 644.

this disease. The tumour, which was in St. George's Hospital, under Mr. Keate, was situated on the cranium, and occupied the greater part of the os frontis. At the time of attempting its removal, its exact nature was not known; but, in performing the operation, a collection of hydatids was discovered between the tables of the skull, and before they were completely extirpated, and the patient cured, repeated operations, and the application of the strongest caustics were necessary.

*Pulsatory tumours.* In my Dictionary the earliest notice was taken of cases in which tumours occur in bones attended with throbbing, and even followed by a spontaneous fracture of the osseous texture. The subject has been particularly considered by Dupuytren and Breschet, both of whom describe such swellings as consisting in the growth of a morbid erectile tissue, like what composes certain nævi, or aneurisms by anastomosis. Dupuytren remarks, however, that the tumour may be partly formed of other substances, especially the encephaloid, or medullary. Sometimes it is rather a slight thrill that is felt in the tumour, than a distinct pulsation; but in other instances, the throbbing is so strong, as to lead surgeons to mistake the disease for aneurism, and even to tie the great artery of the limb. The investigations of Mr. Stanley prove that pulsation occurs in tumours of varied character. The majority of those, which he has himself examined, consisted of medullary matter; but one which originated in the humerus, and pulsated strongly, was composed of firm gelatinous matter, which formed the walls of a cyst, about half an inch thick, and containing serous fluid. In one, recorded by Dupuytren, growing from the tibia, the morbid structure consisted of cells containing a gelatinous matter. In some of those related by Dupuytren and Scarpa, the pulsating tumour consisted of a sac, filled with coagulated blood and layers of fibrine; and in the sides of the sac were numerous dilated arteries, presenting open orifices upon its internal surface. In these instances it was supposed that the current of blood from these arteries into the sac might have produced the pulsation; but, in the greater number of pulsating tumours, growing from bones, no such change in the arteries can be found to account for this symptom. In all the specimens which Mr. Stanley had examined, the walls of the bone were absorbed between the tumour and the contiguous large artery, so that, on the outer surface of the tumour, there were either no remains of the bone, or so thin a layer of it that the impulse communicated by the artery to the tumour could be felt at every point of its surface. One variety, recognised by Mr. Stanley in four cases, consists chiefly in an enlargement of the arteries of the medullary membrane, accompanied by absorption of the interior of the bone, and simultaneous deposit of bone externally, so that the tumour is covered by a thin, more or less complete osseous shell. This is the disease regarded by Dupuytren and Breschet as corresponding to growths of morbid erectile tissue, and sometimes curable by ligature of the main artery, provided the operation be done before much destruction of bone has occurred. In one case, tying the femoral artery was followed by a permanent cure; in another, the same practice was successful for only seven years, at the end of which the tumour returned.

*Osteo-sarcoma* is a term frequently employed, though rather vaguely; it is found to be a convenient name, because it suits any tumour, which consists partly of bone, and partly of a soft or fleshy substance: thus, medullary tumours of bones, when surrounded by, or interspersed with, osseous matter, have been sometimes described under the appellation of *osteo-sarcoma;* and so have fibrous, and fatty lardaceous tumours blended

with osseous matter, or the remains of the original shell of the diseased bone.

Scrofulous caries of the spine, scrofulous disease of the heads of bones, anchylosis, and spina bifida, will be noticed in subsequent parts of this work.

## DISEASES OF THE JOINTS.

Some diseases of the joints begin in the synovial membranes; some in the cartilages; and others in the heads of bones. The commencement of disease in the ligaments appears to be a rare occurrence: Sir Benjamin Brodie states, that he has never known it proved by dissection. Mr. Aston Key refers to some instances, in which the ligamentum teres was implicated in a very early stage of the morbus coxarius; though here the disease probably began in the synovial membrane. Some syphilitic pains in the joints are suspected to arise from an affection of the ligaments; and it is believed, that the obstinate effects of many severe sprains depend upon a slow inflammation of the ligaments, the consequence of their having been ruptured, or over-stretched.*

### INFLAMMATION OF THE SYNOVIAL MEMBRANES.

This may arise as an effect of phlebitis, gout, rheumatism, derangement of the constitution by mercury, or by the poison of syphilis. With the exception of the case originating from phlebitis, we must agree with Sir Benjamin Brodie, that inflammation of the synovial membrane from constitutional causes is generally less severe than other forms of it; for, though it produces an increased secretion of synovia, there is usually no effusion of fibrine, nor any material thickening of the synovial membrane itself. Sometimes it attacks several joints together, and even extends to the bursæ mucosæ and sheaths of the tendons; while, in other instances, it attacks different joints one after another. Frequently inflammation of the synovial membranes is entirely a local disease, excited by mechanical injuries of the joints, as sprains, contusions, wounds, dislocations, or fractures of the heads of the bones. The danger of a wound of the synovial membrane, depends, first, on the size of the joint; secondly, on the extent of the laceration or rent in the synovial membrane and integuments together; for where the former alone is torn, as in a simple dislocation, or where the opening in it is speedily covered by the integuments, the danger of severe consequences is infinitely less, than in the opposite circumstances; thirdly, on the degree of contusion and laceration of the synovial membrane, in addition to the mere solution of continuity in it, forming a communication between the cavity of the joint and the external wound. Wounds of the knee-joint from gunshot are sure to be followed by so dangerous a degree of inflammation of the synovial membrane, and such constitutional derangement, that the rule of practice in such a case, is to perform amputation without delay, before inflammation and its consequences on the part and the system at large have had time to come on. But a clean incised wound, or even a fine puncture gently made with a lancet, or couching needle, and so as to admit of being immediately

* See Sir Benj. Brodie's Pathological and Surgical Obs. on Diseases of Joints. 3d ed. p. 5. 8vo. Lond. 1834.

afterwards covered with the integuments, may not be followed by any bad symptom whatever, more especially if care be taken to keep the joint quiet, and to employ antiphlogistic means. It is the knowledge of this fact, which encourages surgeons sometimes to cut into the knee-joint, either for the purpose of discharging fluid, or of extracting loose cartilaginous bodies, which, acting as extraneous substances, excite frequent attacks of pain, swelling, and lameness.

Exposure to cold is the most frequent cause of inflammation of the synovial membrane, and the knee, as being less covered by muscles, is more subject to the effect of atmospheric influence, than the hip or shoulder. Sir Benjamin Brodie observes, that the disease seldom attacks young children, becomes less rare as they approach the age of puberty, and is most frequent in adult persons. The disease begins with pain in the joint, which is generally most severe at one point, and attains its greatest height in a week or ten days. In a day or two after the commencement of the pain, the joint becomes swollen. At first the swelling arises altogether from a collection of fluid, which in the superficial joints may be felt to undulate. In time, however, the fluctuation is less manifest, because the synovial membrane is now thickened, or lymph is effused from its inner or outer surface. As the swelling in the early stage arises principally from the distension of the synovial membrane, its shape is very much regulated by the situation of the ligaments and tendons, which resist it in certain directions and allow it to take place in others. Thus, as Sir Benjamin Brodie has explained, in the knee, the swelling is chiefly on the anterior and lower part of the thigh, under the extensor muscles, where there is only a yielding cellular structure between these muscles and the bone. It is also considerable in the spaces between the ligament of the patella and the lateral ligaments. In the elbow, the main swelling is above the olecranon.

When, after the absorption of the fluid, and the subsidence of the principal swelling, the synovial membrane continues thickened, it sometimes happens, as Sir Benjamin Brodie observes, not only that a certain degree of inflammation lingers in the part, but ulceration may take place in the cartilages, suppuration ensue, and the articulating surfaces be completely destroyed.

The following statement from the same authority deserves attention: in syphilitic cases, it seldom happens that more than one or two joints are affected at the same time. In the early stage of syphilis, the inflammation is usually an accompaniment of a papular eruption or lichen; there is then but little pain; fluid is effused only in small quantity, and when this has been absorbed, the joint is restored as nearly as possible to its original condition. In the more advanced stages of syphilis, we find inflammation of the synovial membrane existing in combination with nodes; and then it is productive of much greater inconvenience, and is more difficult to cure; and the synovial membrane is left thickened, and the joint larger than natural, after the fluid has been dispersed. On the other hand, in rheumatism, several joints are mostly affected, either at the same time, or in succession; and the bursæ mucosæ and sheaths of tendons are often involved. There is usually a good deal of pain and swelling, and the joints are frequently left stiff and enlarged after the attack. When the inflammation is connected with gout, the pain is generally excessive, compared with the other symptoms.

The treatment of inflammation of the synovial membrane, varies according as it may be acute, or chronic, a local, or a constitutional affection.

In the acute and local form of the complaint, perfect quietude, leeches, venesection, repeated according to circumstances, saline purgatives, and diaphoretics, are required. If the skin be very tense, fomentations and poultices will be the best applications; but, otherwise, cold evaporating lotions.

In chronic cases, the taking away of blood from the part, by means of leeches, or cupping, quietude of the joint, and cold evaporating lotions, are the best early measures. Afterwards, when the inflammation has been in a great measure subdued, blisters become useful, either applied in succession, or kept open with savine cerate. In a still later stage, stimulating liniments, as the ointment of tartarized antimony, that of the hydriodate of potash, or camphorated mercurial ointment.

When patients are so far recovered, that they cannot be prevented from moving about, though the joint will not yet bear much exercise with impunity, its motions should be moderated by the application of circular straps of adhesive or soap-plaster, and a bandage, or it may be covered with a kind of cap made of leather, or other elastic materials, and laced, or buckled on the joint.

Amongst the means employed for the removal of the stiffness, and thickening of the soft parts, left after synovial inflammation, friction made by the hand with hair powder; the pumping of water, cold or warm, from a height of several feet; the vapour bath; and champooing; deserve to be mentioned.

When inflammation of the synovial membrane arises from rheumatism, and especially when several joints are attacked, local or general bleeding, followed by the exhibition of purgatives, pulv. ipec. comp., or the wine, or acetous extract of colchicum, will be the most successful means. When the inflammation affects only one or two joints, calomel combined with opium is the best medicine. There is also a case, which begins with acute inflammation of the periosteum of the femur, then involves the synovial membrane of the knee, and may advance to ulceration of the cartilages: this is an example, particularly pointed out as one demanding the exhibition of one or two grains of calomel, with a quarter, or half a grain of opium every six hours, to which also two grains of antimonial powder may sometimes be added.* In other cases, arising from syphilis, a well-regulated course of mercury is necessary; and when the disease has been excited by the abuse of that mineral, or is conjoined with disease of the bones and periosteum, the iodide of potassium with sarsaparilla may be prescribed.

### EXTRANEOUS, CARTILAGINOUS, OR OSSEOUS SUBSTANCES IN JOINTS,

Are more frequent in the knee than any other joint, but they occasionally present themselves in the elbow, ankle, and articulations of the lower jaw. It is only in the knee that they become objects of surgical attention. Sometimes they are quite detached from the synovial membrane; sometimes connected with it by a narrow pedicle. They have a glistening pearly lustre, and mostly consist of a cartilaginous substance, with osseous matter in its centre, and a firm capsule investing their outer surface. Sometimes the joint contains only one body of this description; sometimes as many as twenty or thirty. They are usually convex on one side, and concave on another, and more or less oblong. Sometimes they are not larger than a pea; in other instances, nearly equal in size to the knee-pan itself.

So long as these cartilaginous formations retain an attachment to some

* Cæsar Hawkins, in Med. Gaz. vol. xii. p. 652.

point of the articular cavity, and are thus kept in one situation, they give no inconvenience; nor even when loose, do they cause any annoyance, unless they happen to be pinched between the articular surfaces of the bones. When this occurs, the patient is suddenly seized with excruciating pain, and is immediately deprived of the use of the limb. These attacks are frequently followed by more or less inflammation of the synovial membrane, and effusion of fluid in the joint. The patient is then obliged to confine himself to his bed for a few days, till the tenderness and swelling subside, after which he returns to his usual occupations; but his knee remains weak, and attacks of the same kind returning from time to time, he finds it necessary to consult a surgeon.

With respect to the manner in which these moveable cartilages are produced, one explanation of it is, that they derive their origin from the synovial membrane, which, in consequence of inflammation, throws out fibrine, and this becoming organized, is at length converted into cartilage or bone. By degrees, however, it is more or less loosened by the movements of the joint, and often completely detached. When this has happened, the new cartilaginous formation never afterwards increases in size; but, by changing its situation, and getting between the condyles of the femur, and head of the tibia, in the motions of the joint, it causes severe pain and lameness. In France, an opinion prevails, that the new substance is first formed in the cellular tissue on the outside of the synovial membrane, or else between the fibres of the synovial membrane itself; that, in the former circumstance, this membrane is pushed inwards, and that a part of it constitutes the pedicle, which at length gives way, and leaves the new formation quite loose in the cavity of the joint. It is possible, however, as Cruveilhier thinks, that they may not always form in one manner; for, in one case, he found one loosely attached to the tibia, and under the synovial membrane. It is also generally admitted, that portions of the natural articular cartilages may sometimes be broken off.

In the majority of cases, met with by Sir Benjamin Brodie, no symptoms of inflammation preceded their formation, and hence, he believes, they are often generated like other tumours. "They appear (says he) to be situated originally either on the external surface, or in the substance of the synovial membrane, since, before they are detached, a thin layer of it may be traced upon them. He met with two cases, in which, from some morbid action, a bony ridge was formed, like an exostosis, round the margin of the cartilaginous surface of the joint, portions of which ridge broke off in the motions of the joint over them.

*Treatment.* Whether these substances should be taken out, or not, depends on two circumstances; first, on the degree of annoyance suffered by the patient; and, secondly, on his willingness to encounter an operation, when the risk of it has been fairly and correctly explained to him; for, it must not be dissembled, that some individuals who have submitted to the operation, have had severe inflammation of the joint brought on by it, and have lost their lives. They therefore sacrificed themselves to an experiment, made in the hope of being relieved from what is commonly a very endurable complaint. But, supposing a person were to be prevented from getting his bread by this disease, and were not only willing, but desirous to submit to the operation, after its danger had been rightly explained to him, and a bandage or laced knee-cap had failed to give him relief, then I should say, that the operation ought to be performed. I once attended a gentleman, who had a large cartilaginous substance loose in the cavity of the knee-joint, which prevented him from

following his affairs; he used to be attacked with inflammation of the synovial membrane every two or three weeks. I explained to him the risk attending the operation, but he chose to encounter it, and fortunately he got well without a single bad symptom. The cartilaginous formation was half as large as the patella, with one side convex, the other concave. In the operation, it is a good plan not to make the incisions through the skin and the synovial membrane exactly opposite one another. The integuments should be drawn to one side, and then cut through; and thus, when the integuments, with the synovial membrane, resume their natural place, the aperture in the latter texture will be closed. The situation, often considered most convenient for the operation, is over the internal condyle; here we may try to fix the foreign body, and after having exposed it, we are to take hold of it directly with a tenaculum, lest it slip away into another part of the joint, whence we may not be able to remove it so as to bring it out of the wound. As there is a risk of inflammation after the operation, it is always prudent, for two or three days before it is undertaken, to keep the patient in bed, or perfectly quiet in his room, to restrict him to a low diet, and to give him an aperient mixture. Above all things, we should never operate while the joint is at all hot, painful, or disposed to inflammation. If inflammation come on after the operation, we must trust to copious and repeated bleeding, leeches, mercury, purgatives, and cold applications. Supposing the cartilaginous substance were rather large, we ought not to force it through an insufficient opening in the synovial membrane; for this would be far more likely to bring on inflammation, than if we were to enlarge the wound. This should not, however, be made any larger than actually necessary, as the danger of wounds of the knee is in a great measure in proportion to their size.

### PULPY THICKENING OF THE SYNOVIAL MEMBRANE.

Another disease of the synovial membrane, called the *pulpy thickening of it*, is a disease generally reputed to be of a scrofulous nature. Not many years ago, many very different complaints were all confounded together under the name of *white swelling;* thus, chronic inflammation of the synovial membrane; a disease beginning with ulceration of the cartilages; a scrofulous disease, commencing in the heads of the bones; and this pulpy disease of the synovial membrane, were all jumbled together under the head of white swelling. The disease, which I now wish to describe, occurs chiefly in young persons, or individuals between the ages of sixteen and twenty-two or twenty-five; and is mostly met with only in the knee. At first, the pain is inconsiderable, merely amounting to a stiffness, accompanied by a slight swelling and rigidity. The disease, therefore, comes on slowly and insidiously. By degrees the swelling increases, and, on touching it with the finger, we find that it communicates a sensation as if it contained a fluid, there being considerable softness and elasticity about it. In time the joint is nearly destroyed. Yet the pain is not very severe; indeed, it occasions no great suffering till abscesses form in the synovial membrane, or on the outside of it. The disease may go on for several years without rendering amputation necessary; it is one of those tedious diseases, in which the patient lingers a long time without getting well, and yet without being reduced to such a state as absolutely to be obliged to submit to amputation. At last, however, the hectic symptoms become aggravated, and amputation is unavoidable. According to Sir Benjamin Brodie, who

first discriminated this case from other forms of disease classed as white swellings, it is incurable, inasmuch as it consists in a total disorganisation of the synovial membrane, which is converted into a brownish or lightish brown pulpy substance, varying from a quarter to half an inch or more in thickness. It is then an organic disease, and white lines may be seen crossing the pulpy substance in various directions. In its advanced stages, the cartilages, ligaments, and bones of the joint become diseased, or destroyed. Generally, the whole synovial membrane is changed in the manner described: but in a few instances only a portion of it is attacked. In the majority of cases, we may recognise this disease by the very gradual progress of the enlargement of the joint, the stiffness without pain, and the soft elastic feel of the tumour: — such are the characteristic marks of the pulpy thickening of the synovial membrane.

*Treatment.* Mr. Syme, who considers the disease not totally incurable, recommends quietude of the joint, which is to be maintained with the assistance of pasteboard or splints. This principle applies to all chronic diseases of the joints. He also puts the patient on a regimen calculated to improve his general health. If there be inflammation in the part, he attacks it by means of leeches, cupping, &c., and with the view of promoting the absorption of the pulpy substance into which the synovial membrane is converted, he recommends blistering the part, and the application of iodine preparations, or iodine with mercury, and the ointment of iodide of potassium.

Mr. Scott adopts a particular mode of dressing diseased joints: he surrounds the joint first with soap plaster, blended with mercurial ointment, over this he applies straps of emplastrum plumbi, and then common soap-plaster spread on thick leather. Whatever efficacy this method may possess is owing, I conceive, not to the mercury, nor to the particularity with which the dressings are put on, but to their effect in keeping the joint motionless. No doubt, the keeping of the joint motionless is one of the most important means in the treatment of the disease, and whether we adopt Mr. Scott's method, or use common splints, either plan will answer the same purpose. When there are abscesses, pasteboards or splints seem preferable to a mass of materials, which are to be removed only once a week, and under which a great deal of filthy discharge would accumulate.

### ULCERATION OF THE CARTILAGES.

Some diseases of the joints are alleged to begin in the cartilages.

*Ulceration of the cartilages* is more commonly noticed in adults, than the pulpy thickening of the synovial membrane. It is not very easy to discriminate the incipient stage of ulceration of the cartilages from chronic thickening of the synovial membrane. In the early stage, there is generally no enlargement of the joint, but, after the disease has made some progress, the synovial membrane begins to be inflamed, and the case is then accompanied by swelling. Generally, however, for the first few weeks, there is little or no swelling; nor is any serious degree of pain experienced in the beginning of the complaint, unless the joint be exercised. Certain other forms of disease in joints are seen, in which there is constant pain, whether the limb be moved or not. At night, however, some pain usually accompanies the present affection; and, after a time, the synovial membrane becomes affected, and then, in addition to the ulceration of the cartilages, there is an effusion of fluid in the joint, which adds considerably to the swelling, and occasions a fluctuation. The latter

circumstance may therefore be considered as sometimes constituting one of the symptoms of the disease. Almost all the surgical diseases of the joints have a tendency to terminate in suppuration and abscesses both within and without the synovial membrane, followed by fistulæ and sinuses, as well as caries of the bones; so that, unless we examine the disease in an early stage, we may not always be able to pronounce exactly in which texture it has commenced. When abscesses form in the disease now under our consideration, the matter collects in the synovial membrane, and also ultimately in the cellular tissue on the outside of the joint, frequently spreading to a great extent under the thickened integuments, and at length making its way out by one or several fistulous ulcerations.

Professor Cruveilhier * and Mr. Key believe, that inflammation of the synovial membrane is the most frequent cause of ulceration of the cartilages. Some of the cases to which the latter refers, prove the existence of a long-continued synovial affection, before any ulceration of the cartilaginous surface could have taken place; for, in them the cartilage was quite sound, with the exception of a slight loss of substance at the edge of the bone, where the synovial membrane was reflected from it, though the symptoms of diseased joint had existed for many months, with pain over a large part of the synovial surface, and general swelling of the joint. According to Mr. Key's investigations, the inner part of the knee-joint usually exhibits the most extensive ulceration, on account of the oblique bearing of the femur, and its unequal pressure on the inner part of the head of the tibia. Hence the inner semilunar cartilage is oftener destroyed than the outer one, and there is a corresponding destruction of the cartilage covering the inner condyle of the femur and inner part of the head of the tibia. The patella and extremity of the femur are stated by Mr. Key to be the parts on which the ulcerative process can be best traced, on account of the disease being less advanced in them. In the former bone, the part which first commonly ulcerates, is the margin of the cartilage where the synovial membrane is reflected from it. At this point, Mr. Key describes grooves of different depths as being formed, which cannot be always distinguished, until the thickened edge of the synovial membrane is raised. The ulcerated surface sometimes exhibits parallel vascular lines, verging towards the centre, and having their origin from the synovial membrane, which, if the vessels are well filled with fine injection, appears highly vascular and fringed, or villous, like a mucous membrane. This highly vascular fringe of membrane, described also by Cruveilhier, is a newly organised, and, as Mr. Key conceives, sometimes a superadded structure for the purpose of producing ulceration of the contiguous cartilage. When recently formed, some parts of it may be raised from the synovial membrane, but it adheres very slightly to that part of the cartilage where ulceration is going on: indeed, according to Mr. Key, this adhesion will not be perceived, unless the joint be opened with care. It seems, therefore, from these interesting researches, that the process, by which the ulceration of cartilage is here effected, is analogous to that by which the sequestrum of the cylindrical bones in necrosis takes place. The cartilage, indisposed to ulceration from the low degree of its organisation, is acted upon by the newly organised synovial surface, which is rendered highly vascular, and forms a groove in the edge of the cartilage, by means of its villous processes. We also learn from Mr. Key's investigations, that the granulations which sometimes

* Anatomie Pathologique, fol. livraison 6.

arise from the surface of the exposed bone, assist the membrane in the work of absorption. The formation of the vascular membrane frequently takes place without suppuration, as may be seen in strumous joints that have been the subject of chronic inflammation for years, without abscess having formed; and the inflammation is sometimes confined to one side of the joint.

The second mode, adverted to by Mr. Key, in which nature effects the ulceration of cartilage, without the agency of its own vessels, is exemplified, where suppuration follows acute inflammation, from a wound of the synovial membrane, which then undergoes a change, enabling it to perform its new function. Its surface becomes highly vascular, and, in most parts, covered with a new deposit of adhesive matter which is in many parts villous, or furnished with vascular fringed projections. In a joint, thus far advanced in disease, Mr. Key considers that the only mode of arresting the disorder, or of repairing the mischief, occasioned by inflammation, consists in the production of anchylosis. To this end, the removal of the cartilage is an essential step; and it would appear, that the office of removing it devolves on the inflamed synovial membrane. The absence of all action in the cartilage, and a total want of vascularity in those parts, where ulceration appears to be most active, were the circumstances which first led Mr. Key to look for some agent in the work of ulceration. The ulceration, as he explains, evidently begins on the surface of the cartilage, and not on that side next to the bone. It presents merely an eroded surface; there is no disorganisation of its texture in the parts where absorption is about to take place. The grooves are formed only in those parts of the cartilage, which happen to be opposed to the fringed and vascular synovial membrane. The removal of the cartilage, which is an impediment to anchylosis in many diseased conditions of joints, is what nature commonly aims at. In the most chronic form of strumous ulceration, the removal of the cartilage is accomplished, according to Mr. Key's researches, by the gradual development and organisation of the synovial membrane, where it is reflected from the edge of the cartilage. Where the process is required to be more rapid, a false membrane is effused from the edge of the synovial membrane, that gradually diffuses itself over the whole surface of the cartilage, and, by means of its increased vascularity, ulcerates the cartilage even to the bone, anastomosing often with the granulations of the exposed cancellous structure.

Another case, is where ulceration begins on the surface of cartilage attached to the bone. In examples of chronic disease in the cancellated structure, Mr. Key finds, that, when the cartilage begins to give way, vessels can be seen shooting towards it, and accumulating in sufficient number to form a vascular tissue, covering the attached surface of the cartilage. Afterwards, when the ulceration has proceeded through the cartilage, or nearly so, into the joint, the synovial membrane inflames, and the ulceration is then forwarded by a similar process, commencing at the edge of the cartilage, by means of the synovial membrane, and a newly developed vascular structure. In acute inflammation, attacking the spongy extremities of bones, the osseous substance is said by Mr. Key not to be softened, but to retain its firmness of texture, and exhibit no marks of disease, except at one part of the cancelli. Here a cavity is found, containing one or more portions of detached bone, surrounded with pus. This cavity communicates with the joint by a fistulous opening of small size. The process of ulceration evidently begins

on the outside of the joint, for the cartilage seems undermined, and its articular surface perfectly sound, while the synovial membrane itself is acutely inflamed, and its cavity has communications with one or more extensive collections of pus above and below the joint. These pathological researches, undertaken by Mr. Key, harmonising as they do with those of Cruveilheir on the same subject, seem to me to be well deserving of attention, and calculated to throw light on the difficult and obscure subject, of the theory of ulceration in general. From Sir Benjamin Brodie's work, I find that he was aware, many years ago, of some facts relative to this doctrine, which, however, he does not adopt.

The cartilage, covering the articular surface of a bone, being once destroyed, is reproduced with great difficulty: indeed, when cartilages are destroyed, and caries has attacked the subjacent bone, the disease must either terminate in anchylosis, which is, under such circumstances, the most favourable termination that can take place, or in a porcelainous or ivory-like deposit on the surface of the part from which the cartilage has been removed. In many instances, when the disease is in the knee, ankle, or elbow, hectic symptoms may begin even before suppuration commences, and especially when the disease is in the knee, though it rarely happens, that amputation is rendered necessary by the constitutional disturbance under such circumstances.

In the *treatment* of this form of disease of the joints, one obviously essential plan is, to keep them as quiet as possible; for every movement occasions a disturbance of the textures affected; and when the cartilages are ulcerated, friction of them must be particularly injurious. The treatment, then, consists in keeping the joint quiet, not only by making the patient observe the recumbent position, but also by the use of splints, or pasteboard, or by the method of strapping and bandages recommended by Mr. Scott. Another indication is, to endeavour to stop the morbid process, which, through the agency of the synovial membrane, and the new vascular substance developed from it, is occasioning the ulceration of the cartilage. For this purpose, experience has not furnished us with any means more effectual than counter-irritation by means of blisters, issues, moxa, or antimonial ointment. However, this observation is to be received with some degree of limitation; for in this, as well as in other diseases of the joints, there is often at first acute inflammation present, the part being painful and hotter than usual, from not having been kept quiet. Under these circumstances, it will be proper to employ common antiphlogistic means, previously to counter-irritation. On the Continent, and also in the surgical schools at Edinburgh, the cautery is sometimes recommended, as a means of producing counter-irritation, in the treatment of diseased joints; but in England surgeons rarely or never resort to it. Here we dislike heated irons as implements of surgery, which may be looked upon, perhaps, as mere prejudice, because no doubt is entertained of their frequent efficacy. They are, what the French term, *heroic* remedies. After the morbid action has been in some degree stopped, we may try other plans, such as pumping cold or warm water on the part from a height, as practised at some of the watering places. If the disease be arrested in time, the cure may take place without any material loss of cartilage, or consequent anchylosis, and after a period has been put to the disease, if there should still remain some uneasiness and weakness in the joint, we may try pumping water on the part from a height, or champooing, or mere friction with the hand or with hair-powder. Anchylosis, however, is the common termination of this disease, and with this view it

is, that nature takes away the cartilage. The application of steam to the part is a beneficial plan, where anchylosis can be avoided, for it promotes the restoration of the functions of the joint, and tends to obviate the stiffness, which is apt to continue a long while after the disease has stopped. Dr. O'Beirne has published several interesting cases, in order to prove the great usefulness of mercury in ulceration of the cartilages of joints. To scrofulous patients, labouring under this disease, he administers the infusion of sarsaparilla in lime-water, as the best medicine for preventing the injurious effects of mercury on their constitutions.*

### SCROFULOUS DISEASE OF JOINTS, BEGINNING IN THE BONES.

Another form of *disease* of the joints, is that in which the affection *begins in the cancellous texture* of the heads of the bones, often set down as *scrofulous.* All the joints are more or less liable to it; but the ankle, knee, and elbow, are those in which it occurs with particular frequency. When the knee is the part affected, there is considerable pain about the head of the tibia, or in the centre of the joint, followed by a general enlargement of it. In consequence of the swelling of the part, and a degree of emaciation, which takes place in the limb above and below the joint, it seems as if the heads of the bones were enlarged; but experience has proved that such is not really the case, and that the appearance depends on the emaciation of the leg and thigh, and the thickening of the synovial membrane and parts external to it. This scrofulous disease of joints is remarkable for the great length of time, during which the skin retains its natural colour; hence, indeed, the term *white swelling.* Ultimately, however, the skin becomes tense and shining, and streaked with dilated tortuous veins. In this stage, the joint will also generally be noticed to be above its natural temperature. Frequently before the disease has advanced to suppuration, the joint cannot be bent and extended, but becomes permanently fixed in one position. Thus, when the knee is affected, it becomes generally more or less bent, and cannot be straightened; frequently it is quite bent, and the patient has no power to change its position. In time, matter forms in the cavity of the joint, and makes its way by ulceration through the synovial membrane, or abscesses sometimes form on the ouside of the joint. Then the cartilages are destroyed, and several fistulous apertures take place about the knee, through which the matter is discharged. Sometimes sinuses occur, and run to a considerable distance from the joint under the fascia or between it and the skin. When a joint in this state is examined after amputation, besides ulceration of the cartilages, and inflammation and thickening of the synovial membrane and of the cellular tissue external to it, we find the heads of the bones softened and weakened in their texture, in which is deposited a soft substance, of a caseous yellow appearance, seemingly in the very tissue of the bone, the phosphate of lime being partly absorbed, and this new softer substance secreted in lieu of it. In many scrofulous bones, a considerble deposit of bony matter takes place on their outside, in very irregular forms, and sometimes in the shape of spiculæ or icicles. Whenever we amputate scrofulous joints, we mostly see these irregular bony deposits. They are, as I have said, sometimes very much like icicles, or stalactical processes, and very sharp.

This scrofulous affection of the heads of the bones is, perhaps, more

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* See Dublin Journ. of Med. Science, vol. v. p. 159.

difficult to cure than the generality of diseases of the joints, excepting the organic change, or pulpy thickening of the synovial membrane. The disorder, indeed, is connected with a scrofulous constitution, the rectifying of which is no easy task. However, this must be attempted by means, which will be described when I come to the subject of scrofula.

In the treatment of scrofulous disease of the joint, commencing in the heads of the bones, we are to keep the part perfectly motionless: this principle applies, as I have before observed, to all diseases of joints. The object is effected either by means of long straps of plaster, by Mr. Scott's plan, or by the use of splints. When there is a tendency in the limb to assume a posture, which would let it be of little use to the patient in case of anchylosis, we should endeavour to counteract such tendency with the aid of splints. In addition to these means, blisters should be applied to the joint, and kept open with savine ointment. Or we may employ the antimonial ointment, issues, moxa, and other counter-irritants, which form the common mode of practice. But whenever the joint is affected with a degree of acute inflammation, we should defer or discontinue the counter-irritants, and trust chiefly to quietude and antiphlogistic measures till the inflammation has subsided. When the diseased process has been arrested by the above methods judiciously put in practice, champooing may be had recourse to, or water allowed to fall upon the part in a column from a considerable height, which plan is to be persevered in for a certain time every day. It is always a rule in the treatment of this disease to open abscesses early, and when anchylosis is likely to take place, the joint should invariably be placed in the posture most likely to let the limb be of the greatest service to the patient.

### COXALGIA, OR SCROFULOUS DISEASE OF THE HIP JOINT,

Is generally supposed to commence in the cartilages; but this is, perhaps, rendered doubtful by the tenor of Mr. Key's investigations, whence it would seem that cartilage is not susceptible of any primary morbid change itself. Sir Benjamin Brodie's observations tend to prove, that in many cases, the cartilages are, at all events, affected in a very early stage. Mr. Key's dissections lead him to believe, that the ulceration of the cartilage is preceded by inflammation of the ligamentum teres. In one case, the ligamentum teres was found much thicker and more pulpy than usual from interstitial effusion; and the vessels upon its investing synovial membrane were distinct and large. At the root of the ligament, where it is attached to the head of the femur, a spot of ulceration of the cartilage was seen, commencing, as it does in other joints, by an extension of the vessels in the form of a membrane from the root of the vascular ligament. The same process was also taking place in the acetabulum, where the ligamentum teres is attached. That the synovial membrane of the hip-joint, and not the cartilage, is often primarily engaged in this disease, appears to Mr. Coulson deducible from one of the first symptoms which marks its commencement, viz., a fulness of the groin, depending, in all probability, upon the increased secretion into the joint, similar to what is known to take place in synovitis of the knee.* It is not to be supposed, however, that Sir Benjamin Brodie is unaware of the fact, that ulceration of the cartilages of joints is often preceded by synovial inflammation; on the contrary, he distinctly states, that he has known many cases in which

* W. Coulson, on Disease of the Hip-Joint, p. 32. 4to. Lond. 1837.

there was evident destruction of the cartilages of a joint by ulceration, manifestly arising from neglected inflammation of the synovial membrane. "When inflammation attacks the synovial membrane of the hip, there is (says he) an evident fulness of the groin, and, in some instances, of the nates also. The pain is aggravated when the patient stands erect, and allows the limb to hang without the foot resting on the ground. It is also increased by motion, but not by pressing the articular surfaces against each other, so that it does not prevent the weight of the body from being borne by the affected limb." Coxalgia is most commonly met with in children between the ages of seven and fourteen; though occasionally at an earlier, and also at a much later period of life. One of the first symptoms is pain about the knee-joint, and sometimes there is more uneasiness felt there, than in the hip-joint itself. The pain generally shoots downwards along the inside of the leg, as far as the instep. The pain is so much complained of in the knee, that nurses and careless practitioners often apply poultices to that joint, without even suspecting that the hip is the true seat of disease. If, however, the surgeon press upon the joint, anteriorly, or posteriorly, or grasp the foot and rotate the head of the femur against the acetabulum, the pain, thus excited, soon apprises him, that the real seat of disease is the hip. The next thing usually noticed is, that the patient feels weakness and stiffness in the joint, and cannot walk his usual distances without great fatigue, and uneasiness in the limb; in fact, he is soon observed to limp, and the limb to shrink and dwindle away. One remarkable symptom is, that the glutæus maximus muscle on the diseased side is much flattened, and its lower margin less prominent, than that of the corresponding muscle on the opposite side. Hence, when any doubt exists about the nature of the case, we should never omit to examine the posterior appearance of the pelvis and muscles attached to it; and then, if the disease be coxalgia, we shall observe that difference between the glutæi muscles which I have described, viz., the glutæus maximus on the diseased side will be flattened, and its lower margin, instead of being prominent and conspicuous, will be almost effaced. In the early stage, the patient inclines his thigh forwards, and, when in the same stage of the disorder, we examine the patient as he lies on his back, it appears as if the affected limb were longer than the other. If the patient stand up, we observe that he does not rest equally on both feet. The sound limb is extended, while the affected one is bent, the knee being lower than that of the opposite side, and the foot generally everted, though it is occasionally turned inwards.* At the present day, most surgeons ascribe the lengthened appearance of the limb to the position of the pelvis being altered; for, in order to save the limb as much as possible, the patient keeps it suspended, and the weight of it has the effect of drawing that side of the pelvis lower down than the opposite side. Therefore, when we examine the two limbs, in the recumbent position of the patient, the diseased limb appears the longest, because the acetabulum is lower than natural, and the posture of the pelvis oblique. This alteration in the position of the pelvis even affects the spinal column more or less; and, we find, that it is also more or less distorted by the efforts made to counterbalance the weight of the suspended limb. In addition to the change in the position of the pelvis, Mr. Coulson conceives, that the limb is really a little lengthened, or rather the trochanter major is slightly protruded. However, there is one resistance to such

* Coulson, Op. cit. p. 51.

protrusion, that has been adverted to only within a recent period. Weber proved by experiments, that it was not simply the muscles and ligaments, as was formerly supposed, which preserved the head of the femur in contact with the acetabulum; but that the acetabulum being closed by the head of the bone in an air-tight manner, the femur was held suspended by the atmospheric pressure. Hence, all the muscles and ligaments about the joint may be cut through without the weight of the leg causing the head of the femur to recede in the slightest degree from the acetabulum; whilst, on the contrary, when all the muscles and ligaments are left entire, the head of the bone will sink from three to four lines out of the acetabulum, if the atmospheric pressure be permitted to act on the upper surface of the head of the femur, through a hole bored from the inside of the pelvis into the joint. By careful measurement of the space between the anterior superior spine of the ilium and the external malleolus, Fricke ascertained, that in *apparent elongation* of the limb, there was always *real shortening*, which amounted to nearly the same extent as the apparent elongation.* In a few instances, the affected limb, even in the early stage, does not appear to be longer, but shorter than the other. The cause (as Sir Charles Bell remarks) is the same in both examples: the patient seeks the position of ease. "If the patient be taken due care of, and be put to bed early in the disease, the leg will be shorter; but, if the disease be of a more chronic nature, so that the person is permitted to go about, the leg will be longer; for, in walking with an inflamed hip, the weight of the body must be thrown on the other hip, in order to relieve the affected joint; and the patient dare not bring the diseased hip exactly under the centre of the body, but he pushes it forward, whilst he bears on the other limb. This gives rise to a curve in the spine; and the limb is longer, owing to the position of the pelvis, which is poised differently; the diseased side being depressed, instead of being elevated, as in the other case."† As the disease advances, pain begins to be felt about the trochanter major, and also in the groin, and the suffering is greatly increased by eversion or abduction of the limb, a fact, which Mr. Key dwells upon, as corroborating his belief, that the disease begins with inflammation of the ligamentum teres; for those movements cannot be endured in the early stage, though flexion and slight inversion cause no complaint. He also deems the pain, felt on pressing the head of the femur against the acetabulum, another proof of the disease beginning with inflammation of the ligamentum teres. In some cases, the disease does not advance to suppuration; the morbid changes cease; and a cure takes place, without the formation of any abscesses. Sometimes the disease terminates in anchylosis, also without suppuration. In other instances, abscesses form, and then the matter generally passes down behind and below the trochanter major, and often spreads to a great extent down the limb. Sometimes the abscess spreads upwards above the great trochanter, and around the pelvis. Such abscesses may burst in various places, and frequently there are several ulcerated openings, leading by fistulæ to the diseased hip. Sometimes the matter escapes by fistulous openings on the nates, or thigh; but, now and then, the acetabulum, becoming carious, an opening takes place through it, the matter thus finds its way into the pelvis, and, descending by the side of the rectum, bursts

* Many other ingenious remarks on this subject have been published by Dr. Gädechens, of Hamburgh; a translation of whose paper by Dr. Bigger is inserted in the Dublin Journ. of Med. Science, vol. xii. p. 409.

† Sir Charles Bell, in Med. Gaz. vol. xiv. p. 302.

near the anus. One memorable case is recorded by Sir Charles Bell, in which not only were the acetabulum and the head of the femur injured by the effects of caries, as usually happens, but, after the disease had advanced to a certain extent, the remains of the head and neck of the thigh-bone passed through the carious acetabulum into the pelvis. In two specimens in the museum of University College, a portion of the head of the femur projects into the pelvis, in consequence of the injured state of the acetabulum. In the second stage of this disease, the acetabulum is either widened, or parts of its brim destroyed, while the head of the femur is more or less diminished, and both the ligamentum teres and the synovial membrane are sometimes nearly annihilated. Hence, the most frequent cause of the shortening of the limb, in the second stage of the disease, a shortening, not dependent upon actual dislocation, which, however, sometimes occurs, as was the case in a patient under my care last spring (1839) in University College Hospital, and the specimen taken from whom is now preserved in the museum of the same college.* The head of the bone then is sometimes truly dislocated by the action of the muscles on the dorsum of the ilium. In rarer cases, the upper end of the femur is drawn downwards and inwards on the foramen ovale. In still less usual instances, the head of the femur is displaced forwards, and rests on the pubes. Sir B. Brodie, in one case, found the head of the bone out of the acetabulum, yet within the capsular ligament. Dislocation may take place very suddenly, the limb becoming, all at once, three or four inches shorter than natural, with the toes turned most frequently outwards, but sometimes inwards. The examples, in which the foot and knee are everted, are those in which the head of the femur is totally destroyed, or separated from the rest of the bone, and the shaft drawn upwards; but, when the head remains, and is not totally destroyed or separated, the toes are turned inwards, unless the dislocation be forwards. Mr. Wickham gives an instance, in which both hip-joints had been diseased, and in which the toes of each limb were turned out. This position he also regards as the invariable one, when a dislocation really happens; for in those cases, where the limb is inverted, he conceives that it is merely drawn across the other.† The view, which I have given, corresponds to that entertained by Sir Benjamin Brodie. In the advanced stage, attended with dislocation, the limb is not only sometimes shortened and turned either outwards, or inwards, but the thigh is considerably bent upon the pelvis. During these changes, the constitution suffers severely from hectic fever, and not unfrequently a fatal termination is the result. Carious disease of the hip-joint, attended with suppuration in the adult, is seldom cured. In a grown-up person, the prognosis is almost always unfavourable if abscesses take place; but children sometimes get through the disease, though suppuration be present. The degree of danger in these cases depends on several circumstances. First, on the extent of the disease in the bone; in some instances, which I have dissected, a considerable portion of the ossa innominata (and not merely the acetabulum and head of the thigh-bone) was diseased and carious. I have seen the os ilium extensively diseased; so that a great deal must depend on the question, how far the disease of the bones has reached. Secondly, much will depend on the size of the abscesses; when there is no suppuration, the danger is less considerable, and then even an adult may recover. It

* See London Med. Gaz. vol. ii. p. 255. New Series.

† On Diseases of the Joints, p. 160. 8vo. Winchester 1833.

is curious to find, that sometimes the case will advance to the stage of dislocation, though no abscesses have occurred. This happened in the remarkable case, which I have quoted from Mr. Wickham's publication. Thirdly, the degree of hectic disturbance influences the prognosis; and so does the age of the patient: because, if he be an adult, and abscesses take place, he will have but little chance of recovery. Many children who die of this disease, have pulmonary tubercles: I attended, with Sir Astley Cooper, a young lady at Walthamstow, who died with disease of the hip, and, on opening her chest, numerous tubercles were found in the lungs. Another patient of mine had a vast accumulation of serous fluid in the abdomen before death.

Dissection reveals appearances of the following kind: The synovial membrane and capsular ligament exhibit the effects of inflammation, being thickened, and occasionally perforated at various points. Frequently the synovial membrane is lined with fibrine, or filled with thick purulent matter. Sometimes it is converted into a gristly substance. In the progress of the disease, it is often completely destroyed. The ligamentum teres is ulcerated; but, in advanced cases, not a vestige of it may remain. The cartilages are abraded in some parts; and absorbed in others. "Sometimes that of the acetabulum is first affected; sometimes that of the femur; and sometimes ulceration begins in both at the same time. As the disease proceeds, these cartilages are completely destroyed, and occasionally replaced by an ivory, or almost vitreous deposit. Loose floating portions of cartilage are occasionally found in the joint after death. Cruveilhier relates a case, in which he found fifteen loose fragments of cartilage in the hip-joint. The cotyloid and transverse ligaments are generally destroyed.

"The socket is widened, and rendered shallow by this process; the bare surfaces of the bone become carious; and the head, and even the neck, of the femur is lessened. In scrofulous inflammation of bone, the earthy matter becomes absorbed, and the bone consequently softened; whilst the cancelli are filled with a yellow carious matter, or a transparent yellow fluid. But (according to Mr. Coulson), the striking feature in this kind of inflammation is the absence of all secretion, or deposit of bone; whereas, in simple inflammation, uninfluenced by the scrofulous diathesis, bone is secreted in abundance. Bony anchylosis in a scrofulous subject is very rare," &c. The head of the bone in scrofulous subjects is much softened.* In the museum of University College, however, we have several fine specimens of anchylosis, and also of bony deposit, after scrofulous disease of joints.

The matter of abscesses, formed in this disease, has frequently to take a long course to reach the surface; and hence sinuses of considerable extent are produced, leading to fistulous openings in the skin. Mr. Liston has a preparation, in which a sinus leads through the foramen ovale, and it was found to terminate in the rectum. Abscesses, produced within the joint, sometimes extend through the carious acetabulum into the cellular tissue of the pelvis. In one case, examined last winter in University College Hospital, this had happened; so that not only was the pelvis greatly occupied by pus, but some of the matter had descended into the upper part of the thigh, under the crural arch.

In the last stage, the acetabulum is sometimes filled up with a whitish organized substance, all distinction between synovial membrane, capsular

* See Coulson, Op. cit. p. 37—39.

ligament, cellular tissue, and this new substance, being lost: all being confounded together, and even the muscles altered in structure. In the acetabulum of the patient last referred to *, a fine specimen of a mass of organized fibrine was found: the preparation is now in the museum of University College. In some cases, the os innominatum is more extensively carious, than the head of the thigh-bone itself.

Sometimes, when the disease stops, anchylosis takes place between the femur and os innominatum, or the os ilium. In a few instances, a new joint is formed, and some degree of motion is allowed. In the museum of University College is the unique specimen of a new joint, formed by a globular or convex mass of new bone, thrown out at the side of the os ilium, and adapted to a cavity produced for its reception, at the inner side of the upper portion of the femur, all the head and neck of which are annihilated. The woman, from whom it was taken by one of my dressers, had a scrofulous abscess within the pelvis. This and various other facts lead me not to join in the doctrine, that scrofulous disease of bone cannot be attended with deposit of new bone.

The most essential part of the treatment consists in keeping the joint perfectly quiet: this principle is insisted on by all good practical surgeons. If the joint be moved, abscesses will form, and the disease take an unfavourable course. In the early stage, we may have recourse to cupping or leeches, poultices, and fomentations; and if the patient be a strong subject, or of rheumatic constitution, we may, after having cleared out the bowels, prescribe two grains of calomel with half a grain of opium, which are to be taken every night, until the mouth is slightly affected. But if these medicines prove of no service, the vinum colchici may be exhibited in doses of ʒss. When the inflammation has been moderated, a blister may be applied, and kept open, or several blisters repeated in succession; and, as soon as the disease has become still more chronic, the joint may be rubbed with iodine liniments, the ung. potassii iodidi, ung. hydrarg. fort. with ʒj of the iodide of potassium to each ℥j of the ointment, or with camphorated liniment, strengthened with ʒij of the tinct. canthar. to each ounce of it. With respect to an issue, seton, or the moxa, although these means are not so much confided in as they were formerly, I know from long experience, that when employed with judgment and discrimination, they often realise every expectation which can be reasonably entertained of the benefit, capable of being derived from counter-irritation, and the maintenance of a discharge from the neighbourhood of the affected joint. They are not, however, to be continued for an immoderate length of time, nor resorted to in very reduced states of the health, nor where abscesses have already formed, or fistulæ, from which a more or less profuse discharge is daily taking place. I have already insisted upon the great importance of keeping diseased joints in general strictly at rest. Here, as soon as the patient can bear mechanical contrivances for this purpose, we are to avail ourselves of them, and endeavour at the same time by their means to get the limb into as straight a position as can be done without occasioning pain. Mr. Scott's plan consists in cleansing the surface of the joint with a sponge, soft brown soap, and warm water, and then thoroughly drying it. The part is then rubbed with a sponge soaked in camphorated spirit of wine, and afterwards covered with cerate, made with equal parts of ceratum saponis and the ung. hydr. fort. c. camphora. This is thickly spread on large

* See London Med. Gaz. loco cit.

square pieces of lint, applied entirely round the joint, and supported with broad strips of the emplastrum plumbi. Over these strips is placed an additional covering of emplastrum saponis, spread on thick leather, and cut into four broad pieces, one for each side of the joint. Lastly, the whole is secured with a calico bandage, which is not to be applied so as to cause any uneasiness from pressure. If abscesses have formed, it does not appear that this method has the power of promoting the absorption of the pus; but, if fistulæ are present, the support of the above applications is alleged to prove beneficial.* The frequency of changing the dressings will depend upon the quantity of discharge. The principles of keeping the joint perfectly motionless, and the limb from inclining forwards, may be enforced by various mechanical contrivances, which consist either of leather splints, or cases of leather, or other materials, adapted correctly to the contour of the hip, nates, and thigh, and made to reach below the outer side of the knee, so as to maintain that joint also at rest.

In University College Hospital slips of patent lint, dipped in a solution of gum arabic, are sometimes employed by Mr. Liston, and laid upon the parts, which are first greased. Several layers of dry lint are added, and the whole is confined with a bandage. When the composition dries, a firm case is formed, which may be made to embrace the parts from the knee up to the false ribs. I have tried this plan with advantage; but, when the patient can afford to purchase an apparatus, I recommend one made of leather, as best adapted to private practice. In scrofulous subjects, mercurial alteratives, with the extract of conium, chalybeate medicines, with the iodide of potassium, sarsaparilla, or for children rhubarb and carbonate of soda, with tonics, are the best medicines. The diet is to be light, but nutritious, with or without wine or beer, according to circumstances. If abscesses have formed and burst, and the appetite is bad, a little wine or porter will often prove of great service.

After the disease has been checked, the patient should be taken out in a spring carriage or boat, for the benefit of the air; and, if possible, he should try what good may be derived from the sea-air, and warm salt-water bath. In the advanced stage of bad cases, the constitution becomes completely hectic; and, before death, there is often general anasarca. Differences of opinion exist on the question, whether abscesses, proceeding from a diseased hip, should be opened early or not: Sir Astley Cooper prefers not making an opening, until the matter has extended to some distance from the joint, where, he believes, that it may then be made, without being followed by so much irritation as at an earlier period. This advice merits consideration, as the more common plan is to open all abscesses near joints without delay.

After the disease of the hip seems cured, the patient should be very cautious; for I have attended some cases, where children, who had returned to school apparently well, on receiving a blow, or fall on the hip in play, were brought home again with a recurrence of the disease in an aggravated and fatal form.

Antiphlogistic measures, in the beginning, appear to be called for by Mr. Key's view of the probable commencement of the disease with inflammation of the ligamentum teres. Afterwards, when the inflammatory symptoms have been subdued, nothing is more beneficial, than the application of some mechanical contrivance for the purpose of preventing all motion of the hip-joint, and keeping the thigh from inclining forwards, which last object is

* See Coulson on Diseases of the Hip, p. 84. 4to. Lond. 1837.

often very difficult of execution, on account of the pain which the attempt is apt to produce. Generally, the aim can be accomplished only in a gentle and gradual manner. One of the best contrivances for hindering all motion of the hip is, as I have stated, a leather apparatus, lined with soft materials, provided with straps and buckles, accurately fitted to the nates and thigh. It should also be made long enough to keep the knee-joint in a perfectly quiet state. Together with this, or some other mechanical contrivance, for the foregoing purposes, counter-irritation may be tried, either by means of a blister, an issue, the antimonial ointment, or a seton. In the course of the disease, it sometimes happens that portions of dead bone exfoliate; but more frequently nothing of this kind takes place. A good situation for issues is just behind and below the trochanter major: here they are less inconvenient to the patient than elsewhere; the peas can be kept in well; and the discharge and counter-irritation, whether kept up by peas, or the occasional use of antimonial ointment or caustic, will have the best effect. The skin, immediately in front of the joint, has sometimes been selected for the situation of issues or setons; but the other is preferred by the generality of practitioners.

### ANCHYLOSIS

Is of two kinds, *complete* and *incomplete;* or, as it is sometimes expressed, *true* and *false.*

Complete or true anchylosis is that, in which the articular surfaces of the bones become firmly and inseparably connected together by osseous matter. When the cartilages of a joint are destroyed by ulceration, and the surfaces of the bones are carious, if we succeed in stopping the disease, the mobility of the joint will not generally be preserved, nor will the cartilages be reproduced; but the heads of the bones will be united together by osseous matter. True anchylosis, then, is, under such circumstances, scarcely to be regarded as a disease, but rather as the mode in which another disease terminates. The functions of the joint are permanently interrupted by it; but its completion denotes the cessation of all further morbid action. In coxalgia, if the cartilages and ligaments be destroyed in diseased joints, generally if attended with ulceration of cartilages and carious bones, and in scrofulous caries of the spine in particular, anchylosis is one of the most favourable terminations which can be hoped for. Now and then, however, coxalgia ends in the formation of a new joint, as already explained; and, occasionally, after the absorption of the cartilage, a substitute is obtained for it in the production of a substance, termed, on account of its hardness and smoothness, the *ivory*, or *porcellainous deposit.* In caries of the spine, the disease is never stopped till a complete and true anchylosis is established. This is the only mode of cure.

Whenever true anchylosis is expected to take place, or considered possible, the limb should be kept in that position which will afterwards be most useful.

True anchylosis is a consequence, however, very much to be apprehended from fractures near or extending into joints, or from other mechanical injuries bringing on inflammation and suppuration of the joints. Here the right principles, with the view to its prevention, are, in the first stage, to employ every thing calculated to lessen inflammation of the joint, as bleeding, leeches, calomel, cold evaporating lotions, and quietude of the part; and, in the second stage, after having thus kept down the inflammation a certain time, to let passive motion be gently resorted to every day.

In all mechanical injuries of, or near, the large joints, these principles are never to be neglected.

In the records of surgery, examples are described, in which all the joints of the body were anchylosed; and in the Hist. de l'Acad. des Sciences for 1716, is the case of a child, twenty-three months old, which was afflicted with universal anchylosis.

Generally speaking, there is a natural tendency to anchylosis in the joints of persons far advanced in age, in whom the vertebræ and heads and tubercles of the ribs are frequently all joined by osseous matter.

*False anchylosis* denotes any loss of, or vast interruption of, the motion of a joint from any causes short of ossification, or the connexion of the articular surfaces by firm bony deposit. Thus the swelling and thickening of the synovial membrane, and of other soft parts, after bruises, fractures, and sprains, and weakness and loss of tone in the muscles, may produce a degree of stiffness about a joint, amounting to what is termed an *incomplete* or *false anchylosis*. Here gentle passive motion, friction, champooing, the exposure of the joint to the vapour of hot water, the aspersion of the part with warm or cold water thrown upon it from a height, the use of stimulating or iodine liniments, and the support of a bandage, are the best means of relief.

Though anchylosis of the lower jaw is of rare occurrence, instances of it have been met with; one is mentioned by Eustachius, and another came under the notice of Cruveilhier. He has given an engraving of the skull; the anchylosis was in the right articulation of the lower jaw. The subject of it, an old woman, was not more than eight or nine years of age when the anchylosis formed, which happened from a blow on the side of the face. The section of the joint which is exhibited, shows that there was not merely a deposit of bony matter external to the joint, but that the condyle of the jaw and glenoid cavity of the temporal bone were actually consolidated into one solid mass. Notwithstanding the anchylosis, the patient contrived to masticate with tolerable facility, by pressing the food against the alveolary processes with her tongue. As for her speech, it was perfect; so that she managed to live to the age of eighty-nine with a great deal of comfort.

## INJURIES AND DISEASES OF TENDONS AND BURSÆ MUCOSÆ.

Some notice of these subjects will appropriately follow the account, that has now been given of the diseases of joints.

We know little about the pathological changes in tendons; but, it would appear from Mr. Key's investigations, that the reticular tissue, interposed between the tendinous fibres, is the medium by which the increased vascularity is produced in tendons which inflame and are about to ulcerate: or rather, I should say, a new vascular substance is developed, which becomes the organ by which the phenomena of ulceration are supposed to be chiefly effected.

The right principles in the treatment of divided tendons are well illustrated in the instance of *ruptured tendo Achillis*, an accident which takes place every now and then, in dancing, leaping, and other exercises, in which the muscles of the calf are put into violent action. It occurs chiefly in the male sex — seldom in females; and even when it happens in men, they are generally athletic and muscular subjects. At the mo-

ment of the tendon giving way, the patient feels a sensation as if he had been struck on the heel with the lash of a whip; and a noise is sometimes heard both by himself and the bystanders, as if a nut had been cracked under the heel of his shoe, or like the smack of a whip. If the part be now examined, a depression will be found in the situation where the tendon has given way, and the power of extending the foot will be considerably diminished, but not entirely lost; for the long flexors of the toes, the peronœi, and the tibialis posticus, yet enable the patient to extend his foot in a weak and imperfect degree. In the treatment, the first and most essential principle is to relax the mass of muscles forming the calf of the leg, and attached to the tendon. The gastrocnemius and soleus are relaxed by bending the leg upon the thigh, and extending the foot: this is the proper position; but it cannot be maintained without the aid of bandages or some kind of machinery. The apparatus invented by Monro, primus, whose tendo Achillis was inadvertently ruptured, consists of a slipper, to the heel of which is affixed a strap, which is buckled to another strap put round the limb a little below the knee, and the heel is kept drawn up towards the ham. This contrivance, which has the recommendation of great simplicity, completely answers, so far as the foot is concerned; but it is a thousand to one against our being provided with, or able to procure, such an apparatus when we are called in to a case of ruptured tendo Achillis; therefore we ought to be prepared to do what may be requisite, without any ready-made mechanical contrivance. Under such circumstances, after bending the knee and extending the foot, we may apply a longitudinal compress on each side the tendon, and then surround the ankle and tendon with a roller, applied in the form of the figure 8; next put a few turns of another roller below the knee, and let this bandage and that on the heel be connected together with a band placed along the back of the leg, by means of which band the foot is kept duly extended. In this manner, we shall experience no difficulty in keeping up the heel, and we need not use any particular contrivance for keeping the leg bent. If the patient be in bed, as he ought always to be for a few days at first, we direct him to keep the leg in the state of flexion; and when he gets up, we desire him to provide himself with a high-heeled shoe. The tendo Achillis generally unites firmly in from four to six weeks. Instances are on record (and Mr. Hunter's own case was one), in which the cure was effected without confinement at all, merely by keeping the foot extended, and letting the patient wear a high-heeled shoe.

With respect to *ganglions*, they are tumours connected with tendinous structures; and having very much the appearance of encysted swellings. They are filled with a fluid resembling white of egg, or calf's-foot jelly, their cysts being fibrous, and lined by a smooth membrane. On pressure, a ganglion feels remarkably hard, and destitute of elasticity. The tumour is generally fixed either to a tendon or to the fibrous sheath, or theca of a tendon; but sometimes what are called ganglions are actually collections of a glairy fluid within the fibrous sheaths themselves. Common ganglions are round, or globular; but sometimes oblong, which is chiefly exemplified when the collection of fluid is within the sheath. Some of these swellings about the wrist are so oblong, that a part of them may be felt on the palmar side of the annular ligament, and the rest higher up the limb on the wrist. Such ganglions form within the loose synovial membranes of the tendons. Ganglions are not usually attended with pain: they form slowly; and, in most cases, the only inconvenience experienced is a slight weakness of the muscles, or joint, whose action is

interfered with. The patient may have a slight weakness of the fingers, or of the wrist; but, although most ganglions form on the hand, or wrist, others occasionally present themselves on the instep. I have seen several examples of ganglions on the foot; and I lately had a patient in the hospital who had one upon the inner head of the gastrocnemius. Certain subjects appear to be very liable to them, especially after bruises or sprains; but, in common instances, no such causes can be assigned for their formation. I attended a girl, who had three of them, two of which formed during the treatment of the first. It is a disputed point, whether any ganglions are truly parts of new formation, that is, whether they are actually new productions or growths. I believe many of them are only collections of fluid in the fibrous sheaths of tendons, which are natural and original parts; but whether others of a more globular, prominent, circumscribed figure, are of the same character, merely enlargements of original parts, is undetermined. Mr. Key looks upon them as new structures, formed upon tendons, and capable of being produced by pressure, friction, or undue exercise of a part.* Instances occur, in which ganglions at the wrist are attended with pulsation, and the occasion of severe pain. In the Dictionary of Surgery, ed. 7., I have referred to one case of this kind, the particulars of which are detailed in the Edinburgh Medical and Surgical Journal. The wife of a prisoner in the Queen's Bench, who was under Mr. Callaway, consulted me for a pulsatory swelling at the wrist, which was found to be a ganglion, with the radial artery passing over it. On pressing even slightly on the tumour, violent pain in the arm was excited, followed by fainting. The reason of this will be quite intelligible from the following account of another case, communicated to me by Mr. Morton, of University College Hospital, who saw the above-mentioned woman with me:—

"January, 1838.—When dissecting the upper extremity of an old woman, we found a small elastic swelling under the skin, a little above the wrist, upon the front of the forearm, near to its radial border. The cyst was of the size of a common hazel nut. Upon its surface several of the filaments from the radial nerve were expanded, so as to form a mesh upon the swelling. The sac lay over, and received the radial artery into its posterior surface. When it was opened a quantity of glairy fluid, of a light straw-colour, escaped. The posterior, or deep-seated surface of the sac, was very irregular in its outline; but it was not connected with the sheaths of the tendons.

"The only difference in the two cases, it appears to me, is, that in the woman, at the Queen's Bench, the radial artery lies upon the tumour, which has grown up from behind it; whereas in the instance above-mentioned, the vessel lay behind the sac."

Although ganglions usually produce little pain or inconvenience, patients are generally very desirous to get rid of them; and few persons behold with indifference any disfigurement, infirmity, or imperfection, about their hands or feet. Ganglions may occasionally be dispersed by blistering, or rubbing them with liniments containing ammonia, iodine, camphor, or the tincture of cantharides. Many of them will also yield to firm pressure, made on them with a piece of lead and a roller. But after being lessened, they often return, and on this account, instead of the plans which I have specified, it has been proposed to rupture them; that is, to employ such pressure as will burst them, and squeeze the fluid into the

* Guy's Hospital Reports, vol. i. p. 415.

surrounding cellular tissue. When we can succeed in effecting this, either by striking the tumour with some obtuse body, such as the back of a book, or by compressing it against a bone with the thumbs, if it admits of it, the disease will generally be cured; for, after it is ruptured, if the pressure on it with lead or other compress be continued, the obliteration of the cavity, in which the fluid was collected, will be obliterated. Occasionally we cannot succeed in rupturing it at all, so strong is the texture of the fibrous cyst. Under these circumstances, we may puncture the cyst with a lancet or couching needle, introduced obliquely through the skin and the cyst, so as to let out the glairy fluid, or jelly-like substance, which it contains, after which steady and firm pressure is to be kept upon the part. I have treated many ganglions in this way with perfect success; and having seen no ill consequences from it, now commonly follow it. For the small tumours at the base of the palmar side of the fingers, Mr. Key deems the puncture the only remedy. This gentleman once punctured a ganglion, situated over the tendon of the trochlearis muscle, and the swelling did not return. In the writings of Mr. Abernethy, we find instances, in which tumours, supposed to have been ganglions, were converted by the irritation of setons into malignant and fatal diseases. Ganglions have been removed with the knife; but I think this practice would only be right when the swelling resisted all other means, was occasioning much greater annoyance than is commonly experienced, and had a shape and conformation that adapted it to such treatment.

*Bursæ mucosæ* are parts very liable to disease. They are membranous sacs, placed under tendons, or parts of the skin exposed to much pressure; and their use is to secrete a synovial fluid, which renders the surfaces, on which the tendons or integuments move, smooth and well qualified to facilitate the action of the muscles, and obviate the effects of friction. Sometimes, in consequence of sprains, bruises, pressure, or accidental inflammation, the cavity of a bursa becomes distended with a greater quantity of secretion than usual; it is therefore enlarged; and, in this state, a considerable degree of pain is experienced in the part; though, in many instances, the inflammation is of a more chronic character. This disease is often seen in the bursa, situated between the patella and the skin; but sometimes it takes place in the flexor tendons of the fingers, in that which is placed over the olecranon, or in that of the ball of the great toe. A curious case is related by Sir Benjamin Brodie, in which the bursa, situated between the latissimus dorsi and the lower angle of the scapula, was enlarged to the size of a man's head, in consequence of the disease now under consideration. The sacs of bursæ mucosæ, when inflamed, become considerably thickened; the fluid within them is sometimes clear, but, in other instances, turbid or even purulent; and occasionally it contains numerous granular bodies, which are compared to melon-seeds, both in respect to size and shape. Substances of this kind, however, are met with only when the disease has been of long standing. These swellings are very common on the patella, particularly in housemaids, who are employed a good deal in scouring rooms, in which occupation the pressure of the bursa against the floor has the effect of bringing on inflammation: hence the disease is sometimes called the *housemaid's knee.*

*Treatment.*—In the first stage of the disease, while acute inflammation prevails, and there is great tenderness, antiphlogistic measures should be employed, especially leeches, or even bleeding, cold applications, quietude

of the limb, and brisk aperient medicines. Afterwards, when the disease has become more chronic, we may try discutient lotions, particularly those which contain the muriate of ammonia, vinegar, and a proportion of alcohol; and in a still later stage, blisters, or liniments containing iodine, or the camphorated mercurial ointment. Sometimes the disease cannot be dispersed by the above plans, and this is especially the case when the tumour contains those small granular bodies, like melon-seeds, to which I have adverted. There is always considerable difficulty in getting rid of them when they are of long standing, and the parietes of the bursa are much thickened; under these circumstances, it is necessary to open the bursa, for the purpose of discharging the granular substances, and afterwards to excite such an inflammation in the cavity of the bursa as shall lead to its suppuration, granulation, and obliteration. If these processes can thus be brought on, without exciting too much inflammation in the surrounding textures, the disease will soon have a favourable conclusion. But, sometimes, though we open the bursa and discharge its contents, the necessary degree of inflammation does not ensue; the bursa continuing to discharge a glairy fluid, and the integuments to be from time to time attacked with troublesome and painful degrees of inflammation, sometimes of the erysipelatous kind. I had a case, in which I opened the bursa over the patella; but the disease continued to annoy the patient for a considerable time after the operation, so that I found it necessary to inject a solution of the nitrate of silver into the sac, in order to excite the requisite inflammation for its obliteration: this measure succeeded, and the patient soon got well. Some surgeons recommend the introduction of a tent or seton for this purpose. I should mention, that we ought not to open bursæ mucosæ without a real necessity for it; for we occasionally hear of cases in which patients lose their lives in consequence of the limb being attacked with phlegmonous erysipelas. There are examples in which it is even necessary to cut away a diseased bursa, it being converted into such an indurated mass that no common plans will cure it; and its size seriously interfering with the action of the joint. In University College Hospital (this summer, 1839) I cut away one from the front of a woman's knee, which was as large as an orange, and every where solid, excepting a small central point, at which there were a few cells filled with a synovial fluid. The preparation is in the museum of University College. The tumour was so intimately attached behind to the ligamentum patellæ, that some care was necessary to avoid wounding the joint. In some of these cases, Mr. Key finds a seton capable of dispersing the swelling.

There is a common and very painful swelling, familiarly called a *bunnion*, situated on the ball of the great toe, and ordinarily supposed to arise from a thickening of the bursa placed at the junction of the first phalanx of the great toe with the metatarsal bone; though from the statements of Mr. Key, which will be presently noticed, this does not appear to be in every instance the nature of the disease. The surrounding cellular tissue is much indurated, and, in some cases, the bones of the joint are involved; at all events, the disease is frequently conjoined with a distortion of the bones of the toe, which seem partially luxated. In consequence of the projection of the tumour, it is greatly exposed to irritation from the pressure of the patient's shoe, and from this cause it becomes the seat of repeated attacks of inflammation; indeed, few complaints are more distressing than an inflamed bunnion. We rarely find persons whose tarsal arch is flattened, that have the great toe in a line with the foot; and thus

the inner part of the joint forms an angular projection. It is this kind of deformity in the arch of the foot, and in the bearing of the great toe, that predisposes to bunnion. For the prevention of this consequence, Mr. Key adopts the following contrivance: — "The offending toe is placed in a separate compartment of the stocking, like the finger of a glove: this again is enclosed in a separate part of the shoe, which is contrived by fixing a piece of firm cow-leather in the sole of the shoe, so as to form a separate apartment for the toe. By these means, it is kept in a straight line with the foot, or parallel to its fellows; and the pressure against the inner side of the joint being removed, the joint acquires a sufficient degree of strength to enable it, in a few months, to dispense with the artificial support." Four or five years ago, Weedon of Hart Street made for a young lady, under my care in Bedford Place, an instrument, which fulfilled the above objects exceedingly well. The principles of treatment consist in the removal of pressure from the part, and, when inflammation is present, in keeping the foot perfectly quiet, with the limb in the horizontal posture, and in employing leeches, poultices, fomentations, and cathartic medicines. Warm applications generally answer better than cold ones; but if the former fail to afford ease, the latter may be tried.

One common plan is to cover a painful bunnion with soap plaster, spread on thick soft leather. The application, by keeping the skin in a pliant state, and protecting the part in some measure from the pressure of the shoe, gives partial relief; but, as Mr. Key observes, the plan does not reach the root of the evil. With this view, the inclination of the great toe must be corrected by mechanical means, made on the principles already explained.

In the dissection of a bunnion, the first effect of the pressure made by the edge of the base of the phalanx, is found by Mr. Key to be that of irritating the lateral ligament: if inflammation follows, it becomes thickened and painful, forming the bunnion. If inflammation is not excited, a series of small cavities or cysts are formed, in a manner analogous to ganglia, between the layers of the ligament. As soon as one of these cavities is obliterated, by inflammation, another is formed; and thus, by their successive formation, the effects of pressure are warded off. In some instances, the irritation extends as far as the bone, and a fungous growth takes place from the cartilage. So long as these cysts remain in the state here represented, but little inconvenience is experienced. The pressure of the shoe, however, is frequently followed by paroxysms of suffering, the part becoming the seat of inflammation, and unable to bear the slightest pressure, either from without or from the base of the phalanx, in progression; sometimes an abscess occurs on the most prominent point, and, as the matter is slow in discharging itself, the surgeon generally makes an opening. This proceeding is condemned by Mr. Key as likely to be followed by an extension of the inflammation into the joint and disease of the bone. He has known gangrene and death ensue from opening an inflamed and suppurating bunnion; and three or four instances of the same results have come under my own observation. I concur with Mr. Key, therefore, in the advice to let nature bring about the discharge of the abscess, after which the ulcer will often heal up, and the part lose its extreme sensibility.*

* See Mr. Aston Key's Obs. in Guy's Hospital Reports, vol. i.

## TUMOURS.

What is a tumour? This at first view, as Dr. Warren justly observes, seems an easy question to answer; but, on a little reflection, there is some difficulty in giving the reply. The most simple idea of a tumour is, that it is an unnatural enlargement in some part of the body. But, is this enlargement an increase of a natural part, or a new formation? John Hunter's definition represents a tumour to be "a circumscribed substance, produced by disease, and different in its nature and consistence from the surrounding parts."

I believe it to be most convenient to limit the surgical meaning of the word *tumour* to a swelling, that is strictly a *new production*, an *adventitious growth*, a *substance that did not constitute any portion of the original structure of the body.*

In proceeding through the subject of diseases of the bones, I described certain morbid formations which are comprised under the preceding definition, as, for instance, exostoses, and fibrous and medullary growths from the medullary membrane. In the account of cancer, fungus hæmatodes, and melanosis, I shall have also to notice tumours, which, at least in some of their forms, are regarded as new productions in the system, and not merely as changes of structure, or as augmentations in the bulk of original tissues, for they comprehend several of those formations which are denominated *heterologous*, and which a distinguished professor of morbid anatomy describes as consisting "in the presence of a solid or fluid substance, different from any of the solids or fluids which enter into the healthy composition of the body." Professor Carswell's definition will include, however, calculous and purulent deposits, which, though they are heterologous formations, it is advantageous not to arrange under the head of tumours. While some of the growths, which I regard as tumours, correspond to the foregoing definition in not being like any of the original tissues of the body, others bear more or less resemblance to some of its primitive structures. Tubercle, scirrhus, and melanosis, are examples of the first; adipous and cartilaginous swellings, of the second. In fact, as Andral says, with reference to such of these deposits as become organised, when once vessels are developed in the morbid product, or sanguineous currents are established in it, the amorphous mass begins to lose its homogeneous nature, and to assume some definite kind of texture. The anatomical elements may now take the arrangement of fibres, layers, coats, or of a net-work; and they may put on the appearance of any of the normal structures, excepting two—the muscular and nervous.

Our profession is under many obligations to the late Mr. Abernethy, for drawing its attention very particularly to the great difference between tumours of the above nature, and other swellings, which are merely alterations of natural structure, or sometimes only the consequence of the accumulation of blood, pus, or other fluid in parts, and which last cases in particular have no claim to be considered as tumours, under the principle of classification here suggested. This was, unquestionably, making a bold step out of all the confusion, in which this part of the pathology of surgery used formerly to be involved. Nobody can doubt that the distinction here laid down is a good one, and that all swellings of original parts, to which no new morbid tissue has been added, and which consist rather of alterations of natural structures, or of the accumulation of pus, blood, or other fluids in them, than of the growth of any adventitious substance, should not be confounded with tumours, in which the latter circumstance

is exemplified. The swellings of arteries, termed *aneurisms* the knotty enlargements of veins, called *varices*, and all tumours arising from accumulations of blood, pus, or serum, in natural cavities and tissues, as well as a multitude of other examples, in which the tumour or swelling does not strictly consist of a new formation, growing upon or amongst, or added to, the original parts and tissues of the body, should not be comprised in the classification.

If there were not some limitation assigned to the surgical meaning of the word *tumour*, every disease, whatever might be its nature, if accompanied by increased fulness, or enlargement of parts, would be arranged under this head, whether an aneurism, a phlegmon, a boil, a carbuncle, an abscess, or a dropsy. In truth, such is the miscellany, adopted in old works, and which should not be called an arrangement, but a chaos.

As, however, we find the new matter deposited not merely upon free surfaces, like those of serous or mucous membranes, or within the cells of the cellular tissue, but likewise in the molecular structure of organs, after the manner of nutrition, it is manifest, that, when original parts become enlarged in the latter way, the disease ought to rank as a tumour, according to the principle of an adventitious substance being added to their primitive tissues.

In practice, the discrimination of the different kinds of tumours from one another is frequently a difficult task. As an excellent surgeon observes, the difficulties arise from a number of causes; from the great variety of these diseases, which is such that the most experienced surgeon is often meeting with species that he has never before seen; from the resemblance, in external appearance, between tumours whose character is quite different; and from the want of an arrangement, which will enable him to view them in groups, instead of being compelled to consider them, as often happens, merely as individuals.*

Tumours, in general, have been divided into *sarcomatous* or *fleshy*, *osseous*, *osteosarcomatous*, and *encysted*; many of the latter being familiarly termed *wens*, and consisting generally of a more or less fluid or fatty substance in a globular cyst. By a *sarcomatous* tumour is meant one that is chiefly or entirely composed of a fatty, fibrous, medullary, fungous, or other substance of inferior hardness to bone, with, or without a cyst, which, when it exists, is merely condensed cellular tissue, not globular, like that of true encysted swelling, and of a different texture. The term *sarcomatous*, or *fleshy*, as applied to tumours generally having no resemblance to flesh, is objectionable; and perhaps its use will gradually cease, especially now that the subject is beginning to have important additional light thrown upon it by the meritorious labours of several pathologists of the present day.

An *encysted* tumour is composed of a regular cyst, or sac, filled with matters of very different kinds in different examples, which matters are commonly secreted by the cyst into its cavity. The contents are not always fluid, being sometimes of a pultaceous consistence, sometimes like horn or bone, and, in other instances, like adipous substance. Frequently the cysts are filled with a fluid resembling honey or white of egg; and

* Surgical Obs. on Tumours, with Cases and Operations, by John C. Warren, M.D., Professor of Anatomy and Surgery in Harvard University, and Surgeon of the Massachusetts General Hospital. 8vo. Lond. 1838. This work, for the present of a copy of which I beg here to return my best thanks to Dr. Warren, is replete with valuable cases, and practical remarks.

occasionally they contain melanotic matter, and even hair, or teeth. We also frequently meet with cysts, which serve as lodgments for hydatids.

Some *sarcomatous tumours* are encompassed likewise by a kind of cyst, by a dense cellular tissue, which yields, and becomes thicker and thicker as the tumour increases in size, and appears to form a sort of barrier between the new morbid formation and the healthy parts, so as to protect the latter in some degree from the extension of the diseased action to them.

Some *sarcomatous tumours* have no such limit, but extend in the direction in which there is the least resistance, and soon transmit their morbid action amongst the surrounding parts. Others have no tendency to communicate any diseased action to the rest of the body; but only become dangerous or annoying by their bulk and pressure. Some tumours grow rapidly, and prove troublesome in a few weeks or months; others remain for years without much change or inconvenience. Medullary tumours are often remarkable for the rapidity of their growth, particularly when they meet with little resistance from the neighbouring textures. The texture of some tumours bears more or less resemblance to that of the neighbouring parts; thus, fatty swellings frequently grow in situations where they are surrounded by the natural adipous tissue. Cartilaginous tumours are often produced within joints, where they become detached from the articular cartilages, and a cause of pain and lameness; and tumours of a cellular structure internally, and covered by a mucous tissue, frequently grow from the surface of mucous membranes. But, we are not to consider the resemblance of the substance of a tumour to the nearest tissues as an invariable principle; for many swellings not only have a different structure and appearance from those of the adjacent parts, from whose vessels they derive their supply of blood, but from every other healthy and natural tissue in the body; and, as I have mentioned, Hunter defined a tumour to consist of a substance different in its nature and consistence from the surrounding parts.

Mr. Abernethy not only proposed the restriction of the meaning of *tumour* to what is truly *a new* and *adventitious formation*, and not *simply a change* or *enlargement of an original tissue*, but he suggested the plan of naming every tumour according to its anatomical structure. Thus he first applied the term *medullary sarcoma* to what is also called *soft cancer*, *fungus hæmatodes*, or the *encephaloid tumour*. That, and some other names which he selected, may be appropriate enough, but fault may be found with others; and his nomenclature, however ingenious, has the defect of not being altogether consistent. Thus, as it was designed to be one founded upon the anatomical structure of tumours, the term *cancerous sarcoma* is not admissible. I should say, also, that as many kinds of tumours have vessels, the phrase *vascular sarcoma* is not well chosen to express only one species of the disease.

One fact, perfectly established, is, that some kinds of sarcoma are merely new formations, unconnected with any *malignant tendency*, or any thing particularly wrong in the constitution. Thus common adipous swellings only become troublesome by their size, weight, and pressure; but a scirrhus, a fungus hæmatodes, and, perhaps, a melanotic tumour, though this may be doubted, are malignant diseases. Certainly each and all of them, inclusive of melanosis, are associated with constitutional derangement or peculiarity, the precise nature of which may not indeed be known, but of the existence of which not a doubt can be entertained.

The distinction between *innocent* and *malignant tumours*, important as it is with reference to practice, and especially with reference to the propriety of operations, and the mode of performing them, is yet a subject involved in the greatest obscurity. Tumours, which in their regular progress destroy life, by the changes produced in the affected part, such as ulceration, bleeding, and sloughing, or by causing similar productions in other parts of the body, more particularly in important internal organs, or by both together, are considered to be *malignant;* and the occurrence of serious local and general symptoms, the development of new growths in other parts, and such constitutional suffering as leads to the suspicion that organs of consequence are involved in the affection, are generally set down as decided proofs of malignant character, and as insuperable objections to an operation. Yet, much caution is required in giving an opinion on the malignancy of some tumours. The *tuberculated sarcoma*, as it was called by Mr. Abernethy, is represented by him as a very malignant disease; yet, in one example of it, recorded by Mr. Lawrence, where the original tumour had a most threatening aspect, where several similar tumours presented themselves in other parts, and where the patient had been brought to the brink of the grave by constitutional disturbance, life was prolonged for many years by amputation.

Some of the new formations or deposits, constituting tumours, are organised and vascular; others are completely free from organisation, and are furnished with neither vessels nor nerves. They seem to be merely morbid products from the blood, only deposits produced in the manner of secretion, and frequently from a serous surface.

With respect to the origin of vascular tumours, we have little information that can be supported by demonstration, or even by arguments unexposed to disputation. It is a subject that was lately considered by Mr. Lawrence, in a paper read to the Medical and Chirurgical Society, in which he inquires into the mode wherein tumours originate and increase, and adverts to the three explanations usually offered of the phenomena: — 1. By the effusion of blood, and its coagulation, and the subsequent organisation of the coagulum. 2. By the effusion and organisation of coagulating lymph. 3. By chronic inflammation. Now, if these explanations were true, we should expect, with Mr. Lawrence, that tumours ought to pass through successive stages, and to present different appearances at different periods of their development. For instance, we ought to find them at first as masses of coagulated blood, or coagulating lymph, and then to observe various degrees of transition from those substances to the textures, which characterise the perfect growth. Observations, however, disclose nothing of this kind: tumours, in their earliest state and smallest size, have their peculiar structure as well marked as in their subsequent progress and full development. An adipous tumour, not exceeding the bulk of a pea, differs only in size from one as large as the head. Effusions of blood into the cellular texture, from external violence, are of daily occurrence; if they could become organised, and then form tumours, few persons would be without these productions, which would also be, from the first, as large as the extravasation. We see, however, that blood thus poured out, disappears by absorption, or irritates the surrounding parts, and causes suppuration, by which it is expelled.

The hypothesis of the formation of tumours by the effusion and organisation of blood, seems, indeed, to have little foundation; and, I think, we must agree with Mr. Lawrence, that no satisfactory proof exists

of blood becoming organised, when effused in wounds, bruises, or serous cavities, or aneurismal sacs.

The preparations in the College of Surgeons, put up by John Hunter himself to prove the extension of vessels into coagulated blood, are considered by many good judges as insufficient for that purpose; because coagulated blood, when effused, soon becomes surrounded by fibrine or coagulating lymph, into which vessels may shoot from those of the surface, out of which such fibrine has been effused. Thus, the coagulum and fibrine being blended together, the former may give a deceptive look of being itself vascular and organised.

The interstitial effusion of coagulating lymph in inflammation, is a thing noticed every day; the substance thus poured out is not formed into tumours, but is absorbed as the inflammation subsides, or its partial organisation causes the enlargement, or condensation, of the affected structure. Then none of the phenomena characteristic of inflammation commonly precede the formation of tumours, which arise insensibly, and often attain some size before the patient is aware of their existence. Besides, as is well observed by Mr. Lawrence, if the accounts given of the origin and growth of tumours were correct, the attempts to check their production by leeches, cold applications, and antiphlogistic treatment, would generally have more effect than we find to be the case. Such treatment has no influence over accidental productions, though sometimes employed with advantage in lessening swellings caused by changes of structure.

From all that is at present known respecting morbid growths in the animal body, it seems to me, that they generally commence at a point as it were, and that directly the nucleus of them has been produced, however small, they have a power of attaining afterwards a magnitude, only limited by their particular nature and character. The vessels, which first extended into their substance, or their cysts from the original vessels of the neighbouring parts, continue to deposit or secrete additional matter, and, as the tumour enlarges, the vessels also enlarge, and shoot into it wherever an increased quantity of an organised substance is about to form. How this process begins, however, and from what cause it originates, we do not know.

The best pathologists are then in a state of ignorance, respecting the circumstances which determine the production of tumours in general, or of any particular variety of them. No more is known about these aberrations of nutrition, than of the mode in which this function is accomplished in its natural or normal state. In order to arrive at as correct a diagnosis as practicable, we should follow Dr. Warren's advice, and begin with acquiring the history of the origin and progress of a tumour, its influence on the part where it is situated, and on the whole system. Then the *figure* of the tumour should be well considered. Certain species of tumour assume particular forms: the steatoma, for example, is commonly rounded, and encysted tumours always have this form. Bony tumours, and those of the complicated glands, are often irregular; and so is a medullary tumour, after it has attained a certain size. The *connexions* of a tumour — its *extent* — its *moveable* or *fixed character*, are all important points to be attended to; and, as Dr. Warren observes, the extent of the part, beyond the reach of the senses of touch and vision, may implicate the most important structures and cause the greatest embarrassment. The *consistence* is another source of information; for it often apprises us of a tumour being malignant, either a schirrus, or a

medullary disease, or some other kind. The *colour* in certain tumours conveys also information. The purple colour of tumours, composed of a substance compared to erectile tissue, is universally known. The darkish red colour assumed by medullary tumours, or fungus hæmatodes, in an advanced stage, is well known to every surgeon; and so is the brownish red discolouration of the integuments often covering a scirrhous tumour. Sometimes, however, a tumour quite free from malignancy, presents a red or purplish appearance from an accidental inflammation of the skin that covers it.

*Pulsation, vibration,* and *undulation* are other characters, affording valuable instruction.* The first two indicate that the tumour is either affected by the pulsation of a contiguous artery, or that it is an aneurism, or else a tumour consisting of vascular erectile tissue, or of the nature of certain swellings spoken of in the remarks on "Diseases of Bones." *Undulation* informs us, of course, that the tumour contains at all events a quantity of fluid, though the rest of it may be more or less solid.

*Adipous sarcoma,* or the *fatty* tumour, is the most common of all these new formations. In its appearance and structure, it has a near resemblance to the subcutaneous fat, but is of a somewhat deeper yellow colour, less granular, and more compact. It is always covered by a thin capsule, formed by the simple condensation of the surrounding cellular tissue, and having a close attachment to the mass itself, by means of small vessels; though, unless the swelling has been inflamed, the connexion to external parts is but slight. It is in consequence of these circumstances, that adipous tumours admit of removal with considerable facility, and, after a sufficient division of the skin, and other textures covering them, the diseased mass may be readily detached from the surrounding parts, sometimes with the fingers, and always without any troublesome dissection.

We frequently observe these fatty growths in persons, in whose constitutions no particular defect can be discovered; and sometimes they occur, not merely in one situation, but in several, though the individual may be in other respects perfectly healthy. They are generally attended with little or no uneasiness, and are characterised by a soft doughy feel, or one as if they were filled with wool. They have less disposition than many other tumours to become dangerous by changing into any malignant form of disease; and whatever pain and inconvenience they may produce, are the result of their weight, pressure, and magnitude; for adipous sarcoma is generally inclined to grow to a larger size, than any other solid kind of tumour met with in the human body. I have seen one or two examples which weighed nearly fifty pounds, and larger ones are upon record. In some persons, they are caused by pressure. I have removed several from the upper part of the deltoid muscle in females, occasioned by the pressure of their dress; a case also noticed by Professor Warren.

They are sometimes the seat of uneasy sensations, and they occasionally interfere more or less with the free action of the neighbouring muscles; but, they are rarely the nidus of any scirrhous or medullary deposit; one or two such occurrences are alluded to by Sir Benjamin Brodie: they are exceedingly uncommon.

Now, when it is recollected, that the operation for the removal of an

* See Warren on Tumours, p. 9.

adipous swelling of immense size may prove fatal from the unavoidable extent of the wound; when we also remember, that we have no means of dispersing a fatty swelling, which, if left to itself, is sure to acquire considerable magnitude; and that when of immoderate size it is apt to become closely adherent to fasciæ, and even to the capsular ligaments of important joints, so as to render its complete removal difficult,— we must see the prudence of always taking away an adipous sarcoma, while it is small and but loosely attached to the surrounding parts. An adipous swelling does not, like a malignant tumour, require the free removal of the adjacent textures.

*Pancreatic sarcoma*, so named by Mr. Abernethy, from a degree of resemblance in its structure to that of the pancreas, is rather an uncommon disease, and scarcely any unequivocal specimen of it has been preserved in the museums of the metropolis. One was exhibited a few winters ago to the Medical and Chirurgical Society, as a rarity, and even that was considered by some gentlemen present as having much the appearance of ordinary scirrhus. Mr. Abernethy represents pancreatic sarcoma as occurring sometimes near the nipple, and sometimes in the lymphatic glands on the mylo-hyoideus muscle, and as an irritable and excessively painful affection.

It has also been met with close to the parotid gland, or under the jaw close to the sub-maxillary gland. Pancreatic sarcoma is loosely connected with the surrounding parts, and therefore very moveable; a character in which it is said to differ from scirrhus, though we know that scirrhus, in its early stage, is frequently as moveable as any other kind of swelling. In some cases, recorded by Mr. Lawrence, the disease was free from pain and malignancy, and effectually cured by operation. The pancreatic sarcoma, which Professor Carswell arranges in his Illustrations of the Elementary Forms of Disease as a species of cancer, does not at all correspond to the disease noticed by Mr. Lawrence; and, as a foundation for classing the disease with cancer, he refers to its disposition to terminate in the gradual destruction, or transformation of the tissues affected, its tendency to affect several organs in the same individual, and its reproductive character.

Another species of sarcoma, described by Mr. Abernethy, is the *mammary*, from the likeness of its structure to that of the mammary gland. It appears to be malignant, communicating to the surrounding parts a disposition to disease, and requiring the same free removal of them in an operation, as a scirrhus, of which I suspect that it is only a modification. In corroboration of this opinion, I may observe, that Professor Carswell, in his invaluable Illustrations of the Elementary Forms of Disease, actually arranges mammary sarcoma as a species of cancer.

The *tuberculated sarcoma*, consisting of numerous firm globular swellings of various sizes and colours, connected together by cellular tissue, advances to ulceration, is a malignant disease, and ultimately proves fatal. It is questionable, I think, whether this form of sarcoma is essentially different from scirrhus, which, we know, has its varieties.

A species of sarcoma, with which surgeons have long been familiar, is described under the name of *cellular tumour*, consisting of a fleshy mass, elastic, and almost fluctuating to the touch; tough, fibrous, and chiefly composed of condensed cellular tissue free from fat, the fluid in the cells being like that of the common cellular membrane.

Between the cellular tumour and the enormous swelling, in which the

male organs of generation are sometimes involved, Mr. Lawrence conceives that there is this distinction,—the former is a new production, the latter merely an enlargement of the cellular and cutaneous tissues by interstitial deposit, and curable by extirpation.

The *fibro-cartilaginous tumour* is another variety of sarcoma, not unfrequently met with about the head, neck, and axilla; and sometimes near the mammary or parotid gland. It differs from scirrhus in having nothing malignant in its nature; the only inconvenience is what results from its pressure and size.

I removed a fibro-cartilaginous swelling from the occiput of a blacksmith at Halliford, which had been stationary and free from pain for many years, but at length began to enlarge and cause severe annoyance. It was as large as an orange; and the patient was induced to have it removed, in consequence of his suspicion that a difficulty of swallowing, which he laboured under, was dependent upon it. The latter affection ultimately proved fatal, and, on opening him, a stricture of the œsophagus was found, with two considerable sacs extending from the tube above the obstruction, in one of which were two orange pips.

The *painful subcutaneous tumour or tubercle*, although of small size, and free from malignant action, is attended with most excruciating pain, and generally situated in the subcutaneous cellular tissue, but sometimes in that which is between muscles. One tumour of this kind, removed by Mr. Liston, lay so deeply, that it was in contact with the posterior tibial nerve. The tumour is usually of the size of a pea, and seldom larger than a cherry. Ordinarily, it does not cause any external tumour, or any rising of the skin, unless situated on a superficial bone; the skin is loose and moveable over it, and its structure is almost like cartilage. The reason of its causing the extraordinary degree of pain by which it is characterised, has been ascribed by some pathologists, amongst whom is the celebrated Camper, to its connexion with the twigs of the subcutaneous nerves. One preparation in Mr. Liston's collection clearly exhibits such an arrangement, which, however, is contrary to what Sir Astley Cooper and Baron Dupuytren have noticed in their dissections.

Camper's opinion that the tumour depends upon a diseased enlargement of a portion of a subcutaneous nerve, is that to which Mr. Wood himself inclines, though he thinks it very desirable that additional minute and accurate examinations of the tubercles and surrounding parts should be made, with the view of ascertaining, if possible, whether the diseased alteration of structure takes place on the neurilema or within it, or whether it may have originated in the contiguous textures, and become afterwards connected with the nerve. In those painful tubercles which he had an opportunity of examining, he found only a firm, whitish, homogeneous body, of a fibro-cartilaginous appearance, without being able to say whether it was included between the nervous fibrils or not, or whether it was even positively connected with them.

The pain comes on periodically, and shoots extensively through the limb. The slightest pressure causes the most excruciating torment; and such is the agony sometimes excited by the action of the muscles, that the use of the limb is entirely lost. The disease is more common in the limbs, particularly the lower ones, than other parts. I have never seen an instance, in which a painful subcutaneous tubercle suppurated; but, according to Dr. Warren, it may, after a time, inflame, the skin over it ulcerate, and a foul acrid discharge take place. Then, the lymphatic glands between it and the trunk become swollen, constitutional disturb-

ance ensues, and the disease may prove fatal.* There is only one right and effectual treatment, namely, excision.

*Nævi, and tumours termed aneurisms by anastomosis.* Certain natural textures in the body are, in the ordinary state, flaccid, but admit of being rendered turgid and firm at particular periods, when injected with blood. This kind of structure is exemplified in the penis, clitoris, and nipple; and by anatomists it is termed the *erectile tissue.* Baron Dupuytren compares the tumours, which usually go under the name of *nævi*, to a *morbid erectile tissue;* and, so far as I can judge, there is a sufficient resemblance between the natural tissues of this kind, and the structure of nævi, to justify the comparison.

Under the head of morbid erectile tissues may be arranged,

1. The superficial nævus.
2. The subcutaneous nævus, and aneurism by anastomosis.

*Superficial nævi*, or *nævi materni*, as they are called, signifying those congenital tumours, spots, or imperfections and peculiarities in the appearance and texture of parts of the skin, which are vulgarly supposed to arise from some influence of the mother's mind upon the fœtus, as when during her pregnancy she *longs* for various delicacies and fruits, which she is not able to procure, or, at all events, which she cannot obtain so quickly as she desires; or when, perhaps, during her pregnancy, she is terribly frightened at the sight of a spider, mouse, or some other animal. Under these circumstances, whatever cutaneous mark the infant is born with, is imputed to such disaster. As a proof of the truth of the connexion of nævi with such longings or frights, a strong resemblance is often fancied between these maternal spots and the objects of desire or alarm. Thus some nævi with a granular surface are compared to strawberries, mulberries, or raspberries, and are supposed to become particularly red and conspicuous when those fruits are in season. Others have a reticulated appearance, produced by the ramifications of minute vessels on their surface, and being thought to resemble a cobweb, are named *spider's nævi;* then other congenital blemishes of the skin, on account of their peculiar red colour, are called *claret marks.* Another form of nævus is familiarly known, receiving the name of a *mole*, in consequence of its brown colour, and the long hairs growing upon it. Objects of this kind always present an opportunity for a flight of the imagination, and for the invention of comparisons and names.

These superficial nævi frequently continue stationary during life, and neither increase in size, nor cause any inconvenience; but sometimes, in consequence of their happening to be situated on the face or neck, they cause considerable disfigurement, and, with the view of removing or lessening it, the excision or removal of the blemish with caustic, or vaccine lymph, may be undertaken, if desired.

Examples do occur, however, in which these maternal spots assume, after birth, a disposition to grow, and even to acquire considerable size. In this circumstance it is prudent to recommend their extirpation with the knife, the nitrate of silver, ligature, or caustic potash, according to circumstances. Very superficial ones are easily cured with nitrate of silver and pressure; or by inserting vaccine lymph in them, or touching them with nitric acid or a strong solution of nitrate of silver, or rubbing them with this substance.

*Of subcutaneous nævi, and aneurism by anastomosis.* With respect to

* See Warren on Tumours, p. 60.

these tumours, probably they differ from the more superficial kinds of cutaneous nævi in being new formations, and not merely changes of structure. Between aneurisms by anastomosis and subcutaneous nævi, I can discern no essential difference. Their nature and texture are alike; and, though the subcutaneous nævus communicates no pulsatory feel, while the aneurism by anastomosis does, this is to be referred to the latter often forming an external tumour; a projection above the level of the skin — while the subcutaneous nævus is more flat and concealed. As for the proposed distinction, between aneurism by anastomosis and nævus, founded upon the supposition, that the former disease consists of an enlargement and growth of the small arteries, and the latter of similar changes in the venous capillaries, it must be abandoned; first, because there is no proof of the alleged circumstances, and secondly, because the blood, which gushes so profusely from nævi, when they are wounded, is of a bright scarlet colour, and manifestly arterial. The aneurism by anastomosis, which is more or less raised above the level of the skin, is in fact a morbid growth — a new production. Its colour is generally bluish, or livid, and, on careful examination, a pulsatory motion, corresponding to the action of the heart, or, at all events, a vibration, may be felt in it. Sometimes, the skin retains its natural colour. I once made an exploratory puncture in a tumour of this kind on a child's back at Sunbury, the integuments being quite free from discolouration, and no vibratory feel being perceptible until the child felt the pain of the incision: the rapid bleeding immediately apprised me of the nature of the disease, and I immediately closed the wound, which healed by the first intention. When compressed, it becomes smaller; but any thing, that quickens the circulation, always makes it more prominent and turgid. Frequently it is a congenital disease, being small and hardly perceptible at the time of birth, and remaining stationary until puberty, when it may begin to enlarge with rapidity. It has been known to follow external violence, and Professor Warren relates one case, where the disease followed a cut, which had been caused by the blow of a stone on the right side of the occipital region. After it has acquired a certain size, it sometimes bursts, and bleeds dangerously. In females, the discharge of blood is most disposed to happen at the menstrual periods, and even to supply the place of the uterine evacuation.

The parts of the body, in which the disease, improperly named *aneurism by anastomosis*, is most frequently seen, are the scalp, face, upper part of the trunk, and sometimes the hands and feet.

John Bell has described it as a tumour, consisting of a congeries of active vessels, and he states, that the cellular tissue, through which these vessels are distributed, resembles the cellular structure of the penis, the gills of a turkey-cock, or the substance of the placenta, spleen, or womb. In short, his comparison is nearly the same as that made by Dupuytren, namely, to the *erectile tissues*. The aneurism by anastomosis, and the larger subcutaneous nævi, are occasionally represented as containing cells, which are filled with blood, and have a direct communication with the blood-vessels. This is yet an unsettled point; for what appears to some persons to be cells, is thought by others to be the orifices of blood-vessels, who, of course, regard the disease as an aggregation of such vessels, ramifying and combining into a tumour. At all events, it is an adventitious growth, — a new formation — full of vessels — abounding in blood — and, when cut, exhibiting such a disposition to bleed profusely and ungovernably, as is perhaps not seen in an equal degree in any other disease that

can be specified. The erectile tumour, or structure, is sometimes blended with medullary or scirrhous cancer.

Whatever plan of treatment be selected for subcutaneous nævi and aneurism by anastomosis, should be regulated by the principle of not endangering life by hemorrhage.

Supposing therefore it is decided to perform the excision of a nævus, we ought to adhere to the rule laid down by Mr. John Bell, "not to cut into the tumour but to cut it out." If we were to cut into the disease, we should sometimes have so profuse a bleeding, that the patient would die under our hands. The blood might gush out in such a torrent, as would destroy a child in two or three minutes. Besides, as it is absolutely necessary to cut the whole of the diseased texture away, without leaving any part of it behind, we should gain no advantage by opening the swelling. The whole must be taken away, or what is left will continue to grow. Hence it is a rule in practice, to make the incisions for the removal of a nævus in the surrounding healthy parts, at some little distance from the circumference of the disease, and then to cut deeply under its base. But, when a nævus is large, excision, even performed with these precautions, is not free from danger, on the score of hemorrhage. Several cases are recorded, in which the operation led to so sudden and profuse a gush of blood, that life was extinct in a few minutes. Such an accident happened in Mr. Wardrop's practice, who with his usual candour has recorded the fact himself. The patient was a child, and the nævus large. On examination, a vessel equal in diameter to a quill, was found to have been divided. Indeed we may form some conception of the disposition to hemorrhage attending this disease, when I state, that I have seen Mr. Lawrence, with the view of curing a growing nævus on one of the fingers, divide every part of the finger, except the periosteum and bone, and yet the vessels on the distal side of the cut bled most profusely; and this notwithstanding the radial and ulnar arteries had both been previously tied by my friend Mr. Hodgson.

Instead of the knife, therefore, other means of curing nævi have been suggested. One of these consists in passing two double ligatures through the centre of the base of the swelling, at right angles with one another, and tying the part by quarters, as it were, so as to include the whole base in the eight threads. For the purpose of making the action of the ligatures extend more widely, so as to embrace tumours having a broad base, long pins are sometimes passed under the swelling, and the ligatures then twisted round their ends, as originally practised, I believe, by my friend Mr. Keate. Sometimes, with the view of lessening the disfigurement, and rendering the action of the ligatures more effectual, Mr. Liston first raises the skin from the surface of the swelling, in order to preserve it, and then applies the long pins and ligatures.

Another plan consists in taking up the principal artery, or arteries leading to the disease. This plan sometimes answers; but more frequently it produces only partial, or temporary relief. The ligature of the carotid for aneurism by anastomosis situated in the orbit, or other parts of the face and head, answered completely in the practice of Travers, Dalrymple, and Warren: in that of Dupuytren, it did not cure the disease, though it put a stop to its increase.

A fourth plan consists in destroying the tumour with caustic potassa. And a fifth is founded on the principle of producing a total change in the texture of the swelling by exciting inflammation in it with pressure,

caustic, or stimulating applications, or by the introduction of a small quantity of the nitrate of silver solution into the morbid tissue. Vaccination is useful for superficial nævi on the same principle. Breaking up their texture with a fine couching needle, or exciting the adhesive inflammation in it by transfixion with pins, has also been done with success. Professor Gibson mentions an example of spontaneous cure, brought on by an accidental inflammation consequent to fever.

*Polypi* constitute another class of tumours, growing from mucous membranes, or, if not growing from them, at all events covered by them. In this place it is only necessary to notice their general characters, and the principles of treatment. They are of two kinds, viz. the *soft gelatinous* polypus, and the *fleshy*, or *fibrous* polypus. As for what are termed *malignant* polypi, they should not be regarded as polypi at all, because they partake in reality of the nature of medullary cancer, and sometimes, perhaps, of scirrhous cancer.

The ordinary soft polypus, such as most frequently grows from the mucous membrane of the nose, is of a light yellowish, or grey colour, not disposed to bleed profusely when injured, and not very sensible. It has no tendency to become malignant, and whatever inconvenience attends it, arises from its pressure and size. It generally has a narrow neck, and often a pyriform shape, though when the swelling is large, its figure is chiefly determined by that of the cavity in which it grows.

*Fleshy* polypi, which are firmer than the preceding, and of a fibrous structure, more commonly grow under the lining of or in the substance of the uterus, than from the mucous membrane of the nose.

The treatment of soft and fleshy polypi consists in extracting them with forceps, as is usually done for those of the nose; or by tying their neck with a ligature, or dividing it with scissors, as is more frequently practised for those which grow from the uterus. Malignant polypi admit of no operation.

*Warts* are excrescences growing from the cutis, and sometimes covered by the cuticle. They usually assume an expanded shape, or radiate from their basis to their surface, which in general has a granular appearance. After they have risen above the level of the skin, their base often remains stationary, but the higher part of them continues to expand, and to become rougher and rougher. Their substance is compact and firm, and sometimes very sensible, and disposed to bleed freely when cut. In this respect, however, warts are not always alike, some appearing to be unorganised, and insensible.

When much stimulated, they generally become smaller, and disappear or drop off. For this purpose, the most eligible applications are, nitrate of silver, acetic acid, tinct. ferri sesquichloridi, or a powder composed of subacetate of copper and savine in equal parts. When the neck of the wart is narrow, the best practice is to divide it.

The thin integuments, situated near the anus, often produce excrescences, which are of an intermediate nature between polypi and warts. They are of all sizes from that of a pea to that of an egg, or orange. In consistence and vascularity, they hold a middle space between warts and polypi. When small, they may be cured by local stimulants; when large, the most expeditious plan is to remove them with a knife.

*Encysted tumours, or wens*, are composed of cysts, whose texture, thickness, and contents, are subject to a great deal of variety. The cysts themselves are organised; but their contents unorganised. They are generally of a globular form, and unattended with pain. They are divided

into three principal kinds, named according to the nature of the substance with which the cysts are filled. When it is fluid, and more or less like honey, the tumour receives the name of *meliceris;* when it is of a pappy or pultaceous consistence, the tumour is called *atheroma;* and when the contents are fatty, *steatoma.* Atheromatous swellings on the head and back of the trunk, usually have thick dense cysts; while the cysts of similar tumours on the face are generally thin. Sometimes the cysts are ossified. In ordinary cases, the cyst has only one cavity; but, occasionally, there are partitions in it, dividing its interior into separate cells of various sizes. The internal surface of the cyst is mostly smooth, presenting an appearance somewhat like that of fine cuticle. In some instances, the cyst is loosely connected to the surrounding parts; in others, it is firmly attached to them, and immoveable. Certain descriptions of encysted tumours attain a considerable, I may say an enormous, size; but common ones, known by the name of *wens*, are from the size of a pea to that of a walnut or orange. Those which contain fat, sometimes become as large as a cocoa nut; but the swellings, known under the appellation of *hydatid cysts*, and *ovarial cysts*, are frequently of enormous magnitude.

The terms *meliceris*, *atheroma*, and *steatoma*, as expressive of three kinds of encysted tumour, are then by no means sufficient to convey an idea of the nature of many encysted swellings. The cyst may secrete matters of very different consistence and appearance: thus, some are filled with a thin fetid brown fluid, mixed with flakes of the fibrinous part of the blood; some contain a serous fluid; some a matter of gelatinous consistence; some, a calcareous matter; some, a melanotic liquid; and others, hair, teeth, hydatids, or various depositions of more or less firm substances disposed in concentric layers.

The greater number of common encysted tumours are situated immediately under the skin; but there are few textures, parts, or situations, in which they may not be produced.

It appears from the investigations of Sir Astley Cooper, that, in the early stage of a common wen, a dark-coloured spot may often be seen on the skin in the centre of the tumour, and such spot, he says, is caused by the obstruction of the orifice of one of the sebaceous glands of the skin. He therefore adopts the opinion, which is now universally admitted to be correct, that some encysted tumours are only enlargements of the cutaneous follicles, in consequence of such obstruction of their orifices. Of course, this explanation would not apply to many cysts in deep situations, and which are unquestionably parts deserving to be considered altogether as adventitious growths.

Children are sometimes born with encysted tumours. When formed near the eyebrow, they generally adhere to the bone, and are covered by the orbicularis palpebrarum, or occipito-frontalis muscle.

In some persons a remarkable disposition to encysted swellings is observed, and this in such a degree, that more than twenty have been noticed in different parts of the body. One of the most remarkable instances of this kind was a woman, who presented herself, about four years ago, at University Hospital, with seventy or eighty encysted tumours on different parts of her body. As some of them obstructed the meatus auditorius, they rendered her deaf in one ear. The largest of them did not exceed a walnut in size, and most of them were not larger than peas. She had had forty or fifty extirpated before she came to the hospital, but they continued to grow in such numbers, that she would not submit to any

further attempts to free her from them. I was informed that, at the menstrual periods, these tumours always became more prominent and turgid, and rather painful; a character more usually exemplified in nævi, than wens.

Perhaps the common species of encysted tumours are more frequently formed on the head than in any other situation, and, when they occur here in adult subjects, they are mostly of the atheromatous kind. In children, atheroma is also very common on the face. Many encysted tumours about the eyelids are likewise atheromatous.

In encysted tumours of the steatomatous sort, hair is sometimes blended with the fatty matter, and it differs from the hair naturally growing on the surface of the body in having no canal nor bulb.

Some cysts not only have the power of forming hair, but of producing a horny substance. This sometimes happens when the swelling ulcerates, so as to let out its contents, and expose the interior of the cyst to the air. Then the cavity becomes dry, and a substance of a cuticular or horny quality, continuing to be secreted, gradually protrudes. One in the British Museum is remarkable for its resemblance to a ram's horn. A few years ago, I removed a horn of this nature from the nates of an elderly medical gentleman in my neighbourhood. Occasionally cysts are met with containing teeth. One instance of this kind fell under the notice of Mr. Barnes of Exeter.

Those small cutaneous encysted tumours, which have a black point on their centre, will sometimes allow the obstructed aperture to be cleared and their contents pressed out; and in this manner, they may be kept stationary and free from inconvenience for a long time.

Encysted tumours are seldom dispersed, though this event occasionally happens, in consequence of changes brought about in them by accidental blows, or by inflammation excited in their cysts. On this principle, they are sometimes, but not often, cured by the application of local stimulants, as a solution of common salt, or lotions, containing the muriate of ammonia.

The plan of puncturing common encysted tumours, squeezing out their contents, and applying stimulants or caustic to their cysts, not only frequently fails to produce a perfect cure, but is attended with some risk of giving rise to the formation of fungous growths, which are ten times worse than the original disease.

Sometimes encysted tumours occur in parts, from which they cannot be wholly removed, and then, if the cyst be thin, a puncture may lead to a cure. In this way, encysted tumours, placed deeply in the orbit, are sometimes cured. An encysted tumour will sometimes inflame, and the most superficial part of it having given way by ulceration or sloughing, the contents escape, and the cyst itself sloughs away, leaving an ulcer which heals, and a cure is the result. I have more than once been called to atheromatous swellings, the skin over which was inflamed, and perforated by a small ulcerated opening, within which the white sour-smelling pappy matter could be discerned. Instead of practising excision, I have sometimes merely pressed out the atheromatous substance, and applied a small poultice, after which the cyst has gradually been separated in fragments, and the cure accomplished. Not long ago, I attended a lady with Sir Astley Cooper, and the swelling being severely inflamed, an incision was made, and the contents of the tumour pressed out: the cyst afterwards followed, and the part healed in a few days.

There are two methods of removing common encysted tumours: one

is to divide the skin and fat over the cyst, and having separated the latter from the surrounding textures, it is to be seized with a small hook, and dissected out entire. In some situations, the dissection may be completed without the hook, which, if the contents of the cyst be very fluid, lets them partially escape, so that cyst collapses, and is less easily taken out perfect. The other method is to cut the cyst at once into two halves, and then to extract each half of it separately, as practised by Sir Astley Cooper. No part of the cyst must be left behind. If not removed, the patient may continue to be annoyed with a discharge of matter from a fistulous opening, or a painful troublesome fungus may arise, requiring another more painful operation than the first to be cured.

Congenital cysts near the eyebrow adhere closely to the bone, and require a free incision, so that every portion of them may be taken out.

## SCIRRHUS AND CANCER.

The specific and malignant disease, known by the name of *cancer*, may begin either as a molecular deposit in the tissue affected, from a derangement of its nutrition, or as a deposit of the cancerous substance upon what Professor Carswell terms a *free surface;* as, for instance, that of a serous membrane: here it is, then, in the form of a secreted matter. It generally has two stages, namely, *that of induration*, or *scirrhus*, as it is termed, the first shape in which the disease usually presents itself; and *that of ulceration*, which is a later condition of it.

The disease, in the stage of scirrhus, is sometimes denominated *occult cancer;* and, in the ulcerated stage, *open cancer*, or *carcinoma*. I think, that when the latter word is employed, the generality of surgeons now signify more particularly the ulcerated form of the disease. There is no uniform custom, however, about this point; and sometimes carcinoma is only synonymous with cancer.

In Professor Carswell's Elementary Forms of Disease, Fasciculi 2. and 3., the term *carcinoma* includes cancer and medullary sarcoma, as two species, under the names of scirrhoma and cephaloma, each of which presents varieties, determined chiefly by the relative quantity of the morbid deposit, the manner of its distribution, and the difference in its colour and consistence.

Scirrhus, at its commencement, occupies a minute and limited space; thus it may be confined to one of the acini of the liver, as Professor Carswell has ascertained. In the breast, it is commonly of a globular form, and irregular and craggy, as it were, on its surface. It afterwards enlarges, though rarely in the degree or with the quickness exemplified in many tumours of a different nature; it also continues to be moveable for a certain time, but has a tendency to become fixed by attachments to the neighbouring textures, at an earlier period, than what is observed with respect to most other swellings.

Scirrhus is likewise remarkable for its excessive firmness, its cartilaginous, or, as it is sometimes expressed, its stony hardness. The substance of it, however, is not one uniform, homogeneous mass, but it is intersected by *septa*, or bands, the interstices of which are filled with a yellow, grey, or light blue semi-transparent inorganic substance. These bands, or septa, often diverge, as they proceed from the centre of the disease, sometimes radiating, as pathologists are fond of expressing them-

selves, a considerable way into the surrounding textures, so as to extend the same morbid action to them. The septa, now described, have a tough consistence, and are very much like a ligamentous tissue.

When a section is made of a scirrhus, a central point, or nucleus, may be observed, from which these dense ligamentous bands proceed towards the circumference. Sometimes the larger bands subdivide into smaller ones, which follow a course similar to that of their trunk, and ramify very regularly, or the bands may pursue from the first an irregular and intricate course, often uniting with and crossing one another, so as truly to present, when minutely inspected, a retiform appearance.

Frequently the greyish or bluish matter, interposed between the firm tough septa, appears broken down or removed, its place being occupied by a glairy or a turbid fluid, by a very soft, pulpy, semi-liquid substance, or blood itself.*

It was a remark first made by Laennec, that scirrhus and medullary sarcoma (la matière cérébriform) as well as other adventitious productions, which have nothing analogous to them in the tissues of the animal body, present in their progress two different states; the first named by him the state of crudity; the second, that of softening. This view does not, however, appear to be correct; for, according to Dr. Carswell's researches, the degree of consistence of cancerous formations is not an invariable character of a particular stage of their development; for they may, when first perceivable, be as hard as cartilage, soft as brain, or fluid as cream; or they may become soft or fluid, after having remained for a greater or less time in a state of hardness.

Scirrhous cancer most commonly begins in glandular or secreting organs, — as the female breast, the skin, the mucous tissues, the tongue, the cardiac and pyloric portions of the stomach, the cervix uteri, the rectum, the lips, especially the lower one, and the glans penis. The testicle and ovaries are also liable to cancerous disease. The parts which I have specified, are some of the principal ones on which cancerous disease makes its *primary* attack; but many other textures and organs may become the seat of it secondarily; as, for instance, the lymphatic glands, the lungs, the liver, and even the bones. It is not to be supposed, however, that lymphatic glands are not sometimes the primary seat of cancer. In fact, sometimes the scirrhous cancer, and in other instances the fungoid or medullary cancer, commences in them.† Mr. R. W. Smith, in some interesting remarks, annexed to a case of this description, expresses his belief, that when carcinoma begins in the axillary glands, and the breast is only affected secondarily, the cases are more rapid in their progress, and more fatal in their termination, than those in which the disease of the lymphatic glands follows that of the breast. In persons, who have long suffered from carcinoma, portions of the natural structure of their bones are frequently absorbed, and a scirrhous substance is deposited in their place. This fact is sometimes exemplified in the ribs and sternum; and we have in the museum of University College the upper part of a cranium, taken from a person who died of cancer of the breast, and illustrating the secondary effects of the disease on the parietal

* The varicous state of the capillaries, alleged to be connected with the production of cancer, in some of its forms, is a subject which I do not enter into at present, because it yet awaits further elucidation.

† For cases, see Warren on Tumours, p. 168. Also, R. W. Smith, in Dublin Journ. of Med. Science, vol. xii. p. 65.

bones. Probably, if the viscera of the same individual had been carefully examined, the cancerous texture might also have been traced in several of them. I attended a gentleman's coachman in Montague Street, Russell Square, for carcinoma of the bladder, and the effects of this disease on the skeleton were such, that one of the ribs and the left thigh-bone underwent spontaneous fractures previously to the patient's death. The rib and the thigh-bone I have placed in the same museum. As secondary effects of cancer, scirrhous formations have been noticed in the walls of the heart itself. A case, illustrative of this fact, occurred in St. Bartholomew's Hospital, and the particulars of it were inserted in the Medical Gazette, by Mr. W. M. Coates. In this example, the primary cancerous affection was situated in the lower lip; a form of the disease not unfrequently regarded as entirely local.

When cancer is considered as a genus, comprehending in its species scirrhus, common vascular sarcoma, pancreatic, medullary, and mammary sarcoma, and fungus hæmatodes (the view adopted by Professor Carswell), many other parts may be set down as very liable to carcinoma, besides those now enumerated by me. Those diseases he considers to be of the same family; 1st, because they often present in the early periods of their formation certain characters common to all of them, however much they may differ from each other in their subsequent periods. 2dly, because they all terminate in the gradual destruction, or transformation of the tissues they affect. 3dly, because they all have a tendency to affect several organs in the same individual. 4thly, because they all possess, though in various degrees, the same reproductive character. Dr. Carswell describes two states of the new adventitious deposit, of which these diseases consist; in one it has little or no tendency to become organised, its form and arrangement appearing to be determined chiefly by external circumstances, and its formation and subsequent increase being entirely dependent on the nutritive function of the organ in which it is contained. In the second state, this deposit exhibits, on the contrary, a greater or less tendency to become organised; it possesses within itself properties, by means of which its subsequent arrangement and development are effected, independently of the nutritive function of the organ in which it is formed, except in so far as the materials of its growth may be derived from this source. The first example Professor Carswell calls *scirrhoma*, the second *cephaloma*. Here, however, when I speak of scirrhus and cancer, only those forms of disease are signified, to which these terms are ordinarily applied; the others will be considered hereafter. There are many interesting observations in Dr. Carswell's Illustrations of the Elementary Forms of Disease, relative to cancer and fungus hæmatodes, which bring the subject completely into a new light. Thus, one circumstance which he observes, and which is new, I believe, to the generality of pathologists of this country, is, that numerous examples might be given of scirrhus, medullary sarcoma, and fungus hæmatodes, as they are commonly called, originating in the same morbid state, and passing successively from the one into the other, in the order now enumerated. Indeed, he says, that we often meet with all the varieties of what he terms scirrhoma and cephaloma, not only in different organs of the same individual, but even in a single organ. And of so much importance has it appeared to Professor Carswell to establish this fact, that the coloured representations in his second fasciculus are chiefly devoted to its illustration. Sir Astley Cooper once informed me, that he removed a lady's breast, and the tumour, on examination, proved to be a true scirrhus, but

a relapse took place, and the second disease in the same part was medullary sarcoma. In University College Hospital I have had several patients, in whom, after death, the two forms of cancer were found, either in different parts of the body, or blended together in the same part.

Scirrhous cancer rarely occurs in subjects under thirty years of age, and not often in any individuals under forty or forty-five. The late Sir Everard Home, however, met with an instance of a true cancerous formation in the breast of a young woman under twenty. This was a rare occurrence, with reference to the breast, or scirrhus in general; yet I may state, that it is not very uncommon for scirrhus of the uterus to be met with in patients under thirty. We have had some melancholy instances of this fact amongst the patients of the Bloomsbury Dispensary.

In consequence of the female breast and the uterus being particularly often the seats of scirrhous cancer, the disease more frequently afflicts women than men; and I may remark, that there is another circumstance, affording an additional reason for females being more liable to this intractable disorder; namely, the change that occurs in their constitutions about the period of life when the menses cease. Hence, between the ages of forty and fifty, they often begin to suffer from scirrhous and cancerous affections.

It is generally believed, that various common tumours, ulcers, and pimples may change into malignant ones, and assume the cancerous action, under the influence of particular states of the constitution. Thus, when a female has a tumour in the breast, not originally of a malignant nature, another morbid action may be excited in the part about the period of life when the menses stop, and the disease may then assume the character of scirrhus or carcinoma. Nay, a tumour of the breast, brought on by a blow, and beginning to all appearances with common inflammation, in a seemingly healthy woman, long before this critical period of life, will sometimes leave a hardness behind that will then change into scirrhus and cancer. I suspect, however, that common adipous tumours less frequently degenerate into cancer than any other swellings; yet, the possibility of such a change is attested by Sir Benjamin Brodie.

Swelling is frequently considered not to be an essential feature of scirrhus and cancer. On this point, I think Sir Charles Bell has delivered one of the most accurate statements. In cancerous diseases of the breast, there is not always an increase in the dimensions of the whole breast, but often an actual diminution of its total bulk. But what is true of the breast, or mamma, is not true of the disease, more generally considered; for the proper structure of the mammary gland frequently either shrinks, or is compressed by the scirrhous deposit; and sometimes the quantity of surrounding fat is lessened by absorption; and the consequences are, that the whole mass is less than the natural breast, or than what the breast was previously to the commencement of the disease. Still it is a fact, that the disease is properly a tumour — it is, indeed, a preternatural growth — a new formation.

The difference in the feel of scirrhi materially depends upon the quantity of fat around them; if much of the adipous substance be absorbed, the irregular knotty form of the disease will be felt; but when a good deal of fat remains, the breast seems large, full and smooth, streaked perhaps with blue dilated veins, and having sometimes an ulcerated aperture in its centre.

However, after a scirrhus of the breast has existed a certain time, its character is generally denoted by the puckered state, and dull leaden

or brownish colour of the integuments, the knotty and uneven feel of the disease, the occasional sharp darting pains in the part, its fixed attachment to the skin above, and to the pectoral muscle underneath it, and the early retraction of the nipple, a circumstance produced by the extension of some of the scirrhous bands between the lactiferous ducts, whereby its spongy texture is destroyed.

A true scirrhous tumour of the breast, one disposed to be attacked by cancerous ulceration, is often known to a man of experience by its remarkable hardness; its great weight in proportion to its size, which is seldom considerable; the lancinating pains occasionally felt in it, and its close connexion with the gland of the breast; so that, when moved, this gland moves along with it. The diagnosis will also be much assisted by reference to the patient's age. With the exception of medullary cancer, few other diseases so completely involve in their ravages every kind of tissue, skin, muscle, mucous membrane, cellular substance, lymphatic glands, &c. In ordinary tumours, the skin does not usually become affected till they have attained a considerable size; but, in true scirrhus, near the surface of the body, the skin generally soon becomes adherent to the morbid mass, and both discoloured and puckered.

Although a scirrhus of the breast may remain for months, and even for years, in a quiet state, without advancing to ulceration, the disease mostly ulcerates before the new formation has acquired great bulk. A large chasm is then commonly produced, partly by a sloughing, and partly by an ulcerative, process; and an excoriating peculiarly fœtid ichor is discharged, often in such abundance as to excite surprise in a person not accustomed to the view of this fatal disease. Its smell is also so different, so much more offensive than any other kind of discharge, that, when once acquainted with it, a surgeon never forgets it; and would afterwards recognise the presence of a patient with cancer, though out of his sight.

When the sloughs have been detached, partial but ineffectual attempts at reparation are made. Even granulations form, but they are greyish, hard, warty, and endowed with but little vitality; never covering the whole surface, but rising only at certain points, and soon changing into fungous growths of extraordinary hardness. However, sometimes cancerous ulceration really stops, cicatrisation even occurs at particular points, and a degree of mitigation is experienced; but the part never heals to any great extent, never becomes healthy. The margins of the sore become indurated, irregular, and twisted in various ways; in some places everted, in others inverted, or turned downwards and inwards.

The disease extends to other parts, and often to remote situations; the absorbent glands especially become affected. The disease is propagated from one gland to another, so that, after all the axillary glands are affected, those which lie under the clavicle, in the neck, or in the upper part of the chest, or under the sternum, in the course of the internal mammary vessels, become diseased.

The absorbent glands are indeed frequently affected in an early stage, becoming much indurated, and having almost the density of cartilage; but sometimes becoming softened and broken down at several points, and containing a purulent or bloody fluid. The lymphatic vessels, entering or leaving the glands, also sometimes feel hard and wiry. In the advanced stage of cancer of the breast, so seriously is the function of the absorbents and veins of the nearest arm sometimes impeded, that the limb is in a constant state of painful œdema, and rendered completely

useless. In ulcerated cancer, frequent hemorrhages take place from the fungous granulations; and these repeated losses of blood, joined with the constant pain and irritation of the disease, the want of sleep, and the progressive extension of the disorder to other parts of the system, soon bring the patient into the lowest state of debility. Nausea and disturbance of digestion now come on, followed by a distressing and incessant cough. Pains in the chest and oppression of the breathing increase from day to day; the patient becomes wan, sallow, and emaciated; the pulse rapid and faltering; and death at length puts an end to this scene of misery, often preceded by anasarca.

One deplorable effect of cancer in its inveterate form is an extraordinary fragility of the bones, which are apt to be broken by the most trivial causes, and even by the ordinary action of the muscles attached to them. In some of these cases, masses of scirrhous matter are deposited in the vertebræ, cranium, sternum, or long cylindrical bones, in lieu of their proper texture.

When cancer attacks the skin or a mucous membrane, an induration or warty lump is first produced, which afterwards ulcerates, and the sore has a particularly hard base. The ulceration gradually assumes the appearance of cancer, and soon cannot be distinguished from a sore that has been the result of scirrhus in other textures.

With regard to the *causes of cancer*, one important question is, whether the disease is a local or a constitutional one? Its origin is frequently ascribed to blows, pressure, and external injuries; but, I believe, the whole history of cancer tends to prove, that, although it may follow a slight contusion, the scratch or irritation of a little wart or excrescence, that has been stationary and harmless for years, or a common inflammation or abscess of the breast, these circumstances can only be regarded as *exciting* causes, which would not have brought on the disease, had there not been a certain state of the constitution qualifying it for the production of the specific structure of a cancerous tumour, and the peculiar morbid actions by which the nature of cancer is distinguished.

I do not adopt the views of some surgeons, who get rid of this question by saying, that cancer is at first a local, and afterwards a constitutional, disease. If cancer were not always dependent upon constitutional causes, why should it be so rare in persons under thirty years of age? Why should it be so common in women at the critical change which affects their system about the age of forty-five? Why also should the disease be so frequent in particular families, as to excite the suspicion of its being hereditary? At all events, we must believe, that the disease is the effect of a specific action in the part, preceded by some peculiar state of the constitution, without which such specific action would not have taken place. It is true, that we occasionally, though rarely, meet with the true cancerous texture in young persons, and that we are not always able to trace any defect in their constitutions; but because we cannot discover it, we are not to presume that it certainly does not exist; and, so far as we can reason from other examples of the disease, we must infer, that when a scirrhous or cancerous disease forms either in a young or old person, there must be peculiarities in the constitution, without which such a complaint would not have been produced. As Professor Carswell justly observes, hundreds and thousands of individuals are daily affected with inflammation, without this local disease being followed by any other than its usual effects; a fact, placing in the clearest light the necessity of a previously existing modification of the economy, as the

immediate and essential condition of the speciality of the adventitious formations, when they occur in conjunction with inflammation.

The same distinguished pathologist, in his highly valuable Illustrations of the Elementary Forms of Disease, refers to another very interesting fact relating to this part of the subject: I allude to the *formation of carcinoma in the blood.* According to his views, cancer is divided into *scirrhoma* and *cephaloma,* of each of which there are varieties, to which the terms *vascular, pancreatic, medullary sarcoma, fungus hæmatodes,* &c. are usually applied. He states, that the heterologous substance, which constitutes the two species of carcinoma, is present in the vessels which ramify in carcinomatous tumours, or their immediate vicinity; and that it can be traced from the trunks into the branches or capillaries; also, that it is found in vessels having no direct communication with a cancerous part, as when it is confined to a small extent of the vena portæ; and, lastly, in blood that has been effused into the cellular tissue, and on the surface of organs. He observes, that the divisions of the vascular system, in which the carcinomatous substance has been found, are the venous and the capillary. The formation of carcinoma in the blood, he says, cannot remain a matter of doubt; and he adopts the belief, that the presence of an organised product in the blood can have no other source but the blood itself, and cannot be introduced into this fluid by absorption. From this view of the origin of carcinoma, says Professor Carswell, its formation in the intimate structure, and on the free surface of organs, follows as a matter of course. The material element of the disease is separated from the blood, and deposited under a variety of circumstances, which modify, in a greater or less degree, the form, bulk, colour, and consistence, which it afterwards presents in the several periods of its development. Dr. Carswell, therefore, does not agree with several pathologists, who limit the seat of cancer to any one tissue, nor does he ascribe its origin to any modification of structure, or special organisation. Here, however, we are to remember, that Dr. Carswell's views of carcinoma comprise, as varieties of this disease, several cases which have usually been separated from it.

Scirrhous cancer is common at all ages between thirty and seventy. Sir Everard Home met with a single instance of the true scirrhous texture in a person only fifteen years of age; and Sir Astley Cooper, in all his long and extensive experience, never saw cancer in more than two individuals, who were less than thirty. The most common period for its commencement is the age of forty-five or fifty. Another fact, which is curious, in relation to the influence of age on cancer, is, that when the disease occurs in persons of very great age, it is slow in its progress, and does not, in general, materially shorten their lives.

Cancer is known to all the world to be one of the most intractable diseases to which the human body is liable. When we consider it as a new formation—as an adventitious deposit, accompanied by the peculiar texture and organisation, which I have described, accompanied also by some peculiarity of constitution, or modification of the economy,—we must see, that the power of medicine can have little or no influence over the disease. Yet, we may not be justified in asserting, that scirrhus and cancer are absolutely incurable. I formerly attended a young woman, under thirty, in Great Ormond-yard, Queen-square, who died of scirrhous cancer of the womb, as ascertained by dissection, the parts having been removed, and preserved by Dr. Miller. Her mother, who was living in the same house, and far advanced in years, had had both her

breasts entirely destroyed by cancerous disease, which had terminated in extensive sloughing. Here, no doubt, the whole scirrhous mass in each breast had been separated by the process established by nature for the detachment of the sloughs, and with them, I presume, the scirrhous bands, radiating from the tumour into the contiguous parts, were also thrown off, after which the ulcers healed like any common sores. The front of the chest on each side presents a most irregular mutilated appearance; the woman cannot now be less than eighty years of age.

As however this mode of termination of cancer is on the principle of extirpation, accidentally brought about by nature herself, strictly speaking, it may not affect the truth of the general observation, that cancer, whether in the state of scirrhus or carcinomatous ulceration, is positively incurable by any means, except such as are calculated to remove or destroy the whole of the parts affected. And, even when this is done, owing to the continued influence of constitutional causes, a recurrence of the disease, either in the same part or others, will always follow in a certain proportion of cases thus treated.

One circumstance, proving the connexion of cancer with constitutional causes, is the greater frequency of the disease in women, who bear no children, than in others who have families. This is a fact universally known and admitted; yet a female may have children, and even many, without being safe from an attack of the disease. One woman is mentioned by Sir Astley Cooper as falling a victim to cancer, though she had been pregnant not less than seventeen times. I have attended several women, who died of cancer uteri, notwithstanding they were mothers.

Another fact, in support of the opinion, that cancer is a constitutional disease, is the presence of the cancerous substance in the blood, either in the vessels, which ramify in a carcinomatous tumour, or its immediate vicinity; or in the vessels of a portion, or of the whole of an organ, to the former of which this substance is exclusively confined, and can be traced from the trunks into the branches and capillaries, or in vessels having no direct communication with an organ affected with the same disease.*

With reference to the prognosis and treatment of scirrhus and cancer, I may observe, that they are amongst the most intractable and fatal forms of organic disease to which the human body is liable. When we consider scirrhus as a new formation, as an adventitious growth or deposit, accompanied by the peculiar texture, which I have endeavoured to describe, we must naturally suspect, that it is not a case over which medical surgery can have much power. Indeed, it is the belief of the most experienced and careful observers, that cancer, whether in the form of scirrhus, or carcinomatous ulceration, is absolutely incurable by any means except those plans, which bring about the total removal or absolute destruction of the parts affected. And even when this is done, a recurrence of the disease, either in the neighbouring tissues, or in remote parts and organs, will follow in a considerable proportion of the cases thus treated: another fact, confirming the truth of the doctrine, that cancer is a disease dependent on constitutional causes. When a scirrhous cancer is so situated as to admit of being entirely removed with the knife, no time, I think, should be lost in attempting to disperse the induration, or cure the ulcer, by other means. It is only while doubts prevail about the true character of the complaint, or while it is in a very early stage, that

* See Dr. Carswell's Illustrations of the Elementary Forms of Disease; Fasciculus 2.

it is generally advisable to try plans which have in view the dispersion of the hardness, or the healing of the sore by external or internal remedies. The ground, on which I offer this advice, is, that all the medicines and applications, described in every pharmacopœia in the world, have already been tried for the relief and cure of cancer in thousands of instances, without the slightest advantage; and in innumerable cases, the time employed in the trial of them has afforded an opportunity for the disease to extend from the part originally attacked, and which might easily have been taken away at first, to other parts not admitting of removal, and the patients have died, without having had that chance of being saved, which a timely operation would have given them.

We occasionally hear and read of cancerous affections being cured by various medicines and applications. But the question is, whether they were diseases, really attended with the true scirrhous formation and structure, or genuine carcinomatous ulceration? Numerous swellings, indurations, and ulcers, have more or less resemblance in their outward characters to scirrhus and cancer; and such are sometimes dispersed, or healed; but that a disease, accompanied by the genuine scirrhous texture, the heterologous substance that distinguishes it, can be cured by medicine, or any local means, not acting so as to destroy the part affected like caustic, is a proposition, against which the voice of experience is loudly raised.

Believing in this fact myself, I shall be brief in the enumeration of a few of the principal medicines, which have been repeatedly praised for their efficacy in scirrhous and cancerous cases; for, according to the view which I have taken of the subject, they have been extolled without good foundation, and, in the trial of them, other diseases have been generally mistaken for those now engaging our attention. *Conium maculatum*, or *hemlock*, was at one time praised up to the skies as a remedy both for cancer and scrofula. It is yet confided in by Recamier, who combines with it an allowance of only one third of the patient's ordinary quantity of food, and makes him take as ordinary beverage a weak infusion of bark. The extract of *belladonna* is a medicine that can only be given in very small doses, the effect of which is not to cure or stop scirrhus, or cancer, but to diminish the pain of the complaint. As for *arsenic*, in the form of the liquor arsenicalis, I have frequently given it the fairest trial in scirrhus and cancer; and am sure, that it has no power over them; though certain troublesome and inveterate ulcerations and tubercular diseases about the nose, lips, and other parts of the face, and on the tongue, will sometimes yield to it. Certain malignant-looking sores on the face, reputed to be of a cancerous nature, were cured, under Mr. Carmichael, by the *sesqui-oxide* or *phosphate of iron*, with the occasional use of purgative medicines. The dose of these preparations of iron varies from a scruple to a drachm twice a day. They are now generally acknowledged to possess no specific virtues against true scirrhus and cancer. As for *mercury*, though it has the power of promoting the absorption of various indurations, and of curing different forms of the most obstinate ulceration, no modern surgeon has any confidence in its usefulness as a medicine for cancer. When the digestive organs are disordered in a patient labouring under a scirrhous affection, small doses of the blue pill, or compound calomel pill, with leeches on the epigastrium, or hypochondrium, and aperient medicines occasionally, will sometimes improve the general health, and put the patient into a better state for an operation; but neither this nor any other medical plan, will serve to disperse a true

scirrhus. The *muriate of barytes* has been tried, but it is now given up, as entitled to no confidence. Living altogether on a *milk*, or *vegetable* diet, or a diet just sufficient to keep the body and soul together, something very nearly approaching to starvation, is one of the schemes which have been resorted to. In the periodical works of the day, we read of cancerous diseases yielding to *iodine*. I have frequently tried it for such complaints in the breast, uterus, and lips, but without success.

Amongst the favourite *topical applications*, are the *liquor arsenicalis* properly diluted, and Dupuytren's powder, consisting of ninety-six parts of calomel, and four of oxide of arsenic. Strong *arsenical pastes* are dangerous applications. I remember a patient being poisoned with them; he had a cancerous ulcer of the face; the surgeon covered it with the paste; and he died in a few hours from the absorption of the arsenic, and its deleterious effects on the system. If any surgeons are yet bold enough to attack cancerous diseases with caustic (which I am not), let them abstain at all events from arsenic, and employ *pure potash*, though, I think, they will often kill the patient even with this.

*Narcotics*, in the form of plasters, are sometimes employed, particularly *opium*, *conium*, *hyoscyamus*, and *belladonna* blended in various proportions with the ordinary brown soap plaster. The *watery solution of opium*, and the *liquor opii sedativus*, are common applications for all kinds of malignant ulcerations. In addition to these articles, I will merely refer to *carrot poultices*, *fermenting poultices*, *a solution of one ounce of the sulphate of iron in one pound of distilled water*; a *paste* composed of *sesqui-oxide of iron* blended with water, or sprinkling the ulcer with the powder; the solutions of the chloride of *lime and soda*; and covering the scirrhous part with a piece of hareskin, or fleecy hosiery, so as to protect the disease from the influence of vicissitudes of temperature, and the injurious effects of accidental blows.

Pressure was recommended by Young, as a means of curing cancer, but the trials made of it in the Middlesex Hospital, and the report of Breschet, are decidedly unfavourable to the practice. I have tried it in two or three examples, without success. In France, however, Recamier is still an advocate for it. According to Dr. Carswell, the influence of pressure in favouring or retarding the development of carcinomatous tumours, is conspicuously seen in those situated near the surface of the body.

As none of these plans and medicines will cure cancer, we are to consider what benefit may be obtained by extirpating the diseased part.

If the operation be done early, and performed on the principle of removing, not merely what is obviously diseased, but a good deal of the substance around the scirrhus or cancer, the result will frequently be a permanent cure, so far as that part is concerned. But the cure is not a certain thing. Indeed, after a cancerous tumour has been extirpated, whether the disease be indolent, or painful, small, or recent, there is no certainty that the disease will not return. On the other hand, it is not certain that the disease will return, even when it has made considerable progress previously to the operation. Yet, it is an undoubted fact, that the more recent the disease is, the less are the chances of relapse.

Hence, as we have no medicine that will cure scirrhus and cancer, we should recommend an operation for their removal as soon as no doubt exists about their nature.

When it is impracticable to remove the whole of the diseased parts, it is a rule in surgery not to undertake an operation at all. The partial

extirpation of a true scirrhus, whether by caustic or the knife, is sure to convert the disease into a fatal painful carcinomatous ulcer.

Another maxim in surgery is, never to perform the operation for the removal of a cancerous tumour when there is reason to believe, that the disease is not confined to the part, but has already extended itself to internal glands and other textures, more or less remote from the original seat of the disease. My experience teaches me, that, if an operation be performed, where the integuments, covering a scirrhous breast, are thickly studded with hard pale tubercles, the patient will be almost sure to have a return of the disease in the skin, though every part of it visibly diseased may have been removed.

What good can arise from cutting away a cancerous breast, when, perhaps, all the absorbent glands about the axilla, neck, and within the sternum, are similarly affected? Where can be the prudence of cutting away an external scirrhus when there are cancerous deposits in the lungs, liver, bones, or other deep-seated textures?

Surgeons do not decline to operate when the axillary glands are diseased together with the breast; and provided the whole disease in each situation can be thus removed, the practice may be right; but, certainly, the extension of the disease to those glands very materially lessens the chance of a permanent cure. It shows that the diseased action has passed to organs more or less remote from the original affection, and that the system may be inveterately under its influence. Camper believed, that a sure sign of the incurability of a cancerous breast consisted in a shooting pain between the second and third ribs. He was convinced, that such pain denoted the extension of the disease to the lymphatic glands under the sternum.

Is it right to operate when the disease is in the ulcerated state? The answer must depend upon circumstances. If the whole of the diseased parts can be removed, if the viscera of the chest and abdomen appear not to have suffered, and the lymphatic glands are not extensively affected, the operation is justifiable, though its chances of success are much less than those where the case is only a scirrhus, under similar conditions. The lips, however, have been removed in the ulcerative stage, without the disease afterwards extending itself to the submaxillary glands, or any relapse taking place. The same fact has been exemplified after the extirpation of portions of cancerous tongues.

When the opportunity for operating has passed away, palliative treatment is all that can be attempted. Appeasing the pain by the application of the watery solution of opium, or dressing the ulcer with the liquor opii sedativus, or with an ointment containing one drachm of the powder of opium in every ounce of lard, are rational methods. I had lately one patient with a dreadful carcinomatous ulceration of the breast, who found no dressing afford her so much ease as the common spermaceti ointment. The fœtor may be lessened by applying the chloride solutions; but they give not the ease derived from other dressings. To a scirrhus which it is not judged advisable to remove, we may apply soap plaster, containing a proportion of the extract of belladonna or hyoscyamus; or we may simply cover the part with a piece of soap plaster or soft fur. On account of the pain, the acetate or hydrochlorate of morphia may also be prescribed. This practice is most particularly called for in examples of ulcerated cancer. Where the agony is great, and the disease incapable of removal by the knife, all that can be done is to render the patient's journey to the grave more free from misery.

The success of an operation will materially depend upon the whole disease in the part — every atom of it — being completely extirpated. Hence, we should always make a free removal of the skin and cellular tissue around a scirrhous tumour, as the fibrous bands frequently extend a considerable distance round the perceptible induration and swelling. In a certain number of instances, however, a relapse will unfortunately take place, whatever be the precautions taken in the performance of the operation. Still the prospects of a radical and permanent cure are more promising when the operation has been properly performed, and strict attention is afterwards paid to the patient's general health. Hence, when we take away a scirrhus, we ought not to think that we have fulfilled the whole of our duty to the patient; but prescribe such medicines, and regimen, as will be likely to produce a beneficially alterative effect on the constitution.

When the disease extends only to one or two of the axillary glands, and the patient seems to be free from organic disease in the chest and abdomen, we may perform the operation; but the diseased gland or glands should be removed with the knife, directly after the scirrhous breast has been extirpated.

### MEDULLARY CANCER, ENCEPHALOID TUMOUR, OR FUNGUS HÆMATODES.

The latter name was adopted by Hey, in consequence of its tendency to throw out, with great rapidity, a large bleeding substance, after ulceration of the skin has taken place. It is sometimes called *soft cancer;* and, by Abernethy, was named *medullary sarcoma*, from its resemblance to the medullary substance of the brain. It is, in fact, very similar to the substance of the brain in all chemical and physical properties. Most commonly it presents itself in masses, contained in fine membranous partitions: but it has three varieties, as originally pointed out by Laennec. The first is the *encysted*, which varies from the size of a filbert to that of an apple. The *unencysted*, which may be very small, but, in other instances, obtains the magnitude of a child's head. Its exterior is not so irregular as that of the encysted, though divided into lobules, with fissures between them. The *infiltrated* or *diffused*, consists of masses, which are not circumscribed, and the medullary substance presents a diversified appearance, in consequence of its being blended in various proportions with the tissues amongst which it is produced. It is generally of the same consistence as the cerebral medulla; but sometimes much softer. It varies also in colour: in some instances, it is quite white; in others light red; and it has occasionally been found to be of a deep red colour. A section of the tumour exhibits numerous bloody points. A vascular organisation is conspicuous in it, and as the coats of its vessels are remarkably delicate, the circulation of the blood through them is readily interrupted; hæmorrhage from congestive rupture takes place; and the effused blood is mixed with the brain-like matter.* When superficial, medullary cancer begins as a colourless swelling, soft and elastic to the touch, unless bound down by a fascia, in which case it has a firm tense feel. When immediately subcutaneous, it is elastic, and hence liable to be mistaken for a tumour containing fluid. When it occurs in the testicle, it is frequently supposed at first to be hydrocele.

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* See Carswell's Illustrations of the Elem. Forms of Disease; Fasc. 2.

Like cancer, it has a tendency to spread to the absorbent glands, which become converted into a similar substance. In every sense of the expression, it is a new formation, an adventitious growth, whether situated in the cellular membrane, in the tissue of the muscles, in that of the viscera, or within the orbit, or in any cavity or on any surface of the body. When it occurs in deep-seated parts, it has an invariable tendency to make its way to the surface, and when this happens, a considerable swelling arises, the skin at length becomes thin and discoloured, and from being at first smooth, now projects irregularly; openings are formed in these projections, and a medullary growth springs up, which sometimes bleeds profusely. It is only at this period of the disease that the name of fungus hæmatodes is at all applicable; and even now it is not very correct, as the mass is not a fungus, but a substance of medullary consistence. Medullary cancer seems to be a constitutional disease, and rarely confined to one organ. It has been observed in the eye, the brain, the lungs, the heart, the liver, the spleen, the kidneys, the bladder, the uterus, the ovaries, the mammæ, the mesenteric glands, the dura mater, the bones, and the thyroid gland, of which there is a fine specimen in Mr. Langstaff's museum. It may commence in almost every texture, or upon any surface. Sometimes it originates in the antrum, from which it may extend to the brain, through the orbit, or outwards through the cheek, or into the mouth, or nose.

An early symptom of this terrible and unfortunately common disease, is a wan, pale complexion, such as is remarkably indicative of what may be termed a fatal organic disease. The patient generally dies hectic. One of its differences from scirrhous cancer is, that it contains within its substance no ligamentous bands, nor central hard nucleus, but consists of a soft pulpy matter contained within septa, composed of a fine delicate membrane. In order to be able to see its structure well, we should subject it to maceration or the action of alkalies. A scirrhous tumour is generally firm, hard, and incompressible from the very first; whereas there is a softness and elasticity about fungus hæmatodes, at once constituting quite a different character. The parts in this latter disease are not destroyed by ulceration, as in cancer; but, after the skin has ulcerated, a medullary bleeding substance protrudes. While the new deposit in schirrous cancer, also, has little or no tendency to become organised, that of medullary cancer exhibits a greater or lesser disposition to become so. Fungus hæmatodes frequently attacks the liver, the spleen, the kidneys, and lungs, *primarily;* whereas it is alleged by some pathologists, that scirrhous cancer only attacks these organs *secondarily;* a point, however, deserving of further investigation. Medullary cancer is not uncommon in young subjects, and persons below the middle age; whereas cancer chiefly attacks individuals between the ages of forty-five and fifty, or older persons. With regard to the treatment, we know of no medicine that will correct the state of the constitution upon which this disease depends. The only chance of curing it, is by the removal of the tumour at an early period of its formation, before the lymphatic glands and other parts have become affected. Thus, if the disease has extended up the spermatic cord, or to the lumbar glands, castration will be of no avail. I am of opinion, that the viscera generally become diseased much sooner in medullary tumours externally situated, than is generally supposed. I am now speaking of that form of them, which comes under the care of surgeons, where the surface of the body, or the limbs, are the seats of the disease. This fact

accounts for the general failure of operations; and induces many judicious surgeons to condemn them altogether.

Notwithstanding there is every reason for believing medullary cancer to be a constitutional disease, and we find, that after an operation, there is usually even a greater disposition to relapse, than is manifested in examples of scirrhus and cancer, experience occasionally brings forward cases forming exceptions to this statement. I removed a testicle affected with fungus hæmatodes from a man in Newton Street, Holborn, who recovered, and continued well a long while afterwards; and we sometimes hear of the same disease in the eyes, breast, and limbs, being effectually extirpated by operation, without being followed by any return of the complaint. Unfortunately, the contrary more generally happens, so that the prognosis should be qualified by a reference to this important fact.

## MELANOSIS.

The *black cancer* of Dupuytren, the *melanoma* of Professor Carswell, is characterised by the formation of a brownish, deep blue or black inorganic matter in various textures and cavities of the body, especially those lined by a serous membrane. The shades of its colour vary in different examples, sometimes presenting only a yellowish or light brown, sometimes a dark brown, and frequently the deepest black.

The scientific arrangement of melanotic diseases, partly suggested by Bayle and Laennec, but improved by the labours of Breschet and Carswell, seems to me to convey the most correct idea of their principal varieties. Thus, melanosis is divided by the latter pathologist into *true* and *spurious;* the *first* comprising those cases, in which the formations or products depend on a change taking place in that process of secretion, whence the natural colour of certain parts of the body is derived; the second comprehending cases, in which either a carbonaceous matter has been introduced from without, or in which the appearances are owing to the action of chemical agents on the blood, or to the mere stagnation of the latter fluid. According to Professor Carswell, the most frequent seat of *true melanosis* is the serous tissue, more especially where this constitutes the cellular element of organs. Here the melanotic matter is formed after the manner of *secretion*, accumulates in the cells, of which the serous tissue is composed, and gradually acquires the form of tumours of various sizes. A similar mode of formation of this matter takes place much more conspicuously in loose cellular tissue, and particularly on extensive serous surfaces, like those of the pleura and peritoneum.* Another mode of formation is pointed out by Dr. Carswell, where the melanotic matter is deposited in the substance, or molecular structure of organs, after the manner of *nutrition;* and, lastly, as he has further explained, the melanotic matter, like that of cancer, or medullary sarcoma, is sometimes formed in the blood, chiefly in the venous capillaries, and under circumstances which show that it must have been formed in these vessels. There are not less than four modifications of true melanosis.

1. *Punctiform melanosis*, the *mélanose infiltrée* of Laennec, in which the black colouring matter appears in the shape of minute points, or dots, either grouped together in a small space, or scattered irregularly over a considerable extent of surface. These appearances are most frequently exhibited in the liver, and, when a section is made of it, the surface seems as if it had been sprinkled with soot or coal dust.

* See Dr. Carswell's Illustrations of the Elementary Forms of Disease; Fasciculus 3.

2. *Tuberiform melanosis*, which is by far the most common, answers to the *concretions mélaniques* of French pathologists. Sometimes the tumour is not larger than a millet seed, but occasionally it is equal in bulk to a child's head, or even of more considerable dimensions. Of this size, however, it is chiefly seen in the horse; for, in the human subject, we rarely meet with an instance of its exceeding the size of an egg or an orange, and commonly it is much smaller. It is in the loose cellular and adipous tissues that melanotic tumours are disposed to attain extraordinary magnitude. Their great size seems to depend upon the agglomeration of numerous small tumours. According to Professor Carswell, when the tumour is single, it is always of a globular or ovoid shape, but, in the contrary circumstance, lobulated. In compound tissues, he has observed it to be most frequently a *single* tumour, but in the cellular and adipous tissues *aggregated*. In the liver, single melanotic tumours of large size are more common than in any other organ of compound structure. Melanotic tumours may be either *encysted* or *without a cyst;* the encysted being chiefly met with in the cellular and adipous tissues. The *tuberiform* melanosis of Professor Carswell, however, is not confined to the cellular and adipous tissues, or parts abounding in them, but may occur on the surface of the peritoneum, or that of the pleura.

3. *Stratiform melanosis*, the *mélanose membraniforme* of Laennec, occurs only on the surface of serous membranes. In its first stage, the part seems merely stained with the melanotic matter; in the second, a distinct layer of this substance is deposited on the surface of the serous membrane. Its consistence is generally that of jelly, and, as it is enclosed either in a soft spongy cellular tissue, or fine transparent serous membrane of new formation; it has a pulpy feel, but is not removed by the finger or scalpel passed over it, unless some force is employed. In certain cases, it forms a black coating, in appearance very much like what is produced by Indian ink.

4. *Liquiform melanosis*, the last of Dr. Carswell's species of true melanosis, the *mélanose liquide* of Breschet, may occur in natural or accidental cavities, and also within a melanotic tumour itself, in consequence of what French pathologists describe as the *softening process* in the centre. The cavities of the pleura and peritoneum are the chief natural cavities, in which the *liquiform melanosis* presents itself, and here only in small quantity. What has been described as this form of melanosis in mucous cavities, seems to Dr. Carswell to be owing to the changed colour of the blood, either effused in such cavities, or contained in its proper vessels, and acted upon by some external chemical agent, consequently they are spurious cases. Ovarial cysts furnish the best examples of *accidental cavities*, in which *liquiform melanosis* is sometimes seen. The consistence of melanosis is exceedingly diversified. In the large cavities, it is never solid; in the cellular and adipous tissues one or two cells may contain liquid black matter; but, in the dense texture of the cutis, the smallest tumour may be as hard as cartilage.

The *spurious forms of melanosis* depend either upon the introduction of carbonaceous matter into the pulmonary tissue in the process of respiration, or upon the action of acids or other chemical agents on the blood, situated in, or upon parts, or, lastly, upon the simple stagnation of this fluid.

Melanosis frequently originates in the subcutaneous cellular tissue, or in the cellular and adipous tissue, behind the peritoneum.

The most striking example of its circumscribed existence in adipous

tissue is specified by Dr. Carswell to be that, in which the disease occurs in the *appendiculæ epiploicæ*, which are sometimes converted by it into a homogeneous solid mass of melanotic matter.

Melanosis may take place in various parts of the same individual, as the eye, the skin, the liver, the lungs, the heart, the pancreas, and the peritoneal covering of the viscera. From this fact, one may infer its connexion with a constitutional cause.

The bones are not often the seat of melanosis. In one example described by Dr. Alison, the whole of the sternum, the anterior portion of the ribs, and a great part of the parietal and occipital bones were black, more brittle, and of a softer consistence, than natural; but without enlargement, or caries. The periosteum was but little changed; but the dura mater was stained black, and the pleura studded with very dark coloured tubercles.

One interesting fact, explained by Professor Carswell, is, that the fluid of melanosis may be found in natural or artificial cavities, without its being the product of their secretion. This happens, when melanotic tumours perforate the sides of those cavities, and pour their fluid contents into them. This has been observed in the thorax and abdomen; and, in one case, a melanotic tumour had perforated the right lateral ventricle of the brain, in which was found a considerable quantity of black fluid, some of which had passed into the third and fourth ventricles, and thence into the theca vertebralis.

Melanosis of the brain is rare. In the museum of University College is a specimen of a small melanotic formation on the cerebellum of a child, that lived only three days from its birth. No doubt, therefore, in this instance, the disease must have commenced in the fœtus.

The matter of true melanosis has no smell—a circumstance, by which the disease may always be known from the effects of gangrene.

With respect to the symptoms of melanosis in the living subject, the disease may at first produce little or no pain; but a sallow complexion, excessive debility, and anasarca frequently come on before its termination. In some instances, however, great general indisposition, and most severe pain in various parts of the body, are experienced from the first; and, occasionally, the patient is rapidly destroyed in the short space of three or four weeks. In common examples, I believe, it does not cause a vast deal of suffering, except when nerves are involved in it, or compressed by it.

The matter of melanosis is completely insensible — it is only an inorganic secretion, or deposit — sometimes produced in textures, or upon surfaces otherwise apparently healthy and natural — sometimes formed in parts, affected with chronic inflammation — and sometimes co-existent in the same mass, either with scirrhus, cancer, or medullary deposit; a point, in which the researches of Professor Carswell agree with those of the late Dr. Armstrong. These facts explain why melanosis is sometimes described as a malignant disease, and sometimes as having this character but very rarely.*

Melanosis is a more common disease in horses, than the human subject; but it is principally met with in those of a white, or grey colour; a fact, corroborating the doctrine of its origin from constitutional peculiarity. As Professor Carswell remarks, the circumstance is also favourable to the theory, which ascribes the origin of melanosis to the accumulation

* See Warren on Tumours, p. 25.

in the blood of the carbon, naturally employed to colour different parts of the body, as the hair, rete mucosum, and choroid coat of the eye.

From chemical analysis, it would seem, that the substance of melanosis consists of fibrine, a black colouring matter, a small quantity of albumen, chloruret of sodium, oxide of iron, water, subphosphate of lime, and a few other salts in small proportions; and it is the general opinion, that the melanotic matter is essentially composed of the constituent elements of the blood. The colouring matter seems also to be a highly carbonised principle.

No remedy is known of for melanosis. Its causes are as obscure as those of cancer, fungus hæmatodes, tubercles, and other new and adventitious formations. The only chance of benefit depends upon the early removal of the disease by operation, when the situation of the part affected will admit of it. An eye, affected with melanosis, has been extirpated, without any relapse having followed the operation at the end of two or three years; so have melanotic tumours of the skin and cellular tissue. Melanotic formations under the tails of horses have likewise been frequently cut away with permanent success. These facts prove, that malanosis in some situations has more chance of effectual relief by operation, than medullary cancer.

## SCROFULA, OR STRUMA,

Commonly called the *king's evil*, from the superstitious notion formerly entertained, that it was curable by the royal touch, frequently presents itself in the form of glandular enlargements under the skin — swellings whose progress is in general remarkably indolent, — which soften very slowly, —and at length frequently suppurate and burst, after which they remain a greater or lesser time as ulcers, and, after healing (which they do very tediously), often leave behind them callous irregular scars, which can never be effaced.

Sometimes the disease occurs in the substance of the cutaneous texture, which it disfigures and alters in a most disgusting manner; and very often it attacks the ears, the eyes, the eylids, the nostrils, and the lips, which it thickens and deforms in an extraordinary degree. In other examples, we find it fixing upon organs more deeply situated, as the bones and joints; or obstructing the organs for the conveyance of the lymph and chyle; or giving rise in the lungs, the peritoneum, and other parts, to those tubercular diseases, which, in this climate at least, are one of the greatest causes of mortality.

Scrofula will not admit of a short and satisfactory definition, and this, notwithstanding our familiar acquaintance with its usual seats, and its ordinary ravages and course. I may observe, however, that it is *characterised by a remarkable propensity to chronic inflammation of the lymphatic and mesenteric glands.* The absorbent glands of the neck, and others under the jaw, are more frequently attacked by scrofula than those of any other region in the body; and perhaps their being more exposed to vicissitudes of temperature, and to the irritation of diseases of the scalp, which are so common in children, may afford some explanation of this fact. Next, perhaps, the *mesenteric glands* are most frequently disorganised by it; and it is not unusual to find it affecting the *glands in the groin*, and even those in the *axilla*, and other situations. Indeed, the absorbent glands of every part of the body are liable to scrofulous disease.

Scrofula always produces in the system a tendency to the formation of

chronic abscesses, not merely in and about the absorbent glands, but in the general cellular tissue of the body.

As already mentioned, it likewise creates a disposition to the origin of *tubercles in the lungs, liver, brain, spleen,* and other internal organs. The most frequent seats of scrofulous tubercles in adults are, first, the lungs, and then the small intestines; but, in children, the bronchial glands, the mesenteric glands, the spleen, the kidneys, and the intestines, in the order here enumerated.

If we regard tubercular phthisis as a scrofulous disease, it will make a material difference in the comparative estimate of the frequency of scrofula in children and grown up persons.

Scrofula is accompanied by a tendency to certain morbid changes in the spongy and cancellous texture of the bones, and also in the synovial membranes.

In the common language of surgery, we frequently say, that a person is scrofulous, though he may not have any visible disease about him; but merely certain appearances, usually regarded as emblems of a scrofulous constitution, or of a predisposition to scrofula. Thus a fair complexion, light-coloured hair, a fine thin delicate skin, exhibiting the minute ramifications of vessels, full sized, rather dilated pupils, and a remarkable whiteness of the albuginea of the eye, a tenderness of the edges of the eyelids, a swelling of the upper lip, with some thickening of the alæ and tip of the nose, are known to denote a scrofulous constitution. In many instances, the ends of the fingers are broad and clubbed, as the expression is, and the belly protuberant. Perhaps the doctrine of a fair complexion and light hair being indications of a predisposition to scrofula, may have been carried too far, and certainly I should have been inclined to suspect, that it had arisen merely from the accidental circumstance of the greater number of children in this country being fair, and having light-coloured hair, had I not found it noticed by Alibert and other French pathologists, that scrofula is most frequently seen in France in the same description of children, where we know that dark complexions and dark eyes predominate. It is not, however, to be supposed, that a dark complexion is an absolute protection, for many scrofulous persons have dark skin and hair; and every surgeon of experience knows how subject the negro and other individuals of the dark races are to scrofula, when brought to this damp, cold, and variable climate.

It is frequently difficult, perhaps sometimes impossible, to draw with precision the line between scrofulous and some other diseases, because there is an insensible transition or gradation from one to the other. Yet certain forms of diseases present themselves daily, in which there can be no hesitation in pronouncing them to be scrofulous. Such are particular indolent swellings and abscesses of the lymphatic glands of the neck, certain diseases of the joints and spinal column, and various tubercular affections.

Children are more liable to scrofula than grown up persons, the period of life most exposed to its attack being from infancy to puberty. Nay, if tubercles are to be regarded as unequivocal effects of scrofula, as many of the best pathologists believe, the disease may commence in the fœtus; and there are in my friend Mr. Langstaff's museum portions of lung, taken from a fœtal subject, and evidently containing completely-formed tubercles.

As puberty approaches, the disposition to every form of scrofula, except that of pulmonary tubercles, lessens, and those who have suffered

from it in their childhood, sometimes become free from it, and bid defiance to its further annoyance. Females are generally considered to be rather more subject to scrofula than males. The disease is well known to be neither infectious nor contagious; not being communicable from one person to another by inoculation, nor through the atmosphere. The idea that scrofulous nurses may impart the disorder to children, is one that is at present universally renounced.

It appears, then, that scrofula may make its appearance in almost any texture of the body, and is not, as is sometimes conceived, peculiar to the lymphatic glands, though they are perhaps more susceptible of it than any other parts. The glands of the neck and those of the mesentery undoubtedly come within this remark; and next to these organs I may say, that the skin, the lungs, the eyes, the ears, and the spongy parts of the bones, are most frequently the seats of scrofulous disease.

*Scrofulous inflammation* is generally remarkable for the slowness and indolence of its character. Its attack is always more insidious, and its progress much slower, than the invasion and advance of phlegmonous inflammation. The acute pain, the throbbing, the firm circumscribed swelling, the bright red colour, and the quickness of the changes, which attend all simple healthy inflammations, may be said to be absent from scrofulous inflammation as it most usually presents itself. Neither does scrofulous inflammation, when situated in a lymphatic gland, or any ordinary texture, commonly produce at first any febrile disturbance; yet, when scrofula makes progress, or attacks organs of great importance in the animal economy, or extends its ravages to the large joints, the degree of constitutional derangement and of hectic is often such as to form a state of considerable and urgent danger.

Scrofulous inflammation near the surface of the body, often begins with a soft swelling of the part affected, which is frequently one of the lymphatic glands. The covering of the gland becomes slightly thickened, and the gland itself has a doughy feel. As the swelling increases, it becomes more elastic, or even communicates the sense of a fluctuation; and, in this stage, a degree of induration is generally noticed under and around the tumour, with a more or less red or livid colour of the skin. If a puncture be now made in the swelling, a thin fluid is discharged, mixed with flakes of a curdy substance, composed of albumen, but only in trivial quantity, and rarely in the shape of good pus. The edges of the puncture next inflame, and the opening becoming larger, in consequence of the ulcerative process, a dark yellow or brown sloughy-looking substance may be seen within it: and betwixt this substance and the skin a probe may be passed freely all round the sore. Indeed, it is one of the characters of scrofulous abscesses, when formed near the surface of the body, always to detach the skin extensively from the subjacent parts. If the disease be allowed to take its own course, without being punctured, a part of the skin at length becomes very thin, and of a light purple red colour; afterwards bursting and discharging a thin fluid-like whey, with which flakes of albumen, and occasionally pus, are also blended. The redness continues, the surrounding hardness remains, the ulcerative process advances, and the disease is now converted into a *scrofulous ulcer*, which is generally not much disposed to heal. The cavity and sides of many deep ulcers and abscesses, resulting from scrofula, are noticed by Mr. Wardrop to be covered with a tough yellow fibrinous incrustation, that produces an impediment to the formation of granulations; and he accounts for the usefulness of laying open scrofulous abscesses partly

on the principle of its promoting the separation of this extraneous incrustation within them.

*Scrofulous ulcers* originate either from glandular swellings, which inflame and break; or else the skin spontaneously inflames in various places, and ulcerates. In general they are not very painful; their edges are hard, irregular, and undermined. Their circumference, and indeed the ulcers themselves, are of a pale red, or purple colour; their bottom is here and there covered with a yellow curd-like substance; and the matter secreted by them is thin. Although it is not the most usual disposition of a scrofulous ulcer to be very painful, it is occasionally met with in this latter state, and particularly when scrofula is excited by a course of mercury, or the ulcer is complicated with dead or carious bone. The cicatrix of a scrofulous sore generally exhibits a very puckered appearance, with small portions of projecting skin, and even complete bridges of it, allowing a probe to pass under them. The healing of a scrofulous sore is often followed by the advance of other tumours to suppuration, or the formation of new ones. Thus one train of evils succeeds another, till the discharge and irritation together seriously weaken the patient; or the disease fixes on some organ of high importance in the economy, followed by hectic derangement, extreme debility, loss of sleep and appetite, colliquative perspirations, diarrhœa, and a state of more or less urgent danger.

One of the common effects of scrofula is a remarkable tendency to the formation of *chronic abscesses*. Their frequent occurrence in the absorbent glands I have already noticed. The same disposition to suppuration is also exemplified in discharges from the ears, nose, vagina, and lachrymal passages, so common in scrofulous children. A similar tendency is likewise often manifested in the cellular tissue of different regions. The cases, termed *psoas*, or *lumbar abscesses*, have long been very correctly regarded as scrofulous: in fact, many patients, afflicted with them, have, or have had scrofula in other forms. Most of those indolent collections of pus, which are termed by the French *abcès froids*, are true scrofulous diseases; and in many instances originate from the irritation of a diseased bone, or joint near them. It is indeed of great practical importance to remember, that many scrofulous abscesses do not begin with disease of the soft parts, but with morbid changes in the synovial membranes, cartilages, or spongy parts of the bones. Lumbar abscesses are generally connected with disease of the vertebræ; and scrofulous suppurations in the hand or foot are mostly a secondary effect of disease of the phalanges of the fingers or toes, or of the carpal or metacarpal, or of the tarsal or metatarsal bones. Many abscesses of the ear in scrofulous children are likewise complicated with necrosis of the meatus auditorius, or even of the ossicula within the tympanum. While the lymphatic and mesenteric glands, the skin, the eyes, the ears, and joints are particularly liable to scrofula in children and young subjects, the lungs become after the arrival of puberty equally prone to tubercles, which are now set down by the greater number of pathologists as a form of scrofulous disease.

Those who doubt the accuracy of this doctrine, observe, that the time of life for scrofula is from childhood to puberty, while tubercular phthisis does not usually show itself before the latter period, and prevails most extensively between the ages of twenty-five and thirty-five; that is, in the very stage of life when the tendency to scrofula appears to terminate. They remark that individuals often reach the worst stages of scrofula, without exhibiting any symptoms of tubercular formations; while, on the

other hand, these latter very frequently take place unaccompanied by any scrofulous affection. It is declared, that in Scotland, Belgium, Dauphiny, Le Valais, Lower Brittany, and some other parts of the world, there is less phthisis than in other countries, where scrofula is much less common. These arguments, plausible as they may seem, do not appear to me to carry great weight; because tubercles, regarded as a form of scrofula, are admitted to be influenced in their production by the age of the individual, and, no doubt, also under particular circumstances, by the climate and country in which he resides. Hence the tubercular varieties of scrofula may bear a larger proportion to other forms of this disease in one place than another, and always do so between the ages of twenty-five and thirty-five. Thus we know, that tubercles and other scrofulous diseases more frequently exist together than is sometimes imagined.

*Tubercles* or *tubercular formations* consist of a greyish semi-transparent caseous, inorganic substance, and in their smallest size are not larger than a millet seed; but by agglomeration often produce much larger masses. In time, they become softened, and this change is followed by suppuration. As they are often extensively disseminated in the lungs, they destroy the original texture of these organs, which become disqualified for the efficient performance of respiration. The matter formed in the situation of tubercles, termed vomicæ, making its way into the ramifications of the bronchi, is coughed up from the trachea, occasionally mixed with blood. Pulmonary phthisis is thus really a scrofulous disease. But the lungs are not the only viscera, in which scrofulous tubercles frequently occur, for they are met with in the spleen, peritoneum, intestines, brain, and liver.

Tubercles, as I have already stated, are at present mostly regarded as effects of scrofula, and though Dr. Abercrombie detected some differences between the constituent parts of scrofulous glands and pulmonary tubercles, Professor Carswell tells us, in his Illustrations of the Elementary Forms of Disease, that he detected the tubercular deposit in abundance both in the lymphatic glands, and in those of the mesentery, when the seat of scrofulous disease. It may exist in the tissues in an infiltrated state, as in the bones and around the joints; and although the character of the affection does not change, the name of tubercle is here no longer assigned to it.*

The lymphatic glands are frequently attacked by scrofula in a secondary way. Thus, in children afflicted with porrigo, the glands under the ear and lower jaw after a time inflame, and, if the constitution be scrofulous, they will become the seat of strumous disease. They may also swell from the irritation of catarrh and sore throat. When the glands of the mesentery become diseased, it is often in consequence of a diseased state of the mucous membrane of the bowels. The glands in the groin and armpit frequently swell, as the consequence of disease in the adjoining limb, and where a tendency to scrofula prevails, such swelling will be so influenced by this condition of the system, as to become a tedious scrofulous abscess or ulcer.

That some peculiarity of constitution, original or acquired, must be a *predisposing cause of scrofula*, is now generally acknowledged, difficult as it is to define precisely what the nature of such peculiarity may be. According to some pathologists, there is an undue preponderance of the white over the red tissues, or, as Portal supposed, a deficiency of red

* Eager in Dubl. Journ. of Med. Science, vol. v. p. 345.

blood in relation to the great quantity of colourless fluid in the vessels. Baudeloque ascribed the disease to some imperfection in the original preparation of the blood; Bordeu to derangement in the nutrition of the different textures of the body. An individual, originally free from a scrofulous diathesis, but afterwards exposed to certain noxious influences, may become the subject of scrofula; indeed, under certain circumstances, scrofula may perhaps affect any kind of constitution.

What is called a *scrofulous constitution,* is not invariably accompanied by the same appearances. Some individuals have a pallid countenance, a deficient proportion of vessels filled with red blood, and a redundance of white tissues, the abdomen is tumid, the muscles are loose and flabby, the circulation is languid, and there is a want of vigour both in the mind and body. Other subjects of scrofulous diathesis have a great deal of colour, an accelerated circulation, and a precocious development of the mental and corporeal powers. In such persons, it cannot be said, that there is any deficiency of vessels containing red blood. With regard to the scrofulous diathesis, which often seems to be congenital, though it may undoubtedly be acquired after birth from the influence of various detrimental circumstances on the system, it appears to be referrible to the fact adverted to by Mr. Lawrence, that each individual has something peculiar to himself in his bodily organisation; that there are infinite varieties of natural organisations in the human species, and that, in individuals, distinguished by some of them, there is a greater or less susceptibility of particular forms of disease. This view would not, however, lead me to doubt the fact, that a constitution, originally perfect, may be so changed by various influences as to become at a subsequent period prone to scrofulous disease. Still those constitutions, which are congenitally disposed to scrofula, will have the disease brought into action by causes which will not invariably excite it in other temperaments. Amongst the *exciting causes of scrofula* are usually specified various circumstances tending to produce debility, or, at all events, to leave the system in a seriously disordered state, as fevers from contagions of a specific kind, like measles, scarlet fever, and small-pox. Hence, previously to the introduction of vaccination, scrofula prevailed even to a greater extent than at the present time.

Of late years, scrofula, and many other diseases, have been ascribed to disorder of the digestive functions, little trouble being taken to consider fairly whether such disorder may not be rather the common effect, or accompaniment of such diseases, than the cause of them. To say that, in scrofula, there is always more or less disorder of digestion, and primarily of no other important function, is an hypothesis that cannot be reconciled with the fact of the occasional existence of scrofulous disease in the fœtus. Impure air, unwholesome diet, unhealthy employments, uncleanliness, and exposure to a damp cold atmosphere, are undoubtedly frequent exciting causes of scrofula, and sometimes communicate a disposition to the disease, even where none originally prevailed. Yet these noxious influences will operate to this extent only in a limited proportion of individuals; for we find, that in a given number of children, all living together under the same roof, breathing the same atmosphere, feeding and sleeping together, and clothed exactly alike, only two or three become scrofulous. Here then we must return to predisposition, and original kind of constitution, organisation, or susceptibility, as an explanation of the difference.

Of all the exciting causes of scrofula, the operation of climate is the

most powerful; for scrofula prevails in the greatest degree in countries which are remarkable for their damp, cold, and variable atmosphere. Individuals, living in warm regions, are more rarely affected; but no sooner do they come to a damp cold changeable climate, than they are even more liable to scrofula than other persons. This is exemplified in the great frequency with which children, brought from the East and West Indies to this country, suffer from the disease. The same thing is also seen in African Blacks, and the natives of the South Sea Islands, many of whom are destroyed by tubercular phthisis. The monkey also, a native of warm regions, is in the same case.

Notwithstanding the general truth of the preceding statements, respecting the comparative rarity of scrofula in hot, and also, I believe, in extremely cold countries, it is certain that the disease, and this even in its worst or tubercular form, is a source of considerable mortality in Italy, Spain, Minorca, Malta, and several other countries, whose shores are washed by the Mediterranean Sea.

It is probably in consequence of the influence of damp and cold in promoting scrofula, that patients generally suffer more from it in one season of the year than another; their complaints being worse in winter and spring, and better in the mild dry weather of summer and autumn.

Besides atmospheric influence, various other influences deserve to be regarded as promoting the occurrence of scrofula, especially where the organisation of the individual renders him, as it were, predisposed to the disease, and he is residing in a climate favourable to its origin. Improper or insufficient diet, neglect of regular exercise, bad nursing, insufficient clothing, inattention to cleanliness, and the residence of children in badly-ventilated crowded dwellings. Hence the frequency of scrofula amongst children who work for many hours daily, crowded together in the unwholesome atmosphere of cotton factories, often badly fed, and, at all events, deprived of that beneficial influence, which due exercise in the open air would have upon their digestive, cutaneous, nervous, sanguiferous, and muscular systems. Period of life has considerable influence, not only in facilitating the attack of scrofula, or in making the individual less susceptible of the disease, but in determining the organs and textures in which it will be most likely to take place, if it is to come on. The period of life, between the termination of suckling and the arrival of puberty, is that in which the greatest tendency to scrofula prevails. In many individuals, as Mr. Lawrence observes, the whole of this period is occupied by a succession of attacks of scrofulous disease in the absorbent glands, the skin, and the joints, and very often it exists in several of these parts at one and the same time. In individuals who have had scrofula in these various shapes, extending over the whole of the body, and who have been for several years the subjects of the most serious forms of disease up to the time of puberty, it is by no means uncommon to find the attacks then decline, and such persons to become healthy and vigorous. At the time, however, that this particular change takes place, and the succession of disease in the eyes, glands, ears, joints, and skin is stopped, it not uncommonly happens, that the disease is developed in other more important parts, as the lungs, the mammary gland, or the testicle. Sex also makes some difference; for, according to a calculation of M. Louis, the proportion of scrofulous males to females is only as seventy to ninety-two, or according to the estimate of Lepelletier, as three to five. This fact is ascribed by M. Jolly,

Dr. Stokes, &c. to the greater abundance of white tissues in the latter than the former.

Scrofula is not contagious. Kortum, Pinel, Alibert, Dupuytren, Lepelletier, and others, tried in vain to communicate the disease, either by making healthy children sleep with scrofulous ones, or rubbing the skin of a healthy child with scrofulous matter, or by inserting it under the cuticle, or introducing in into the veins or stomach. With respect to the power of a scrofulous nurse to impart scrofula to the child at her breast, it is sometimes suspected that, as her milk is imperfect and not well adapted to nutrition, she may communicate to such child a predisposition to the disease; but the notion of her doing this by the action of any contagious principle, or virus, is now universally rejected. Even the suspicion adverted to is far from being unequivocally well founded.

According to M. Lepelletier, privation of solar light has considerable influence in giving a tendency to scrofula; but, though it certainly occasions a pale complexion, a flaxidity of fibre, and a general bloated appearance, these changes may not amount exactly to the state implied by the term scrofula. Independently of the redundance of white tissues and fluids, conjectured to form one of the chief attributes of a scrofulous constitution, and at the same time one of the chief anatomical characters of scrofula, there is no doubt that the composition of the fluids of scrofulous individuals is more or less altered; especially that some of them contain an extraordinary proportion of the phosphate and carbonate of lime and the chloruret of soda; and that these same principles enter copiously into scrofulous tubercles. M. Labillardière, a chemist at the Veterinary School of Alfort, has ascertained that the milk of a cow, affected with tubercles, contains seven times as much phosphate of lime as the milk of a healthy cow.

The vascular system of scrofulous persons appears to Dr. Macartney to be weak, the vessels small, the blood deficient in quantity, and not possessing the full power of generating coagulating lymph. The secretions, which indicate strength, seem to him to be deficient; the fat of the soft parts, and the marrow of the bones, to want the genuine oily composition; the earth of the bones not to be formed in proper quantity; the unctuous secretions of the skin to be deficient; the sebaceous secretion to be albuminous and inodorous, and liable to dry and produce irritation of the parts it ought to protect. The mucous and serous secretions appear to Dr. Macartney to be the only ones perfectly formed; and he describes the brain as pale, and not having the usual quantity of red blood. *

## TREATMENT OF SCROFULA.

On this subject I shall here make only a few general observations, because the practice, applicable to particular forms of the disease, is more conveniently considered in other parts of this work.

A scrofulous constitution will generally derive infinitely greater benefit from regimen, diet, pure air, proper exercise, &c. than from medicines, which are not, however, to be neglected. The cure of some forms of scrofula will mainly depend on improvement of the system at large, as may be said to be the case with scrofulous ulcers. But there are other examples, in which the local treatment is more efficacious than the inter-

* On Inflammation, p. 82.

nal; and such is scrofulous disease of the bones and joints, as well as one variety of lupus, a tubercular affection of the skin of the nose, now frequently regarded as scrofulous.

When we remember the circumstances which operate as exciting causes of scrofula, we must immediately see, that one of the chief means of obviating that morbid condition of the system, which accompanies scrofula, is the removal of the patient from the reach of various detrimental influences. If he be residing in a damp, cold, badly ventilated, crowded place, he should be immediately taken from it. If his diet be faulty in point either of quality or quantity, it should be rectified. If his clothing be insufficient to protect him effectually from the influence of damp and of sudden changes of the atmosphere, it should be made warmer. If the patient be a child, kept in a sedentary state, working in some crowded factory for a great part of the twenty-four hours, it should be taken from such employ and place, and allowed to have the benefit of a salubrious air and healthy exercise.

The doctrines of the late Mr. Abernethy make the principal indication in the treatment of scrofula to consist in the improvement of the state of the digestive functions. While I do not admit the truth of the theory, that the origin of scrofula is essentially dependent on disorder of the digestive organs, I fully concur in the advice, that we should always endeavour to restore the natural and healthy functions of those important viscera when in any respect deranged. This indication, in fact, has not been neglected by practitioners who lived half a century ago. Whoever compares the practice of Mr. Charles White, in giving small doses of calomel, occasional purgatives, and the simple or compound decoction of sarsaparilla, with the blue pill, sarsaparilla, and laxative treatment of Mr. Abernethy, will see no very material difference between them, especially when the stress, which White laid upon attention to diet, clothing, the avoidance of damp and cold, and the usefulness of good air and regular exercise, is taken into the acoount. Mr. Abernethy's practice consisted in giving five grains of the blue pill every night, half a pint of the compound decoction of sarsaparilla twice a day, and, if the bowels did not act by a certain hour every day, some aperient medicine was administered. The plan was followed up until the bowels became regular; and then, with the view of preventing a relapse, five grains of the compound calomel pill were given every night for an indefinite time. When acidity prevailed, small doses of the carbonate of soda were prescribed; and when the stomach was weak and the appetite bad, bark, steel, and the mineral acids were recommended.

A light nutritious diet is generally found to agree best with scrofulous patients; but it should not include wine and porter, unless the forms of disease are attended with profuse suppuration and hectic debility. When the tongue is foul, the breath bad, and the belly tumid, it is advisable to let the treatment commence with brisk purgatives, as jalap and scammony, or the compound powder of scammony, or the antimonial powder and calomel. Such medicines may be given in proper doses at night, and their operation promoted by giving the senna mixture, or castor oil, on the following morning.

The bowels, having thus been well opened, we may next employ milder medicines of the aperient and alterative kinds, as rhubarb and the subcarbonate of soda, to which a small quantity of mercury with chalk may be added. Then, with such treatment may be combined, after a short time, the employment of tonic medicines, as the infusion of cascarilla, the

sulphate of quinine, and other preparations of bark, or the infusion of calumba, with or without the vinum ferri, or we may give either the compound infusion of gentian, with the subcarbonate of soda; or else the compound decoction of sarsaparilla, with the diluted nitric or sulphuric acid. Those who believe in debility, as essentially conducive to the origin of scrofula, place their chief dependence on tonics, and especially bark, quinine, steel medicines, and cold sea-bathing, or the shower bath, and flesh-brush. If the skin be dry, antimonials are used. Mercury has sometimes been decried as decidedly injurious to scrofulous patients; but this is only a prejudice, apparently derived from the notions about debility, or from the fact of scrofula often following a course of mercury, instituted for the cure of syphilis. Mercury in small alterative doses is often beneficial; and, in scrofulous ophthalmy, even the freer use of it one of the best means of removing the opaque matter sometimes effused in the cornea.

The fear of prescribing mercury for scrofulous patients has now, however, nearly subsided; and surgeons frequently order, besides the preparations I have mentioned, the bichloride, one grain of which is dissolved in an ounce of the tincture of bark, and given in the dose of a teaspoonful, three or four times a day. All the foregoing plans are founded upon the aim of improving the health in general, and do not embrace the idea of combating scrofula with any specific. Amongst the medicines, which have attracted celebrity for their supposed *specific virtues* against scrofula, I have to mention conium or hemlock, the chloride of lime, the chloride of barytes, the sesquicarbonate of soda, and preparations of iodine. As for hemlock, it has now lost the reputation of being a specific, though sometimes prescribed in equal proportion with the compound calomel pill as an useful alterative. The chlorides of lime and barytes, I believe, are completely out of favour. The sesquicarbonate of soda is undoubtedly a useful medicine; but not entitled to be regarded as possessing any specific power over the disease. It is often joined with rhubarb and a few grains of the hydrargyrum cum creta, or with rhubarb and cascarilla; which formulæ are sometimes beneficial as alterative medicines, but nothing more. With respect to iodine, it is at present in considerable repute, and as prescribed by Dr. Lugol for internal use, in small doses, varying from half a grain to two grains in the twenty-four hours, dissolved in distilled water, with double its proportion of iodide of potassium, seems to possess considerable power over some forms of scrofula. Dr. Lugol also employs iodine in baths and lotions to a much greater extent than is done in this country. His baths contain about two grains of iodine in each pint of water, and his lotions for ulcers, &c. about one grain and a half, dissolved with iodide of potassium.

## OF THE VENEREAL DISEASE.

### LUES VENEREA — SYPHILIS.

By the "venereal disease" are usually signified certain morbid changes, produced in various textures of the human body by the action of a specific morbid poison. Some writers, however, extend the meaning of the expression further; for they make it comprehend not only *syphilis*, or the *true venereal disease*, but also clap, or *gonorrhœa*, sores of different descrip-

tions on the genitals, and numerous effects or accompaniments of the latter complaints. Such writers do not speak of the *venereal disease* in the singular, but in the plural number, and offer a description not of one disorder, but of several, under the appellation of *venereal diseases*, the varieties of which are sometimes ascribed to the existence of different kinds of venereal poison, each capable of producing distinct and peculiar effects on the part and constitution.

Now, if it be inquired what we know about any venereal poison, and what proof we have of its existence, the answer is, that it has never been detected in a separate form, and nothing is known respecting its appearance, colour, consistence, or any of its general or chemical qualities. Venereal pus, considered in all its relations, may present globules more or less similar to those of other kinds of pus; it may, according to situation, be mixed with other secretions, normal or morbid, especially with mucus; but its most distinguishing property is that of being capable of inoculation, the results of which are characteristic and specific.* The only further explanation that can be given of it, is perhaps what Mr. Lawrence has suggested, namely, that it is that state of the secretion of a sore, which renders it capable of producing the disease in another person, or that state of the blood in the mother which renders it capable of communicating the disease to the *fœtus in utero;* but what that particular state is we are unable to describe; we are only able to observe its effects, and judge from them that a virus or poison is concerned.

A chancre, or primary venereal sore, produces pus of the specific kind, however only in a certain stage of it; and, as M. Ricord believes, it is from inattention to this simple fact, that the results of inoculation with the matter of venereal sores have been disputed or involved in uncertainty. It is plain that a primary syphilitic ulcer cannot be the same in all its stages, and that it could never heal up, did it not at length change into a simple sore. If we are to believe M. Ricord, it is during the progress or the stationary state of a chancre, while no work of cicatrisation is going on in it, that it secretes the venereal virus, which is not at all dependent upon the greater or lesser degree of inflammation accompanying the chancre.† On the other hand, Dr. Wallace inferred, that a bubo was rarely or never formed, *i. e.* the poison was never absorbed so as to affect the glands in the groin, until some part of the ulcer had produced granulations, by which such absorption was effected. If this view be correct, and the granulating process be a part of the work of cicatrisation, the two foregoing doctrines are at variance with one another; but I am not sure that M. Ricord extends his meaning to the stage of granulation, for a chancre that has granulated may become stationary.

It would not appear to be the nature of the venereal poison always and inevitably to excite inflammation, ulceration, or disease of the part to which it is applied in any shape; it cannot therefore be a very active and quickly penetrating agent; and though the proportion of cases, in which the poison takes effect, is considerable, experience proves, that many individuals, exposing themselves to the risk, come off with impunity. When the contrary happens, the poison, after the expiration of a variable space of time, which appears to be requisite for it to make an impression,

* See Ph. Ricord, Traité Pratique des Maladies Vénériennes, p. 55. 8vo. Paris, 1836.

† Op. cit. p. 85.

produces changes, not only in the part to which it is immediately applied, but, at a subsequent period, in a given number of examples, disease in other situations, in consequence of its absorption into the system.

Syphilis cannot be propagated from individual to individual through the medium of the breath, nor of the atmosphere, nor apparently through the medium of any of the ordinary natural secretions, and certainly never by one person merely touching the sound part of the skin of another individual labouring under the disorder, as was at one time believed.* With the exception of what may happen between a syphilitic pregnant female and the child in her womb, only one way is positively known in which the disease can be communicated, and that is through the medium of the specific poison, blended at the time of its application with pus, or some other morbid secretion. Such infectious matter begins its action by exciting inflammation, followed by a pimple, or pustule, which is gradually converted into an ulcer. Of course, such ulcer is almost always on the parts of generation; but, if a person accidentally prick himself with a lancet infected with venereal matter, or if such matter happen to come in contact with any abraded part of the skin, syphilis may then commence in other situations.

The symptoms or effects of the venereal disease are divided into the *primary* and *secondary*. The primary are those which arise from the direct application of the poison to the part, namely, *ulceration* of that part, often followed by a *swelling of the absorbent glands*, to which the lymphatics of the ulcerated texture first direct their course; the sore receiving the name of *chancre*, and the glandular swelling that of *bubo*. The latter is deemed one of the primary effects, because excited not really by the poison after its entrance into the circulation (as all the secondary symptoms are believed to be), but by its directly irritating the gland or glands, as it is passing through this portion of the absorbent system into the blood.

The application of the poison does not invariably cause a chancre. It seems as if some individuals were less susceptible of the venereal disease than others, and, no doubt, those who are attentive to ablution, after a suspicious connexion, much oftener avoid being infected, than other parties who neglect this precaution. Nor does the poison, when it gives rise to a primary ulcer, or chancre, constantly lead to the formation of a bubo. I may say, that in the majority of cases, the latter swelling is not produced, and this sometimes even when secondary symptoms follow, and the poison has found its way into the constitution.

The *secondary symptoms* are all those effects of the disease which take place from the introduction of the poison into the circulation, whether ulceration of the throat, cutaneous eruptions, ulcers, or excrescences on the surface of the body, inflammation of the iris, various affections of the nose, ears, testicles, larynx, or joints; and, in the osseous system, severe pains, nodes, caries, or necrosis. These secondary symptoms, which make the *constitutional form of the disease*, do not occur, however, with any regularity. In many cases, they never show themselves at all; while in others, they take place with great severity, though there may be no remarkable differences in the appearance of the primary ulcers, or the kind of treatment, to account for this diversity of consequences. In a given number

* While such doctrines prevailed, medical writers did not deem it at all indelicate to publish the venereal cases, met with in virtuous princes, holy abbots, and pious prelates. See Ph. Ricord, op. cit. p. 94.

of cases of primary symptoms, under any plan of treatment, secondary symptoms will occur only in a limited proportion of the patients.

M. Ricord, by means of inoculations with venereal matter, practised repeatedly and extensively, has the merit of having, perhaps, settled some points, relative to syphilis, which have until lately been a source of endless dispute. Amongst other things, his experiments prove, that the cessation or the continuance of the primary complaint, whatever may be the period of its duration, does not make the patient incapable of contracting others; and his investigations, verified by Fricke, Lallemand, Ruef, and Blandin, fully establish the doctrine, originally promulgated by Hunter, that the number of secondary symptoms is not at all in relation to that of the primary ones; and that no more constitutional effects will follow two, three, four, or five chancres *contracted at the same time*, than if there were only one chancre.*

In this work, I shall not dwell upon the facts and arguments against the opinion, that the venereal disease began in Europe towards the close of the fifteenth century, having been either brought to this quarter of the world from St. Domingo by the followers of Columbus, or having broken out from unknown causes in the French army then besieging Naples. Every consideration that I have been able to give to the subject leads me to believe, that the venereal disease has existed from time immemorial; that it always has existed, and always will exist, in every populous country, where promiscuous sexual intercourse takes place. Those, who ascribe the origin of syphilis to the latter part of the fifteenth century, are much influenced by one fact, which is, that down to that period no description of any disease, corresponding exactly to what we call syphilis, had been given by medical writers; and although ulcerations on the genitals, and buboes, had been commonly treated of, no mention was made of the secondary symptoms, no connexion was ever traced, or even suspected, between the primary effects, as they are called, and the sore throat, cutaneous affections, and the pain and swellings of the bones, which we denominate secondary ones. Perhaps, however, it is scarcely allowable to infer, that because no notice is taken of the secondary symptoms of the venereal disease in the old works on medicine and surgery, that such complaints were not in existence previously to the close of the fifteenth century. The relation of the primary and secondary symptoms to one another might have been overlooked; it might never have been suspected when there had been a chancre on the penis, that the sore throat, cutaneous affection, or node, which came on subsequently, had any connexion with the sore. Certainly this will not seem incredible when it is recollected, that it was not until a recent date that some particular effects of the venereal disease were made out; and that, even at the present day, with all the advantages of a better system of pathology, our knowledge of many circumstances, relative to this extraordinary disease, is very obscure and uncertain. Thus, two or three hundred years hence, when it shall be recorded to posterity, that, at as late a period as the year 1800, no account had been given of syphilitic iritis, and that the true character of gonorrhœal ophthalmia had not been described, I think it would not be correct to infer, that those affections had no existence until the time when they began to be discussed in works on surgery. Their not having prevailed, and their not having been described, are two different things.

* Ricord, op. cit. p. 84.

Not only are diseases of the genitals acknowledged to have existed from time immemorial, but we have every ground for believing, that they were of a contagious nature. This seems proved by the precautions adopted by various governments, to prevent the extension of such disorders among the population. Thus, in the borough of Southwark, prior to the time sometimes fixed upon for the origin of syphilis, there were places called *stews*, where prostitutes were confined, and received the benefit of surgical assistance. They were taken up and put into these establishments, whether agreeable to them or not, by virtue of certain decrees, made expressly to protect the rest of the community from the risk of catching their complaints. At the same time, or even earlier, similar establishments were formed in Paris, Edinburgh, Avignon, and even in the holy city of Rome, under the Pope's nose, under the walls of the Vatican itself, with an abbess at the head of it.

In relation to the origin of syphilis, one interesting question presents itself, namely, are we to fancy that the disease never had but one primary source? and that it is to the mysterious concoction of the specific virus by one couple of individuals, that all quarters of the world, and all generations, are under obligations for the gift of the venereal disease. No doubt, syphilis must have had a beginning, like every thing else; but probably it has had numerous beginnings. Various considerations would lead us to expect (what is indeed the fact), that in every country where the population is numerous, and promiscuous sexual intercourse exists, the venereal disease would be prevalent. Mr. Travers expresses his conviction, that if all the syphilis in the world were now to be annihilated, a never-failing source of the disease would still remain in the action of the matter of superficial or gonorrhœal ulcers of the penis on the human constitution. If I have a correct comprehension of this gentleman's views, however, he looks upon the poison of syphilis and that of gonorrhœa as identical, and the suggestion which I have quoted from his interesting remarks on the pathology of the venereal disease, perhaps, necessarily involves that conclusion; but this is a disputed point, and the greater number of professional men do not now take the same view of it as John Hunter did. The experiments of M. Ricord are asserted, indeed, to furnish complete and ocular proof, that whenever inoculation with what is called *gonorrhœal matter* communicates the venereal disease, chancres exist in the passage, which is the source of the matter of the supposed gonorrhœa. Some persons, as Dr. Macartney notices, are subject to inflammation of the glans penis and prepuce, after copulation with healthy women. Sometimes a female will suffer after marriage an extensive inflammation of the internal labia and vagina, attended with a purulent discharge, although no venereal disease has been communicated. Dr. Macartney conceives it possible, that the transmission of pus, generated in this way, and mixed with other secretions, might have given origin to true venereal inflammation.*

I have explained, that the venereal disease is commonly believed to be communicable only through the medium of pus. The late Mr. Hey, of Leeds, was induced, however, to regard this doctrine as incorrect; and, from some cases which came under his observation, he suspected that the disease might sometimes be communicated, not only after all ulceration and suppuration had ceased, but even when the person giving it to another was to all appearance in perfect health; but whoever reads the

* See Macartney on Inflammation, p. 103.

cases, on which Mr. Hey founded this extraordinary inference, will perceive how great was the possibility of his being deceived by the patients, who gave him the histories of their cases. Some particulars involved the honour of the individuals themselves, and therefore they might have been ashamed of disclosing every secret relative to their cases. It is more rational, I think, to suppose that Mr. Hey had been deceived by the patients themselves, than that any such mysterious sources of infection existed, as those implied by his view of their cases. The idea that syphilis can be communicated by a person so healthy, that he has no venereal matter formed upon any part of the surface of his body, or indeed any visible or palpable complaint whatsoever, is a problem, that every thing yet ascertained about the nature of syphilis tends to refute. As the venereal disease may be transmitted from the mother to the fœtus through the medium of her blood, many surgeons have been inclined to suspect that it may be also communicated through the medium of the natural secretions, such as the saliva, the semen, the milk, &c. With respect to the fœtus we may infer, that it receives the infection by means of the circulating blood, in the same manner as the mother herself receives her secondary symptoms; but with regard to the saliva, semen, and milk there is no clear evidence that these natural secretions will serve for the transmission of the disease. I believe with Mr. Travers, that none of the common natural secretions of a contaminated individual can communicate the disease to other persons. The following statement in this gentleman's work is interesting: a man who has syphilis in the secondary form, provided he be free from all affections of the genitals, will communicate no taint to his progeny, any more than to his wife; but a healthy wet nurse, getting a sore nipple in consequence of suckling a pocky child, and having secondary symptoms, will communicate the disease to the fœtus of which she may become pregnant. Now this is agreeable to the usually received opinions, that the blood will contaminate the embryo, though all genital sores may be absent, and though the party cohabiting with the woman, is beyond the sphere of the influence of the disease in her. So far, then, as the present state of our knowledge reaches, we may conclude, that the disease is only communicable through the medium of purulent fluid, and not an ordinary natural secretion, with the exception of the mode of its transmission to the fœtus, which receives the infection through the circulation, and may be regarded as under the same circumstances, with respect to the secondary effects of the disorder, as the mother herself. There may also be an exception to the general principle in what happens between the pocky child and its nurse, provided the disease in the former is to be regarded as the constitutional modification of it, transmitted through the blood of the mother.*

The effects of the venereal disease are different in different individuals; two men may have connexion with the same woman; both may catch the disease, but one will have it severely, and the other only in a slight and mild form. One man has been known to give the disease to different women; some of whom have had it in a lenient shape, while the others have suffered most severely. Sometimes the same individual will have

* Certain descriptions would tend to prove, however, that the ordinary secretions of the female organs are sometimes the medium or vehicle of infection. M. Ricord joins in the belief, that the disease may be communicated through the medium of common secretions, mucus, milk, &c. "If," says he, "the mouth of a child may infect its nurse, the breast of the nurse may infect the child." Op. cit. p. 95.

two or more sores of different kinds at the same time. In some examples, sores of the Hunterian character are seen on the glans penis, while sores of other descriptions are close by them. One of the most curious circumstances in the venereal disease is not unfrequently exemplified in the army: soldiers are sometimes gregarious in their amours: a party of six or eight will have connexion, one after another, with the same woman. In this manner, several men contract disease from the same source, and on one and the same occasion; yet they do not all suffer in the same manner. Some have sores of one kind; some of another; and some, various sorts of ulcers; while others will contract a discharge from the urethra. That discharge, however, according to the experiments of M. Ricord, if capable of communicating a chancre by inoculation, has always for its source some venereal ulceration in the part from which it proceeds. It is not, however, every gonorrhœa, or discharge from the urethra, that has this property.

"Ever since I have employed the *speculum* uteri in the investigation of venereal complaints (says M. Ricord), many perplexities about them, previously inexplicable, have been reduced to the most ordinary and simple facts. With this instrument I have ascertained, that a woman may be simultaneously affected with blennorrhagia and deep-seated chancres in the vagina and uterus, so that, though considered only to be labouring under blennorrhagia, she might well communicate chancres and blennorrhagia together, or merely one of these affections." M. Ricord further declares, as the result of numerous observations, that whenever he has had the opportunity of examining women who had communicated disease, he had never found that a chancre had originated from a discharge, unattended with ulceration in the genital organs of the female from whom the complaint was contracted. Inoculation afterwards confirmed what the observations made with the speculum had established. It is not, however, according to M. Ricord, every state of ulceration in the vagina or womb, keeping up a discharge, that will admit of a chancre being produced by inoculation with such discharge; for, if it be in the granulating stage, it is no longer adapted to this purpose. On this point, however, M. Ricord leaves us in some difficulty; for, in another part of his work (p. 137.) he admits, that what he terms the *specific ulcerative period* is indefinite, and that he has inoculated with pus derived from sores of eighteen months' continuance.

Supposing it to be clearly proved, continues M. Ricord, that "the muco-purulent secretion, taken from the female genital organs, can never produce a chancre, when the speculum demonstrates that no ulcerations of this nature exist in those parts, it is allowable by the most rigorous analogy and the closest logic to conclude, as I have done, that whenever a discharge from the male urethra has communicated a chancre to a woman, there must have been something more than gonorrhœa about the man, and the urethra, at some point of its extent, must have been the seat of a chancre."

As for the Hunterian hypothesis, which supposes the cause of gonorrhœa and syphilis to be identical, and the difference of effect to depend upon the textures affected, the poison when applied to a non-secreting surface being supposed to give rise to chancre, and applied to a mucous one being fancied to occasion gonorrhœa, M. Ricord argues, that, if this were true, the muco-purulent discharge from the urethra ought, when put on the skin, to cause a chancre; and the pus of a chancre, applied to mucous membranes, ought to cause gonorrhœa. But M. Ricord asserts it as a well-known fact, that gonorrhœal matter never produces chancre on the

skin, and that when it is applied to any mucous membrane, and has effect, it gives rise only to a discharge. He further observes, that the matter from the urethra, applied to the mucous membrane of the eye, has never caused chancres in that texture, or the eyelids; *nor*, on the other hand, says he, has *the muco-purulent secretion of gonorrhœal ophthalmia ever given rise to chancres by inoculation, or otherwise*, although the eyelids are capable of being the seat of such ulcers. When a bubo has originated from gonorrhœa, and suppurated, M. Ricord has constantly found, that no disease can be imparted by inoculation with the matter. The same fact he has repeatedly made out in relation of the matter of abscesses, now and then following inflammation of the testicle from clap.

Many of the circumstances, which have been noticed, are adverse to the opinion, that syphilis is owing to a plurality of poisons; for here are many different effects, apparently produced from the same source. Facts of this nature, however, create considerable difficulty in the investigation of syphilis,—a difficulty that cannot be solved by reference to peculiarities of constitution or states of health; for certainly no explanation on these principles will account for two or three different kinds of sores occurring in the same individual on the same part, and all at the same time. Neither can the circumstances be ascribed to the differences of texture between the prepuce, glands, and corona glandis. No doubt, the kind of texture often modifies the appearances of sores; but this will not explain the peculiarities I have mentioned, because sores of different kinds are met with on one and the same texture; as, for instance, on the prepuce, or on other parts of the skin of the penis. The researches and experiments of M. Ricord, however, if established beyond all doubt, would throw considerable light on some points here noticed. I would also remark, that before any inference can be drawn from the circumstances mentioned with respect to profligate soldiers, a minute investigation into their cases would be essential; for it is hardly to be credited, that such individuals would not be in the custom of cohabiting with a great number of women in a short space of time, and not merely with the one who received them in a gregarious way.

That the effects of the venereal disease are modified by climate, mode of life, and state of the general health, is universally acknowledged. Hence syphilitic affections get well with greater facility in warm climates, and the symptoms are much milder there than in cold countries. The observations, made by Dr. Ferguson on the venereal disease in Portugal and the West Indies, leave no doubt on these points. When the British army was in Portugal, our soldiers suffered severely from this disease; yet the natives, from whom they caught it, had it in an exceedingly mild form; so that, while amongst our troops it made terrible ravages, occasioning in many of them the worst of mutilations, the natives suffered but very slightly, and got well under what would here be regarded as inert treatment. Attempts have indeed been made to explain these facts by the greater excesses which our soldiers were guilty of, and their habit of drinking more spirits and wine than the Portuguese; and no doubt, these circumstances must have had some share in rendering the disease worse in them, than in the more abstemious natives. Another question is, whether the greater mildness of the symptoms of the venereal disease in warm than in other countries, is to be ascribed to any modifications or changes in the nature of the poison, produced by the temperature or atmospheric causes? I think what has already been stated will refute this notion; for it appears

that in Portugal the British soldiers suffered severely from the disease; consequently, the virus must have possessed sufficient activity, provided the ravages alluded to were truly occasioned by the operation of the virus, and not by phagedenic diseases, independent of such a cause. Another question is, whether the greater mildness of the disease in warm countries is owing to the effects of the atmosphere in rendering the individual less susceptible of the influence of the disease; or whether it maintains the system in such a state as makes the disease yield more readily to the remedies employed. All these points are still disputed ones. The opinion, that the disease is continually getting milder and milder, and will in the end cease altogether, has been entertained almost from the earliest periods; at all events, nearly from the time of its supposed origin, towards the close of the fifteenth century; but, instead of adopting this conjecture, a more rational way of explaining its greater mildness at the present day will naturally suggest itself to every man of judgment and reflection; viz., by the consideration of its treatment being now conducted with much greater skill and discrimination, than it was forty or fifty years ago. Many, who incline to the opinion that the disease originated towards the close of the fifteenth century, lean also to the belief, that the disease is continually changing its nature, and becoming milder; for if they did not shape their conclusions in this manner, they would be obliged to renounce the other doctrine, respecting the time of the first origin of syphilis: because the venereal disease of the present time is totally different from the rapidly fatal and infectious disorder which broke out in the French army before Naples. As a matter of course, therefore, they must think, that syphilis has changed its nature, and assumed milder forms. Within my recollection, the disease was more severe than it is now; but the cause of this fact I should account for on a different principle; in fact, when I was a student at St. Bartholomew's Hospital, the treatment of this disease was what would now be considered injurious in the extreme, for it consisted in the administration of mercury in the most unmerciful and indiscriminate manner. The practice in those days was founded, indeed, on a doctrine now exploded, viz., that it is the invariable character of syphilis to proceed from bad to worse, unless checked by the power of mercury. This was undoubtedly a most pernicious error—one that led to the death of many unfortunate persons. When Mr. Abernethy was making investigations into the nature of the venereal disease, he went to all the most experienced hospital surgeons in London, and put these questions to them — whether the venereal disease is capable of spontaneous cure, and whether the primary symptoms can be removed and the disease be permanently cured without the aid of mercury? and from all these men of eminence he received the answer, that a spontaneous cure, or even one without mercury, was totally impossible. In those days, then, the opinion prevailed universally, that the disease would be sure to extend itself, and could not possibly admit of a salutary change, unless the patient were put under the influence of mercury. However, in the year 1813, in one of the early editions of this work, I happened to take into consideration some observations, inserted by the late Mr. Pearson in his Treatise on the effects of certain Articles of the Materia Medica in the Cure of Lues Venerea, and from which it clearly appeared to me, that what he stated was absolutely equivalent to an admission, that syphilis would sometimes, at least, get well under the administration of the most inert medicines. Although

this gentleman, whose experience at the Lock Hospital was unbounded, may be said to have added the weight of his authority to the maintenance of all the principal Hunterian doctrines relative to syphilis, any impartial man who studied his book could not fail to discern the clear admission in it, that a beneficial change was often brought about, in syphilitic cases, without the exhibition of mercury. Since the year 1813, the correctness of the view, which I then took, has been fully confirmed by subsequent experiments and observations. Amongst the investigations to which I allude, those made in the hospital of the Coldstream Guards by the late Mr. Rose are the most important. The great question, as to the spontaneous curability of syphilis, was by him completely settled. It was proved, that the venereal disease might be cured, not only without mercury, but without any medicines whatever. As for the cure without mercury, that indeed may be said not to have been a new discovery: the spontaneous cure was the great point made out. Many practitioners of the sixteenth and seventeenth centuries treated the venereal disease with considerable success without mercury, that is to say, by means of guaiacum, sarsaparilla, and antimony, occasionally aided by venesection and purgatives. If it had been the character of the venereal disease always to grow progressively worse without mercury, no patient could ever have recovered prior to the epoch when that medicine began to be exhibited, which is contradicted by abundant evidence.

Mr. Rose had vast opportunities of bringing the question to a decision; for he could not only put his patients under particular treatment, but he had it in his power to enforce its strict adoption, and to watch his patients for the requisite period of time. Now, he cured without mercury all the ulcers on the parts of generation, sores of every kind, which he met with in the course of between two and three years in a regiment of soldiers, together with all the constitutional symptoms that followed them. It is not to be understood, that none of those, who were cured of the primary sores without mercury, had no secondary symptoms; a certain proportion of the men, so treated, had them; but, be it noticed, that Mr. Rose cured both the primary and the secondary symptoms too on the same plan. Some of these cases were probably not truly venereal; yet others must be admitted to have been venereal; for it cannot be imagined, that there were not many cases of true syphilis in a regiment of twelve or fifteen hundred men, who were continually having intercourse with the lowest prostitutes of the metropolis. In the treatment pursued by Mr. Rose, all ideas of specific remedies were renounced; his general practice was to confine the patient in bed; various local applications were used according to circumstances; aperient medicines, antimonials, bark, diluted sulphuric acid, and occasionally sarsaparilla, were administered; these were the chief means resorted to. From these, and other accounts corroborating them, there can be no doubt, that the venereal disease, both in its primary and secondary forms, may be cured without mercury; but this is not settling the question whether such practice is the right method or not? And I have only mentioned the circumstance to prove, that the old notions about the progressive nature of the venereal disease, till stopped by the imaginary specific effects of mercury, were completely erroneous. The facts, established by Mr. Rose, are chiefly valuable on two accounts; first, as leading to more correct views of the diagnosis of the disease, inasmuch as they abolish the false doctrine, that all sores, healed without mercury, are necessarily not venereal, a maxim usually taught when I was a student; and, secondly, Mr. Rose's facts are import-

ant, as encouraging us to withhold mercury when the patient's health is not in a safe or favourable state for its exhibition. Thirty or forty years ago, surgeons were actually frightened into the use of mercury, lest the disease should get progressively worse and worse, and the mischief advance till the patient had been destroyed.

The venereal disease presents itself in a great variety of shapes, and is attended by apparently the most capricious irregularities, and this in relation both to the primary and the secondary symptoms: thus, we find, that some persons will have only superficial ulcers without induration around and below them, but with elevated or raised margins; while others will have sores, characterised by a hard circumference, an indurated base, an indisposition to granulate, and, in a word, all the features belonging to, what is called, the Hunterian chancre. Again, others will have phagedenic sores, entirely different from either of the other kinds now described; and while one individual will have only one sore of one of the descriptions here pointed out, another will have not merely a sore, corresponding to one of those varieties, but also a bubo; and a third will have gonorrhœa, in addition to the chancre and bubo. With respect to the secondary symptoms, these also exhibit the most perplexing diversities: the primary symptoms are frequently followed by secondary ones, as varied as the former, and even more so; thus, with regard to the cutaneous eruption, the spots on the skin may either be a scaly eruption, a papular eruption, a pustular eruption, or a tubercular eruption. The sore throat also, which is a common secondary symptom, presents itself in a variety of forms: there may be a deep excavated ulcer on the tonsils, or only a superficial ulceration of them; or there may be an ulceration, extending to the upper part of the pharynx and soft palate, without affecting the tonsils. Then, in the affections of the osseous system, we notice the same indisposition in the disease to confine itself to any determinate shape: there may be only periostitis — a mere swelling or inflammation of the periosteum; or there may be true nodes, or a real enlargement of the osseous texture itself — an increased deposition of bony matter; or there may be merely pains in the bones, or swellings and pains of the joints. Thus, we see in the outline of this singular disease, nothing but variety and irregularity, which it is difficult to solve by reference to any principles yet suggested by the many able men who have exerted their talents in the investigation of this Protean disorder.

Mr. Carmichael attempted to explain some of the varieties of the venereal disease, by supposing a plurality of poisons; by the consideration that it is in truth not one, but several diseases, each depending on a specific poison of its own. His doctrine is, that, except in a few anomalous cases, every primary sore has its corresponding eruption; so that we may foretell by the appearance of the former what the latter will be, provided it come out at all; or if we see only the eruption, we may be able to pronounce from it what has been the character of the primary sore. When these views were first made known, they raised the most lively hopes, that a great step had been made in the knowledge of venereal complaints. But the disease in London is not found to have the same regularity and constancy in the relations between its primary and secondary symptoms, as Mr. Carmichael thought that he had noticed in Dublin. A primary sore of a determinate character will frequently communicate a sore of a different kind, and, what is still more inexplicable, frequently several sores, each of different kinds. Certain facts, recorded by Mr. Evans, prove, that a connexion with a common prostitute, in whom there are

no ulcers at all, will sometimes give rise to venereal complaints, and then the disease seems indeed to have been communicated through the medium of the ordinary secretions of the genital organs, with which the poison was commixed. So far as the doctrine of Mr. Carmichael goes, which ascribes the origin of phagedenic ulcers to a particular venereal poison, the idea does not seem at all tenable. We have seen that the phagedenic character may occur as a complication of any kind of ulcers, whatever may have been their original nature, and that such unfavourable change often depends on constitutional causes, bad health, injudicious treatment, intemperance, disturbance of the part, and other very definite and manifest circumstances. It is true, that we see in hospital gangrene and phagedenic diseases from syphilis, which are believed to be analogous to, or identical with, hospital gangrene, disorders certainly capable of propagation by contagion; but this refers to the accidental application of the matter, by means of a sponge, &c., to the abraded surface in another person. Without such abrasion there would have been no evil consequences. Then, how unlikely, how impossible I might say, it would be for a person afflicted with a phagedenic disease of the genitals to have sexual intercourse, so as to give the complaint to another person. On the contrary, we have reason to believe, that some of the worst forms of phagedenic ulcers are communicated by women, who have but trivial complaints themselves. Every body has heard of the captivating Lisbon opera dancer, whose charms attracted so many of the officers of the British army into her embraces. If we are to credit the reports, many hundreds of our countrymen had connexion with her, no doubt civil also as well as military; and great numbers of them received, as a reward for their adoration of this irresistible goddess, the present of something more than a trifling clap. Many who had an acquaintance with this lady, contracted venereal complaints of a particularly obstinate and afflicting kind, such as are comprised under what is sometimes facetiously denominated the *black lion*, a phagedenic, rapidly spreading, almost uncontrollable ulceration of the penis, yet this lady continued to dance every night for months and months together, as if she were right in every respect herself, whilst her unfortunate friends were suffering all the pains and penalties inflicted upon them through the power of so fascinating a goddess, whose poison, like that of the serpent, hurt not herself. Now it cannot be imagined that she had phagedenic ulceration of the genitals, while she was discharging her duties so well, which consisted of dancing in the early part of the night, and of another sort of amusement in the latter part of it. It is impossible then to suppose, that these phagedenic sores could have arisen from a particular kind of poison, the product of any phagedenic sore. Mr. Carmichael's description of the venereal disease is excellent, so far as the symptoms are concerned; we daily recognise in practice the very forms and shapes of the disorder which he has described so well; yet we see various circumstances, which prevent us from coming to his conclusion respecting the diversities of venereal diseases. We cannot trace any uniform and mutual correspondence between the primary and the secondary symptoms; for the different effects, which he refers to different poisons, are found by us to be frequently too much blended together. One series of complaints is not so separate, so restricted to particular cases, as Mr. Carmichael's views would induce us to expect; for instance, we often meet with the scaly and pustular eruptions in the same patient. His account of the causes of phagedæna is totally incompatible with the facts revealed to us by experience. No doubt the Lisbon opera dancer

had not any thing very serious the matter with her; probably her natural secretions were somewhat changed, or she might have had at most some gleety affection. Then we must recollect another fact, which agrees with my inference from the opera dancer's case; in the large towns in France, it is customary for the Cyprian corps to be inspected once a week by medical officers; this was the established plan when I was abroad. Mr. Evans, who was stationed in Valenciennes, attended several of these reviews, made under the direction of the police. The British garrison at Valenciennes, at that time, consisted of four or five thousand men, and many of them suffered severely from venereal complaints; there was at least the usual number of venereal cases among them: yet Mr. Evans informs us, that in the inspections referred to, where some hundreds of concubines were carefully examined, very little disease was found. M. Ricord, whose researches lead him to recognise only one kind of venereal poison, after noticing the influence of situation and texture, describes the varieties and particular forms of chancre as being developed after, and under the influence of, conditions which have nothing to do with the specific cause; as, for instance, peculiarity of constitution, preceding or concomitant diseases, hygiene, and the general or local treatment pursued. "Hence," he remarks, "we see patients with phagedenic chancres, who have contracted their disease from persons that had apparently only slight sores."*

Mr. Travers suggests one peculiar mode by which the venereal disease may be communicated; he supposes that a woman may, in some instances, be the passive medium of infection, that is, when she has had connexion with an infected person, and immediately afterwards has connexion with another man who is sound, the last person may be contaminated, though she may escape the disease. This seems possible; but whether it frequently happens or not, it is difficult to say. "It is incontestable," says M. Ricord, "that women who have had intercourse with infected men, and who have afterwards cohabited with healthy ones, have infected the latter, though not themselves diseased, but only the vehicle of the infectious matter. Such cases I have had an opportunity of verifying, and if they were not common, might create a belief in the spontaneous origin of the venereal disease amongst healthy persons." † At all events, it appears as if the natural secretions of the female organs were sometimes pregnant with infection, though no ulceration exist in the genitals.

Mercury often facilitates the cure of venereal complaints: this is a truth unequivocally settled; yet, generally speaking, the disease may also be brought to a conclusion without the influence of mercury. In this last sentence are contained the sum and substance of all the valuable inquiries made in modern times, respecting the possibility of dispensing with mercury in the cure of venereal complaints.

But the question, about the necessity of using mercury, is not settled by our being told, that such medicine is not essentially and absolutely necessary for the cure. The decision for or against its employment must rest on other grounds; and first it should be considered, not only whether the non-mercurial method is the most expeditious mode of cure, but whether it succeeds most effectually in removing the primary symptoms, and also in preventing or curing the secondary ones? This view changes the question altogether. It has been fully proved, that all the primary and secondary symptoms of syphilis may be cured without

* Op. cit. p. 136. † Id. p. 98.

mercury; but we are to inquire, is this the quickest way of doing it, and does this practice render the secondary symptoms less frequent? When we look over some of the evidence on these points, we might be induced to suppose, that mercury ought not to be given at all; but when the comparatively greater quickness of the cure of the primary eruptions, often exemplified when mercury is not given, is found to be counterbalanced by the comparatively greater frequency of the secondary symptoms, when mercury is not given, our first impressions receive a check. It appears from valuable and important documents deposited in the Army Medical Board Office, that out of 1940 cases of venereal primary sores cured without mercury, the average time required for the cure when buboes did not exist, was only twenty-one days; when there were buboes, forty-five days. On the other hand, when mercury was employed, out of 2827 chancres, treated with that medicine, the average time for a cure when there was no bubo, was thirty-three days, and with a bubo fifty; so that here things are in favour of the non-mercurial treatment, so far as the primary symptoms are concerned, and without reference to secondary ones; and this corresponds with the results of similar investigations made in the venereal hospital at Paris, and which proved that the non-mercurial removed the primary symptoms sooner, than the mercurial treatment. But as we are not compelled to restrict ourselves to either one method or the other, I think that the entire rejection of mercury, even in relation to the treatment of primary symptoms, (and abstractedly in this point of view,) is not rendered justifiable by any views, which have yet been brought before the public. This must be manifest, when it is acknowledged, that a certain number of cases of primary symptoms, cured without mercury (not perhaps a considerable number), are very tedious ones. The calculations I have mentioned were the average of the whole number of cases, throwing out of view cases in which the cure was particularly tedious; therefore with reference to them, a determination to abstain from mercury was, strictly speaking, decidedly wrong. A consideration, which ought to influence us more powerfully, than the slowness or quickness of the cure of the primary symptoms, is the question, whether the secondary symptoms are more frequent after the non-mercurial, than after the mercurial treatment. On this interesting point we receive different information from different quarters; one computation makes the proportion of cases, in which secondary symptoms followed the non-mercurial treatment, to be one in three; a second, one in ten; a third, one in twelve; a fourth, one in five; and a fifth, only one in twenty; but the cases of secondary symptoms, where mercury had been given, were only one in fifty-five. This fact, if it were to agree with general experience, would be a most important consideration in favour of the use of mercury. Its power in preventing the secondary symptoms from coming on would then be fully proved to be greater than that of the other plans of treatment here specified (excluding the effects of the salts of iodine, which had not then been tried). It would indeed be proved, that secondary symptoms more frequently come on when mercury is not used, than when it is. But it does not follow from this, as a matter of course, that we are to give mercury. The state of a chancre may be such as to be more likely to be exasperated by mercury, than to be benefited by it. The condition of the patient's health may be a prohibition to its employment. Then a circumstance, that ought to have some weight, is the well-known fact, that when secondary symptoms do follow the non-mercurial treatment,

they are for the most part milder, and more easily curable, than those which take place after the use of mercury. All the experience that I have had in the hospital and elsewhere attests this fact. I am not surprised, therefore, that mercury is nearly abandoned, not only in several hospitals on the continent, but, as I am informed, in one of the principal hospitals in the United States.

Whenever mercury is given, the wisest plan is to give it in moderation, and, above all things, to avoid the pernicious custom of putting the patient under a *course*, in which the mercury is given rapidly and profusely, and continued for an immoderate length of time. Experience has fully convinced me, that in no variety of chancre, nor in any other stage of the venereal disease, is it proper to give mercury so unmercifully, and for so long a period as was formerly done. At all events, violent and long salivations should be given up. This practice, as I can state from my own observation in the foul wards of St. Bartholomew's Hospital, during a period of twelve years, instead of being more successful than the present methods, often led to the most dreadful of mutilations, and the number of those who lost their palates and noses, was infinitely greater than what is now observed. I should guess, that for every such instance in the present day, there were then twenty. When these facts are considered, and joined with the treatment employed thirty or forty years ago, we cannot avoid concluding, that a great deal of those ravages must have been produced not by the disease itself, but by the manner of treating it. At present, the practice of subjecting patients to long and immoderate courses of mercury is given up by all experienced and judicious surgeons. Common ulcerations are also more carefully discriminated from venereal ones; and when mercury is given, it is so administered as merely to produce a moderate affection of the gums and salivary glands, and not to occasion a total derangement of the whole economy.

Surgeons are also now no longer blinded by the pernicious fear, that unless mercury be given, the disease will continue to grow worse and worse till the patient is ultimately destroyed. In former days, directly a patient was brought to a hospital, however bad his health might be at the time, it was immediately considered necessary to cram him with mercury. But we are now aware, that the notion by which the old surgeons were terrified into such practice, was a mere ghost, nothing but a bugbear. When the patient's health is seriously impaired, I advise, as a general rule, the postponement of mercury till an amelioration in that respect has taken place. Even those practitioners, who place the greatest reliance on mercury as a specific, and still maintain that it ought to be called so, qualify their assertions by admitting, that it ought not to be given under every condition of the system; they candidly allow, that neither the condition of the parts, nor that of the constitution, is at all times such as will let mercury be given with impunity; they confess that its rash and unscientific employment will aggravate the symptoms; and they specify two cases in which its use is generally erroneous, namely, during excessive weakness of the system, and while the disease is complicated with excessive inflammation. Under these two conditions, the greatest advocates of mercury commonly admit, that its employment should be postponed. But these are not the only states, in which it should usually be prohibited; it should not be given during any great derangement of the system from diarrhœa, or fever, or from what is termed *erythismus*, a peculiar state of constitution, in which the patient labours under excessive irritability, weakness, palpitation of the heart, and other evils from

the mercury already given. There are some constitutions, in which this condition is liable also to be induced by a very slight quantity of mercury, and when it is present, the patient may die suddenly on making any trivial exertion.

Although mercury may not be absolutely essential to the cure of the venereal disease, yet so long as it shall continue to be looked upon by many surgeons as a remedy of greater power for the prevention of secondary symptoms, than any other known medicine, with the exception, perhaps, of the salts of iodine, its employment is not likely to be discontinued. It is used either *topically*, that is, as a direct application to sores, nodes, and other affections, or *constitutionally*, being introduced into the system, either through the medium of the stomach or the skin.

Amongst *topical* mercurial preparations, the *black wash* is in very common use for venereal sores, both primary and secondary. It should vary in strength according to circumstances: when I was a student the proportion of the ingredients was a drachm of calomel to a pint of lime water; but now it is frequently made stronger, and sometimes as much as ten or fifteen grains of calomel are put into each ounce of lime water. With regard to the manner of using it: — if the sore or sores are on the outside of the prepuce, a piece of lint is dipped in the lotion and applied to them; but if the sores are under the prepuce, the introduction of lint into that situation would create too much irritation, and the lotion may therefore be occasionally injected under the prepuce with a small syringe. The *yellow wash*, used in the same manner, contains two grains of the bichloride of mercury in each ounce of lime water.

In general, *ointments* are not good applications for primary venereal sores of any description. Now and then the *unguentum hydrargyri nitratis*, blended with the unguentum cetacei, or with zinc ointment, in various proportions, is employed; and, of late, the unguentum hydrargyri iodidi, in the proportion of twenty grains of the iodide to one and a half ounce of lard, has been commended as a dressing for inveterate venereal ulcers. I cannot make any report of its real utility from my own experience.

Another manner of using mercury topically is that of *fumigation*. For this purpose, an apparatus is made use of, furnished with an iron heater, and a copper tube, by which the fumes can be conveniently directed to the part affected; and, in order to be able to do this better, we have both a straight tube and a curved one, the latter being particularly convenient for ulcers in the throat. The mercurial fumigating preparation in general use is *cinnabar*, or the *red sulphuret of mercury*, from which, when placed on the heater, a subtile grey powder is sublimed, which, lodging on the sore, is found in many instances to produce a very beneficial effect upon it. I have seen sore throats, chancres, and other ulcerations, which had resisted for weeks and months every plan that could be devised, assume a healthy appearance, and heal up rapidly, after fumigation had been tried a few times. To know this truth is important; much more so than to be able to say exactly, how far the specific power of mercury was here concerned in the production of the good. The fumigation of a sore of moderate size is not likely to have much or any effect on the constitution; and I should suppose, that the method cannot generally operate on this principle. Perhaps, with the exception of fumigation, I may say, as a general remark, that topical mercurial applications are not usually considered at all more useful than others which contain no mercury. The black, or calomel wash, is frequently made use of; but I do not know that it pos-

sesses more efficacy, than several other astringent lotions, which have not a particle of mercury in them.

With respect to the introduction of mercury into the system from the surface of the body, this can be accomplished either by rubbing mercurial ointment into the skin, or by mercurial fumigation of an extensive portion of the surface of the body. Friction with the ointment, the ordinary method, the most generally adopted, as requiring no machine for the purpose, is practised by the patient himself, who rubs some part of his body, which is frequently the inside of the thigh, for a quarter of an hour or twenty minutes before the fire, sometimes once a day and sometimes twice, with half a drachm or a drachm of the ointment. The quantity of ointment employed, however, varies in different cases, according to circumstances. Sometimes a scruple, sometimes half a drachm, and, in other instances, double this quantity, or even more, may be employed at a time. This is termed *rubbing in*, because a portion of the ointment seems as if it had been made to enter the pores of the skin by the friction; but, except where the patient is very easily affected, what remains on the surface of the skin should not be wiped away, the patient putting on a pair of flannel or other drawers over it. I ought to mention, however, that sometimes friction and the rancidity of the ointment together (for we seldom meet with mercurial ointment perfectly free from rancidity), will bring out numerous pimplès, and even erysipelatous inflammation, and then the patient should be directed to repeat the friction on another part, and not to leave any of the ointment on the skin. A few years ago, friction with mercurial ointment was commonly preferred in this country to all other plans of treating the venereal disease; first, because it was conceived to be the most efficient mode of treatment, and the mercury in the ointment being combined with a very small proportion of oxygen, was usually given as one reason for the alleged fact; secondly, because it occasions less risk of disturbing the stomach and bowels than internal preparations; thirdly, because it is frequently considered to be the only certain way of getting a sufficient quantity of mercury into the system. Preparations of mercury, given by the mouth, sometimes disorder the stomach and bring on diarrhœa. I have long suspected, that the latter was the principal cause of mercurial friction being formerly so favourite a practice; for, while the doctrine prevailed, that it was necessary for the cure of syphilis to fill the patient with mercury, to saturate him with it from head to foot, and to salivate him unmercifully, the stomach and bowels often revolted against the scheme, which absolutely could not be carried into execution in every instance by preparations, designed for internal administration. It was then chiefly by means of mercurial friction that the old fiercely salivating practitioners were enabled to get into the system as much mercury as they wished; not that they did not also give internal preparations so far as they could. I believe that the doctrine of the superior efficacy of mercurial friction is founded on prejudice, and that, unless the stomach and bowels be disordered, and the constitution cannot be affected with moderate doses of the blue pill, it is seldom indispensably necessary to have recourse to this uncleanly practice. In certain cases, we are indeed obliged to direct mercurial frictions, as when the stomach and bowels will not bear even a small quantity of mercury, which occasionally happens, or when it is necessary to resort to more plans than one, in order to bring the system under the influence of the mineral. Under these, and perhaps a few other circumstances, we may be called upon to prescribe frictions, as well as internal preparations.

*Fumigating the surface of the body* is not at present deemed so necessary and eligible a method of putting a patient under the influence of mercury, as some of its admirers once endeavoured to instil into the minds of the profession. It is attended with considerable trouble and inconvenience; it requires a particular machine, somewhat resembling a sedan-chair, in which the patient sits naked with his head out of an opening at the top of it. At the bottom of the machine is an iron heater, on which a preparation of mercury is thrown, which is sublimed and covers all the surface of the patient's body. The preparation of mercury employed for this purpose is the grey-oxide. Another mercurial powder, that was recommended and used by Mr. Abernethy, was calomel that had been put into liquor ammoniæ, and then dried. After having undergone the process, the patient puts on his shirt or flannel waistcoat, and goes to bed. The reasons formerly urged in favour of the practice were, that it is less fatiguing to a debilitated person than mercurial frictions, and that the system can be more quickly brought under the influence of mercury than in any other way whatsoever. This seems to have been Mr. Abernethy's opinion, who was once an advocate for fumigations; but afterwards relinquished them. With regard to the reasons given for the use of fumigations, that mercury may thus be employed, when the patient is in the weakest state, and that he may be mercurialised without the fatigue of friction, or the risk of disordering his stomach and bowels with internal preparations, the argument, though plausible, has not really much weight; because, when the health is seriously impaired, we are seldom justified in giving mercury at all; and, at all events, it should then never be introduced so rapidly into the system. But, if the plan deserves adoption in any particular instance, it may be useful to know, that it is not necessary for the patient to go into the machine at all; he may turn his flannel waistcoat and drawers inside out; and put them into the machine to be fumigated. They will become covered with the fine powder sublimed from the heater, and, on being worn afterwards, will salivate the patient as well as if he had gone into the machine himself.

Of the *internal preparations*, the *pilula hydrargyri*, or *common blue pill*, has the greatest reputation in this country; it is one of the mildest of all the internal preparations; the common dose of it is five grains; but frequently we are called upon to give a larger dose, and sometimes a smaller; from three to ten grains may be stated to be the ordinary average quantity proper to be given in the twenty-four hours. We may join it with other medicines, according to circumstances, as with the sulphate of quinine, the iodide of potassium, extract of conium, and various other medicines. It is often combined with a small quantity of opium, in order to lessen its tendency to affect the bowels.

The *chloride of mercury*, or *calomel*, is not extensively employed in England for syphilitic complaints, though it is a favourite medicine for this purpose abroad, especially in Germany. Even in England, for one effect of the venereal disease, calomel is usually preferred, viz. syphilitic iritis. This preparation, like the blue pill, may be joined with other medicines, as with guaiacum and the sulphuret of antimony, as in the *pil. hydrarg. chlorid. comp.*, which is not unfrequently prescribed in venereal affections, but especially in those requiring merely slight alterative treatment.

The *bichloride of mercury*, or *corrosive sublimate*, is a very powerful medicine, and, if it be incautiously given, it may readily poison the individual. The dose is small, the average quantity, usually given, is one

eighth of a grain, twice or thrice a day. When mixed with distilled water, it dissolves more readily if a small proportion of the chloride of ammonia be added. There are instances, in which from half a grain to three quarters of a grain may be prescribed in divided doses to be taken in a day. When it is wished to give it with bark, we may dissolve one grain of it in an ounce of the tinctura cinchonæ, of which a teaspoonful is the proper dose. The *biniodide of mercury* (L. P.) in the form of an alcoholic solution, is sometimes deemed useful in obstinate forms of syphilis, occasionally met with in very scrofulous subjects. The proportions are, alcohol at 36° 1½ ounce; deuto-ioduret of mercury 20 grains. The dose 10, 15, or 20 drops in a glass of distilled water.

The *hydrargyrum cum cretâ* is the mildest preparation of mercury ever employed in this country, and, on this account, is preferred where we wish to exert a slight mercurial influence on the constitution. It is deemed the best preparation of mercury for infants labouring under syphilis.

One caution is necessary in the employment of mercury; namely, to watch its effects very attentively; for it will act differently on different individuals. Some will be violently salivated by a few grains of blue pill, or a scruple of blue ointment; while others will use from one to three drachms of it daily for months together, with no manifest effect on the function of the salivary glands, bowels, or other organs. The doses of mercurial preparations must then be regulated by circumstances; indeed it is wholly impossible to give any precise rules on this head, on account of the different effects of the mineral on different individuals. I may say, however, that the safest plan is always to begin with small quantities of mercury, watching the effects of the medicine, and being guided by them.

The action of mercury on the animal economy is very powerful; the nervous, the absorbent, and the sanguiferous systems are all considerably affected by it; an universal irritability is excited; there is a quickness of the pulse, and a feverish state of the whole constitution brought on by it; the secretions are all increased, especially those of the skin, kidneys, and salivary glands. *Salivation*, or an increased secretion of saliva, and a soreness and swelling of the gums and mouth, are the effects, which surgeons have long been accustomed to observe with attention; for these are usually regarded as tests of the remedy having a sufficient influence on the system effectually to cure the complaint, for which it is given; not merely to cure the *primary symptoms*, but give the patient the best possible chance of escaping the *secondary ones*. In fact this is the main object of giving mercury; we know that we can cure the primary symptoms without mercury; and were these alone abstractedly considered, perhaps, we should seldom be justified in salivating the patient at all. But the great argument for the mercurial practice is, that, without it, the patients will be more likely to be attacked by secondary symptoms. However, even on this point, I doubt whether secondary symptoms are more frequent after the treatment of primary sores with the iodide of potass and sarsaparilla, than after mercurial treatment, and, at all events, many gentlemen who watch the results of the first mode of practice commonly adopted in University College Hospital, know that the secondary symptoms, when they do follow it, which is not very frequently, are but slight compared with cases brought to this hospital from others, where the God Mercury is more rigorously worshipped.

The first change perceived is a copper taste in the mouth; the breath

acquires a peculiar fœtid smell; sometimes letting out a secret which the individual may not always wish to be known, namely, that he is under a mercurial course; his watch and the money in his pocket will also, in consequence of the transpiration of the mercury from the surface of the body, become coated with mercury, so as to let out the same information. When mercury is given in ordinary doses, a swelling and sponginess of the gums are generally brought on — an inflammation and tenderness of them; an uneasiness, pain, and looseness of the teeth, and more or less inflammation of the mucous membrane of the mouth. When the constitution is remarkably susceptible of the action of mercury, a very small quantity of it will sometimes throw the patient into a violent salivation, attended with ulceration and even sloughing of the parts in the mouth. The gums and mucous membrane of the mouth will ulcerate; the edges of the tongue will be in the same condition; and the tongue itself may swell to an enormous size, and be pressed against the teeth; in consequence of which deep ulcerated indentations will be formed in it. I have frequently seen the ulceration so severe as to extend through the cheek, and even produce extensive mortification of the parts, with necrosis of the jaw. It is this risk, which should always induce us to begin with small doses of mercury, and to watch their effects. The quantity of saliva, discharged from a patient in a complete salivation, is sometimes very copious — from three to four pints may be poured out in the twenty-four hours. I never look upon a patient, in a state of violent salivation, without a feeling of disgust, for I know that it is a practice completely unnecessary — nay, it is highly prejudicial; and I should therefore say, it is a cruel mode of administering mercury, by no means justified by anything, which is made out respecting the true character of the venereal disease. I am happy to say, however, that such practice is not now common in London; but whoever had the opportunity of seeing the mercurial courses, pursued in the foul wards of hospitals a few years ago, will never forget the horrid scenes there displayed. At that period, an immense number of deaths were actually produced by the abuse of mercury. If it be introduced too quickly or copiously into the system, we may not be able to stop the salivation for a considerable time. Thus, a poor woman, whom I lately attended, was at first under a physician, who gave her ten grains of blue pill in divided doses: this quantity produced a most violent salivation, with loss of all the teeth, and ulceration, and sloughing. Here no blame could attach to the practitioner; there must have been an idiosyncrasy concerned, or an extraordinary susceptibility of the action of mercury, such as could hardly have been contemplated. But even in common constitutions, these severe effects will sometimes come on before we are able to check the mercurial action; and, I may say, that we know of no means that will check a violent salivation so quickly, as mercury will sometimes bring it on. The usual plans, resorted to for this object, are exposure to cold air, the exhibition of saline purgative medicines, and the use of gargles, especially those containing the chloride of soda. When there is ulceration, the same gargle, or one of hydrochloric acid, may be used.

There are one or two interesting questions connected with this part of the subject: one is, how far salivation is a right criterion of the influence of mercury on the constitution? and another is, how far it is a means of judging whether that influence is such as affords the patient the best chance of secondary symptoms being prevented, and the primary affection cured in the most expeditious and favourable manner? Perhaps I

may state as a general fact, that salivation is a good test for these purposes: but the remark is liable to exceptions; for some individuals cannot be salivated by any quantity of mercury, and yet their venereal complaints will get well with tolerable facility; while others may be salivated by a few grains of blue pill, and therefore long before any adequate mercurial impression can have been made on their disorder. But supposing salivation to be generally a good test of the proper influence of mercury on the system, then the question arises—to what degree are we to understand that salivation is to be carried? Certainly not so far as purposely to bring on ulceration and sloughing of the mouth, or even to produce so profuse a discharge of saliva as to make it run out of the mouth in streams: this is not at all requisite as a test of the adequate influence of mercury. I should say, that a moderate swelling and tenderness of the gums, a distinct copper taste in the mouth, and a gentle increase in the secretion of saliva, are the three conditions which we should aim at bringing about; a more violent mercurialisation is not only generally unnecessary, but decidedly injurious. Neither are we to imagine, that mercury should be given in the same quantity during the whole time that the medicine may be proper; sometimes it may be necessary to suspend the use of the medicine in consequence of the gums getting too tender: and, under other circumstances, where the constitution is difficult to affect with mercury, we may be required to increase the quantity of it. Indeed, there is only one general rule which I can offer, and which was laid down by Mr. Hunter, namely, that we must be guided, in the administration of mercury, partly by its influence on the disease, and partly by its influence on the constitution.

As for the length of time that the salivation should be kept up, it is difficult, also, to lay down any precise rules on this point; sometimes all the specific characters of the ulcer are removed long before it is healed, and sometimes a chancre heals so rapidly, that we have little opportunity to give mercury before it is well. When the complaint yields in this rapid manner, it is usual to continue the employment of mercury for ten days or a fortnight, and this is done to diminish the risk of secondary symptoms. In other instances, where the sore heals very tardily, perhaps when a bubo is also present, the disease will not get well for months, though all the specific characters of venereal ulceration may be removed; then, of course, we should not think of continuing mercury till cicatrisation had taken place.

The diet and regimen to be observed during a mercurial course is a subject of importance, because if we give a patient mercury, and allow him to continue his usual diet, and to follow his common occupations, we shall generally be disappointed in the results of our treatment. If we allow a patient to take wine and a full diet, to walk about the streets, to expose himself to all weathers, and even to ride on horseback, as some are disposed to do, I think it will be found that secondary symptoms are more likely to come on, and even affections of the periosteum and bones will be more frequently produced. I always recommend patients to clothe themselves more warmly than usual, and to confine themselves at home; but there are many who will not submit to this: they say they are obliged to go to their offices, or counting-houses, and that they have no choice; I then tell them that, if this be the case, any unfavourable circumstances which may occur must be imputed, not to my having omitted to give them good advice, but to their not following it.

As mercury produces a quickness of the pulse, and a feverish state of

the system, it is advisable not to let the patient have a full meat diet; it is better for him to live on light farinaceous food, such as milk, sago, arrow-root, &c. This practice is consistent with medical science on another account; for, in many venereal cases, there is a good deal of inflammation present; perhaps in the groin there may be severe inflammation, or a similar state of the throat may exist. Under these circumstances, letting the patient have a full diet would be contrary to all the rules which influence both physicians and surgeons in their treatment of disease in general. When the patient is in so reduced and weak a state, that it is necessary to let him have plenty of animal food, I should say, that mercury can then rarely do him any good. It is especially necessary, also, during a mercurial course, to recommend abstinence from all acid drinks and acid fruits; for mercury has often a tendency to produce diarrhœa, and mercurial friction will sometimes act more on the bowels than on the salivary glands. When diarrhœa has been induced by the use of mercury, the condition of the patient is much the same as if he had dysentery: a slimy matter is discharged from his bowels, and frequently blood. Under such circumstances, we must discontinue mercury, for the further administration of it would not only do no good to the venereal complaint, but put the patient's health into a most dangerous state. The mercury should be left off, and recourse had to opium and rhubarb, or the chalk mixture.

Sometimes mercury has a peculiar effect on the skin, causing a specific eruption, named the *mercurial erythema*, or *eczema*. It is generally preceded by an increased heat of the surface, accelerated pulse, difficulty of respiration, and more or less fever. On the first or second day after the feverish attack, the erythematic affection makes its appearance, sometimes bearing a considerable resemblance to urticaria, or nettle-rash, and when it assumes this form, the disorder will always prove very slight; but, in other instances, large red patches appear on the surface, crowded with vesicles, which, uniting altogether, may cover the greater part of the body. After a time they burst, and form incrustations on the skin, and the patient, from the extent of surface affected, is really in a very distressing condition. Under wrong treatment, this is actually a dangerous complaint; and, in former times, when the disease was supposed to be syphilitic, the quantity of mercury used to be increased, and the patient destroyed.

Former practitioners were confirmed in their suspicions, that this was a syphilitic eruption, by the fact, that eruptions are rarely the consequence of mercury, but very frequently the consequence of the venereal disease; therefore the cutaneous affection was ascribed to the latter disorder, and treated as such by pushing the mercury in greater quantities, according to old maxims and firmly rooted prejudices. As the mercurial erythema sometimes comes on, when only a small quantity of mercury has been exhibited, it is supposed that it can occur only when there is a particular idiosyncrasy in the individual: it is asserted that it never takes place, except when the patient has been exposing himself to cold damp air. Here, then, is another reason, why the kind of regimen, which I have recommended, should be attended to. Sometimes the eruption begins on the part where the patient has been rubbing in mercury, as on the thigh or leg; but, in many instances, it comes on, though the mercury has been given only internally; so that the friction is not essential to its production. The treatment consists in fomenting the parts well with a decoction of poppy-heads or chamomile flowers, discontinuing the mercury,

as a matter of course, and administering small doses of antimonial powder and saline purgatives, or castor oil. When the inflammation has abated, and there is merely a discharge from the surface, sarsaparilla may be given, or bark with diluted sulphuric acid, and a light nutritious diet. The warm bath will also afford great relief. If the part be excoriated, it will be necessary to apply the zinc ointment.

Mercury acts upon some individuals like a poison: they are seized with palpitations of the heart, tremblings of the limbs, oppression of the breathing, and irregular pulse. When such indisposition takes place in a person employing mercury, we may conclude, that this mineral is actually producing a deleterious impression on the system. It was noticed by the late Mr. Pearson that every year, when it was the custom to salivate freely, a certain number of individuals, thus treated, died suddenly, in the Lock Hospital; they were first affected as I have described, and, on attempting to make the slightest effort, they dropped down dead. Mr. Pearson learned from experience, that these deaths arose from the deleterious action of mercury on the constitution, and the derangement of the system, thus excited, he proposed to call the *mercurial erythismus*. I need hardly say, that the treatment consists in suspending the use of mercury altogether, letting the patient be exposed to a pure, cool, dry air, administering tonics, especially sarsaparilla, or, as some practitioners prefer, ammonia in camphor mixture.

With regard to other medicines, often given in some stage or another of venereal complaints, we should, in estimating their anti-syphilitic power, never forget the important truth, that mercury is not absolutely necessary for the cure of the generality of venereal complaints; for, so far as Mr. Rose's inquiry went, he never met with a case which he could not cure without mercury. Mercury is frequently useful in accelerating the cure, and, perhaps, with the exception of the iodide of potass, still more importantly serviceable than any other known medicine, in lessening the frequency, though, I believe, not the severity, of secondary symptoms. Yet, let not these advantages render us blind to the fact, that mercury is not absolutely necessary for the cure of syphilis; and, in estimating the anti-syphilitic power of any medicine, this truth must never be lost sight of. Sometimes, indeed, mercury, so far from being indispensable to the cure, may have the effect, in particular states of the health, of retarding, or even preventing altogether, the patient's recovery. Frequently the general health becomes bad before a venereal complaint is cured, and then, on the mercury being discontinued, the health improves, and a cure of the syphilitic affection follows. This frequently occurs, and gives a kind of false credit to any medicine which may have been prescribed after the discontinuance of mercury. It is, perhaps, in this manner, that sarsaparilla has acquired the reputation of having anti-venereal qualities: — the patient is taking mercury, and his health suffers; the mercury is left off, and then a favourable change takes place in the constitution, and chancres, buboes, secondary ulcers, &c., yield, whether sarsaparilla be given or not. Yet, I by no means wish to insinuate, that sarsaparilla is completely useless; probably it has some good effect in accelerating the cure, independently of the benefit derived from our stopping or moderating the mercurial course. Nothing can be more various, than the opinions about the real efficacy of sarsaparilla: — Dr. Cullen believed that it has no power at all; and it is found, that if we give it to a person in health, it makes no sensible impression on the constitution; it does not affect the pulse; neither does it materially increase any of the secretions. Hence it has been presumed, that

it possesses little or no power. Fordyce thought it useful in certain complaints that would not yield to mercury; and the late Mr. Pearson came to the conclusion that though sarsaparilla was, in a certain degree, useful in venereal complaints, it could not cure them without mercury. The latter part of this opinion we now know is erroneous. He also says, that sarsaparilla is particularly valuable as a means of obviating the pernicious effects produced on the system by a mercurial course; and, in his day, when mercury was given copiously, and its action maintained for a considerable time, these effects were often of a severe description. At the present day, sarsaparilla is commonly given at the end of a mercurial course; and, so far as I can judge, the practice is attended with beneficial effects, restoring the patient to health much sooner than if he did not take the medicine. It is also used as an alterative in various complaints reputed to be venereal, though not exactly possessing the characters of the disease insisted upon by Hunter, or those of the scaly venereal disease, as described by Mr. Carmichael. Many affections, arranged with venereal ones, undoubtedly yield to sarsaparilla, and alterative plans of treatment, even better than to a full mercurial course. We often find this benefit accrue from sarsaparilla, given either with small doses of bichloride of mercury, with nitric acid, with iodide of potass, or antimonial medicines; and numerous cases present themselves which are more served in the beginning, by this method of treatment, than by mercury; though, in a later stage, mercury may be administered with surprising effect. In University College Hospital, at least two thirds of the venereal cases are readily cured without mercury, small doses of the iodide of potassium with sarsaparilla being substituted for it; and it is well known that our cases are far from being often followed by secondary symptoms; which, when they do occur, are for the most part exceedingly mild and easily cured. Instead of having recourse to mercurial frictions, and violent salivation, I also, sometimes, adopt the practice of giving a few grains of the blue pill daily, in conjunction with the iodide of potassium; and the efficiency and mildness of this method, where mercury is called for, give me a favourable opinion of it. With respect to the compound decoction of sarsaparilla, and the mineral acids, they are all useful in particular stages of the disease, where the health is not in a favourable state for the action of mercury; but whether any of them really possess what is sometimes understood by an anti-syphilitic power is a question that resolves itself very much into the consideration, how far syphilis is capable of getting well without mercury, and how far it admits of a spontaneous cure. Certainly it is quite conceivable, that, although the cure of the disease may sometimes be promoted by the discontinuance of mercury, it may still admit of being expedited in a greater degree, when, with this change in the treatment, we join the administration of sarsaparilla, or other alterative medicines. Another circumstance, never to be forgotten, is, that venereal complaints are frequently complicated with common as well as with specific inflammation, and, consequently, that they often call for antiphlogistic treatment. The whole of the inflammation attending the effects of the venereal disease is not specific: a good deal of it is merely common inflammation, and may be benefited by the same means as are usually resorted to for checking inflammation in general, — bleeding, leeches, cold applications, poultices, low diet, quietude, &c.

From these general observations on the venereal disease and its treatment, I now proceed to consider more particularly each of the primary and secondary symptoms.

## CHANCRES.

It is not strictly because a sore has been contracted in a suspicious sexual intercourse; nor on account of its situation; the greater or lesser induration at its base; its colour; its excavated surface; its undermined callous edges; or its deep red margin, that it must necessarily be concluded that it is always a chancre; but the inference, according to M. Ricord, is rather to be deduced from the kind of pus which it secretes, and the contamination which such pus is capable of imparting. All the other conditions may vary, the secretion alone, and its general consecutive effects remaining the same.

The term *chancre,* as conveying the idea of an ulcer that has a corroded appearance, is not exactly what ought to be employed; perhaps the expression *primary sore* is preferable. It is not every sore, arising from sexual intercourse, that is to be considered a chancre; there are many which are supposed to be produced by the irritating action of the secretions of the genital organs more or less changed. Sores, produced in this way, are not uncommonly classed with venereal ones, though not having the aspect which the meaning of the word *chancre* would convey; and for this and other reasons, the term *primary sore* seems preferable. Primary sores are most frequently situated on the external parts of the organs of generation, and especially on those parts of them, which are covered by a thin delicate membrane, as on the inside of the prepuce, and on the glans penis, or corona glandis, in the male subject, and on the labia, nymphæ, &c., in the female. They are also sometimes met with in other situations about the genital organs, as on the common integuments of the penis, or on the skin of the labia, and sometimes, as all surgeons now admit, actually within the orifice of the urethra or vagina, though less frequently in these situations, than in the others which have been specified. The formation of chancres on the outside of the labia, in the perinæum, and on the common skin of the penis, seems to prove, that the venereal matter may produce ulceration even in situations where a thick cuticle intervenes between it and the cutis, so far as those parts are concerned. I am not aware, that there is any clear proof on record of a venereal primary sore having been produced on any common part of the general surface of the body, away from the genital organs, unless there had been a wound, ulcer, pimple, or some kind of breach existing in that situation at the period when the matter was applied.

The period of the commencement of venereal ulceration, after the application of the virus, is extremely irregular. Mr. Hunter met with chancres which began within twenty-four hours after exposure to contamination; but knew of other cases, in which the sores did not make their appearance till six or eight weeks after coition. Perhaps, a true primary venereal ulcer does not often form earlier than six or seven days after the application of the virus. On an average, says Dr. Wallace, of a number of cases of primary syphilis, *produced by artificial inoculation,* notes of which are now before me, the phlogosis, or redness, commenced on the second day: the stage of ulceration occupied seven days; that of granulation ten days; and cicatrisation six days; making the whole period from the insertion of the virus to the healing of the ulcer twenty-five days.*

* Wallace on the Ven. Dis. p. 71.

Primary venereal sores are of several kinds. The most remarkable is that which was so well described by Mr. Hunter, and is called, accordingly, the *Hunterian chancre.* It is characterised by a tendency to assume a circular form, its excavated surface, the tenacious and adherent quality of the matter produced on it, and by its hard cartilaginous base and margin. It generally begins as a pimple, or minute vesicle, which enlarges, and soon breaks and ulcerates. Generally speaking, venereal ulceration does not extend itself with great rapidity; neither is it the common character of the Hunterian chancre to make quick progress. Nevertheless, exceptions to this statement do occur, and these seem to depend on the state of the health: for when this is in an unfavourable condition, or certain forms of constitutional disturbance and irritability prevail, the ulceration will spread with greater quickness than usual. When the sore is situated on the prepuce, or the frænum, there is usually more inflammation present than when it is situated on the glans. When the ulcer is on the glans, it is less painful, but more disposed to give rise to hæmorrhage. What is termed *phymosis,* is an inflammation, a thickening, and a contraction of the extremity of the prepuce, rendering it impossible to draw it back so as to uncover the glans: this case is less frequently a consequence of the Hunterian chancre, than of some other primary sores on the penis. My own experience does not incline me to adopt the opinion, that the hard cartilaginous base of the Hunterian chancre is essential to a sore, that is capable of imparting to the system such effects, or secondary symptoms, as are exclusively regarded as syphilitic. Neither does it lead me to join in the statement of M. Ricord, that the indurated chancre is more frequently than others followed by secondary symptoms.* All surgeons know, that the Hunterian chancre may, and often does, give rise to secondary symptoms; but there are other kinds of primary sores, which will produce similar complaints, so similar that they cannot be discriminated. It is curious to find, that the frequency of the Hunterian chancre is much lessened in London, though still very common in Paris, as I learn from my friend, Mr. Morton, of University College, who has spent the last two summers in attending the Parisian Hospitals.

Another kind of primary sore is that which is generally called the *superficial ulcer with raised edges;* it is not accompanied by induration, but its margin is very high; it is often seen on the outside of the prepuce; and frequently is not a single sore, but is accompanied by others of the same nature, sometimes by two, three, four, or more. In many instances, we see them surrounding the orifice of the prepuce, producing a thickening of it and phymosis, which may continue long after the cure of the sores. Sometimes we notice some of these superficial ulcers on the corona glandis, and others under the prepuce, or around its orifice, or just on the outside of it. They are frequently very obstinate, and it may be long before any impression can be made upon them, whether mercury be given in full quantities, or merely in alterative doses. Sometimes, in five or six weeks, there will be very little change in them whatever is done, and what change does take place, may be for the worse. I have seen thousands of them in my lifetime; but, I have observed, that, after five or six weeks, they generally yield to common treatment, to mild alterative plans, namely, to small doses of iodide of potass or mercury, aperient medicines, and antimonials, and sometimes to bark, sarsaparilla, and the mineral acids. At first, the surgeon will be discouraged by finding

* Op. cit. p. 93.

them resist all plans of treatment. One common situation for such a sore is just at the side of the frænum, which is generally soon destroyed. The black or yellow wash, the nitrate of silver, or lotions of the sulphate of copper, or zinc, are the best applications.

Another description of primary sore is the *phagedenic*, as it is termed,—a corroding ulcer without granulations, corresponding to the description of phagedenic sores in general. It is destitute of any remarkable degree of surrounding induration, but its circumference is of a livid-red colour. It is invariably rendered worse by mercury, a fact, which I deem to be as well established as anything yet made out, with regard to the treatment of venereal complaints. In this form of the disease, when the treatment is injudiciously conducted, the whole of the penis is frequently destroyed in a very short time. Sometimes considerable hæmorrhage takes place, and a useful hint is afforded by it; for we commonly observe, that, after loss of blood, the extension of the ravages of the disease stops, or is suspended for a time; and hence we may infer, that venesection will frequently be useful in the early stages of the disease, a truth fully confirmed by experience.

Another is the *sloughing ulcer*. It appears first as a black spot, which increases, and is thrown off, leaving exposed to view a corroded or phagedenic surface. After the slough has separated, an ulcer may remain of a painful character, with a dark blue, or livid crimson margin. In this manner, the disease will go on alternately sloughing and ulcerating, sometimes till nearly all the external parts of generation are destroyed. With respect to the hypothesis, that phagedenic primary sores derive their origin from a specific poison, various considerations oppose its adoption. The sore is not always phagedenic from the beginning, which we should naturally suppose would be the case, if it arose from a specific poison. The causes of phagedenic ulceration may frequently be traced very unequivocally to the condition of the individual's health; to his having neglected to restrict himself to proper regimen; to his having been guilty of excess; or to his having neglected some other kind of primary sore in its commencement. The opinions I have delivered on primary phagedenic sores, derive considerable support from the observations of Mr. Travers. Numerous phagedenic venereal ulcers, of a particularly severe character, are brought into St. Thomas's Hospital from a particular district of the town, namely, Swan Alley, near St. Katharine's Docks, in consequence of which the disease is familiarly known in the Borough hospitals by the name of the *Swan Alley Sore*. I have seen the same disease in St. Bartholomew's, brought, I believe, from other alleys. The genuine form of it, however, as described by my friend Mr. Travers, is usually seen in very young girls, who reside near St. Katharine's Docks, and have frequent connection with sailors, Lascars, and other men of colour. It usually shows itself in the cleft of the nates, in the groin, or on one of the labia towards the perinæum, and as it enlarges, the surrounding skin puts on a crimson colour; its surface is generally covered with a deep ash-coloured slough; it often extends with alarming rapidity, producing great constitutional disturbance and intense pain; the appetite is lost, and extreme prostration of strength attends the disease throughout the greater part of its course. This kind of sore is rarely or never followed by secondary symptoms; a fact, confirming the view I have taken, that this sore does not depend on a specific poison, but is in a great measure accounted for by the state of the health at the time it is contracted. We learn from Mr. Travers's statements, that most of the young creatures, who are brought from that

genteel place, Swan Alley, afflicted with phagedenic ulceration, have had very little wholesome food; they are generally kept by Jews and Jewesses, who give them plenty of gin, though but little proper nourishment. They are half starved, and more or less in a continual state of excitement and intoxication, having connection with Lascars, and other dirty foreign seamen, as many times in the day as there are hours. In this manner, their constitutions must soon get into a very disadvantageous state for the favourable progress of any disease whatever, and we cannot wonder, that their impaired, imperfectly developed frames, their course of life, and uncleanliness, should promote phagedenic ulceration, and give it an unusually severe character.

If proper treatment be not delayed too long, however, we shall generally be able to stop the progress of the disease; but if the case be neglected, or wrongly treated at first, the ulceration will often make such havoc, as to destroy all the soft parts, closing the lower aperture of the pelvis. I have seen cases, whose severity was even to this extent, and then of course the result was fatal. Although I have given it as my opinion, that phagedenic ulceration does not necessarily depend on a specific poison, I would not wish it to be imagined, that sores, originally excited by the venereal virus, are not convertible into phagedenic ones: on the contrary, I believe, that any sore may assume the phagedenic character in particular states of the health, or in consequence of bad treatment; but that, in the greater number of phagedenic sores, there is no specific poison concerned at all in their production, and never essentially as a cause of them.

Dr. Wallace has attempted to form a classification of phagedenic and sloughing chancres. One of his principal divisions is into *phagedenic chancres without slough; phagedenic chancres with white slough;* and *phagedenic chancres with black slough.* For these last, he does not recommend mercury; but, when the slough is white, and also when the case is phagedenic without any slough, he frequently resorts to that mineral. But, whoever carefully reflects upon the bad effects, admitted to arise from the free use of mercury in phagedenic cases, will not find great reason to imitate the practice.

With respect to primary venereal sores, we should be careful not to confound with them several common complaints which cannot even be suspected to be connected with, or to originate from, any kind of virus, as, for example, the disease called *herpes preputii*, which begins with heat and itching of the foreskin, and, in one or two days, is followed by red patches as large as a silver penny, on each of which may be remarked five or six small vesicles, which lose their transparency in a few days, and become filled with pus. They then burst, and the fluid oozing out of them, and drying, forms scabs. *Excoriations of the corona glandis* too, and of the prepuce, are common in individuals who are not cleanly, and who neglect to wash these parts occasionally. Under such circumstances, troublesome excoriations will be likely to be produced by the lodgment of the natural mucus, and its becoming acrid and irritating. These cases merely require cleanliness for their cure. Patients with such excoriations often ask our advice, and if we give them mercury we give it unnecessarily; nothing is required but a weak solution of the sulphate of zinc, or a lotion of rose water and subcarbonate of potash. There are also cases, in which there is a scaly appearance of the prepuce, a kind of *psoriasis*, which must not be mistaken for a venereal complaint.

The old practitioners sometimes cut chancres completely away; in other instances, they destroyed them by means of caustic. The latter practice is often followed at the present day, when the sore is recent and of small size, in order to lessen the chance of secondary symptoms. The late Dr. Wallace particularly insisted upon the usefulness of this practice, on the ground, that if its surface can be destroyed in the early stage, before granulations form, the risk of secondary symptoms from absorption will be greatly diminished.* "If, by any means," says Dr. Wallace, "the poisonous quality of an ulcer, produced by the direct application of the venereal virus, can be destroyed before the process of ulceration has ceased *in any point of the ulcer*, the contamination of the system will be prevented." The same practice is urged by M. Ricord; the secondary symptoms, he remarks, which can only take place after a chancre, do not occur in all cases, and, when they do follow, do not present themselves till after a certain period. To be convinced of this important point, the real beginning of a chancre must be discriminated from the supposed one; that is to say, the calculation is not to be made from the day when the patient first perceived the sore, but from the day when he actually contracted it. It will then be found, says M. Ricord, that if the ulceration be completely destroyed by caustic, or other means within three, four, or five days after the application of the cause, such ulceration will not be attended with risk of secondary inflammation. "It is only about the fifth day," he continues, "that the induration of a chancre commences, and it is ordinarily the indurated chancre that is followed by secondary symptoms." Such induration seems to M. Ricord, then, to denote, that the principle (that is, the active principle of the disease) has penetrated further into the system. While it is absent, he considers it allowable to suppose, that the disease is yet superficial. Dr. Wallace, I think, offered a better explanation in the fact, that absorption does not usually take place till granulations are formed on some part of the ulcer. During the two or three days spent by Dr. Wallace in the application of the nitrate of silver, he prepared his patient by a purgative, and by regularity in his mode of living, for subsequent constitutional treatment. In the meanwhile, lint dipped in the liq. plumbi acet., and covered with oiled silk, was applied to the sore. As soon as ulceration had ceased, and the process of reparation begun, he had recourse to mercury "to hasten the process of healing, and to diminish the chance of secondary symptoms." Although I do not concur with Dr. Wallace in so free a use of mercury, as he advocates, or in the use of it at all in some cases for which he recommends it, I am perfectly convinced of the usefulness of the maxim inculcated by him, as well as by M. Ricord, "that the sooner a primary sore is healed, the sooner the risk of several serious consequences, both local and constitutional, will be removed."† I have already stated, that all chancres are not to be treated alike. In phagedenic ulceration mercury is improper; the right plan at first is the soothing one; antiphlogistic treatment will be proper; and, if the patient be not too far reduced, and manifest traces of inflammation be present, venesection, saline antimonial medicines, sarsaparilla with mineral acids, and anodynes, such as conium, hyoscyamus, or the acetate or muriate of morphia, with low diet, and plenty of ventilation, and strict cleanliness, will form the best plan of treatment. Then to the ulcer itself it will be useful to apply

* W. Wallace on the Venereal Disease, p. 53., &c. 8vo. Lond. 1833.
† Op. cit. p. 113.

lotions, containing opium or hyoscyamus, with a proportion of nitric acid. Quietude in the recumbent position is of course an essential thing. But in the worst kind of phagedenic ulceration, which I have adverted to, and which is accompanied by great debility, the diet must not be too low. We begin with putting the patient on a diet of eggs and milk, and when the stomach has acquired more power, the patient may be allowed a mutton chop every day, and from ten to twelve ounces of wine. Sometimes the undiluted nitric acid may be applied; in other instances, a lotion, consisting of a pint of distilled water, three drachms of the chloride of sodium, and one drachm of caustic potass, will produce a clean surface, and promote the formation of healthy granulations. The treatment of phagedenic venereal ulcers by compression has been recommended, but I cannot speak of it from my own experience.

Sloughing chancres are believed to be less frequently than others followed by secondary symptoms. "If from the violence of the inflammation," says Dr. Wallace, "a process of sloughing commences in a chancre, before the action of ulceration has ceased upon any portion of its surface, and if this process involves the structure of the part beyond the point of contamination, it may form, not only a natural cure of the local disease, but may also prevent contamination of the system." Hence, he accounts for the escape of many patients from the attack of secondary symptoms, whose chancres slough in the early stage. It would be erroneous to suppose, however, that no patients who have sloughing chancres experience secondary symptoms. In University College Hospital, the contrary fact is occasionally seen; but, under the treatment there adopted, the secondary symptoms have always been free from severity, and readily cured.

With respect to the treatment of the primary sore, characterised by a cartilaginous hard base and margin, the Hunterian chancre, as it is called, the employment of mercury is the common practice; but, there are differences of opinion as to the extent to which it should be carried. Some of those surgeons, who are decidedly against the free exhibition of mercury in other primary venereal sores, are strong advocates for it in the example now under consideration. Mr. Carmichael is one of this number; and, though he cannot be said to be generally an admirer of the copious administration of mercury, he recommends a full course of mercury for the Hunterian chancre. Frequently we hear it asserted, that thus the disease is cured sooner, and the chance of secondary symptoms more effectually lessened, than by any other known plan. This doctrine would find, however, but little support in the facts brought forward by Mr. Rose; and, in University College Hospital, I have treated the Hunterian chancre, as successfully as other chancres, with the hydriodate of potassium and sarsaparilla, no mercury being exhibited. If mercury be preferred, it should be given so as to affect the gums, and produce a mild degree of salivation; but I would avoid bringing on a more violent action of it on the system, such as would occasion severe derangement of the health, by which the cure would be more likely to be retarded than quickened. At all events, I advise, in the first place, a trial of what the moderate action of mercury will do, aided by a proper regimen, before the patient is subjected to a severe and profuse salivation.

When a sore is situated under the prepuce, and the latter is so swollen that it cannot be drawn back, and the sore examined, we should always be careful to wash the matter away which collects under the foreskin.

For this purpose, we should first use warm water, and then a solution of the acetate of lead or sulphate of zinc. Here, by attending to cleanliness, we are doing a great deal towards the cure. Now that the plan of giving mercury in moderate quantities is generally preferred to a violent and profuse salivation, we should do no material harm by following this method, even though the concealed situation of the sore might not let us judge of its exact character. In such a case, if the iodide of potassium were objected to, I should consider the exhibition of mercury, on the moderate plan specified, perfectly justifiable. Formerly, when the ulcer could not be seen, and when it was the custom to salivate the patient profusely, the question, as to whether mercury should be given or not, was a very serious one — it was virtually, whether the patient should or should not undergo a long and violent salivation? whether his constitution should be subjected to severe impairment or not? But now the decision does not involve a consideration of this importance.

If a chancre heal up quickly under the influence of mercury, the general rule is to continue the medicine for ten days or a fortnight after the sore has been cured. Another general rule is, that of not discontinuing mercury until the hardness of the base, upon which the chancre was situated, has been dispersed, for this is not uncommonly looked upon as the criterion of all diseased action having ceased in the part. Exceptions occur, however, where a chancre leaves a callous cicatrix, which will not yield to mercury; and, consequently, a perseverance in it beyond a certain period would do more harm than good.

One kind of chancre, situated on the lining of the prepuce, where it is reflected over the corona glandis, sometimes leads to an accumulation of pus between the skin of the dorsum penis and the corpora cavernosa. If an outlet be not made for the pus collected in this situation, it will sometimes spread up to the pubes, and a good deal of the skin of the penis be destroyed. Occasionally, several small openings take place, but they are insufficient to prevent the mischief. Here the best practice is either to make a free opening, or to slit open the prepuce from its orifice up to the corona glandis.

Dr. Wallace frequently demonstrated to the pupils of his hospital the remarkable influence of the nitrate of silver in stopping the progress of a chancre on the frænum. The tendency, which a chancre has in this situation to perforate the frænum, is universally known, and it is also usually believed, that, when such perforation has taken place, the ulcer cannot be healed until the whole frænum has been destroyed, and hence it is common to divide the perforated part with a bistoury. Now, Dr. Wallace affirms, that, in nineteen cases out of twenty, if the patient apply before the ulcer has perforated the frænum, its perforation may be prevented, by the application of the nitrate of silver; and that, if the frænum be already perforated, the remaining portion of it may yet be saved by the same practice.*

Many surgeons do not place implicit reliance on the doctrine of the possibility of knowing whether a primary sore is venereal or not, by its mere appearance; and when there is doubt, it may be the wisest maxim always to give mercury, or the iodide of potassium, in moderate quantities. The successful treatment of primary sores materially depends on the kind of regimen observed by the patient; for if he neglect to keep

* See Wallace on the Ven. Dis. p. 95.

himself quiet — if he expose himself to all weather, and be guilty of excesses, he will be liable to more severe consequences, than other patients with similar complaints, who conduct themselves more prudently. With respect to dressings, astringent lotions, and especially the black and yellow washes, usually answer better than greasy applications; and, when there is much inflammation, we should enjoin the recumbent position, which, indeed, has a great effect in promoting the cure of sores on the genitals, whatever be their character.

I will conclude these observations on chancres with a statement made by Dr. Wallace, which, as coming from a gentleman strongly attached to the mercurial treatment, merits great attention. "In dispensary practice, and among the lower ranks of society, says he, the internal administration of mercury, particularly at inclement seasons of the year, can seldom with safety be recommended. In such persons, and under such circumstances, topical applications (nitrate of silver and mercurial lotions) are of infinite value. In cases of this kind, I generally confine my treatment to them, in conjunction with the internal use of nitrous acid; and, by these means, I succeed, for the most part, in healing the disease with rapidity. *Cases, treated in this way, are also very seldom followed by secondary symptoms.*" *

### BUBOES.

The venereal matter or poison, in its passage through the inguinal glands, frequently gives rise to inflammation and enlargement of them, which, in many instances, is followed by suppuration and ulceration. The swelling, abscess, or sore, thus produced, is termed a *bubo*, a name derived from a Greek word signifying *the groin;* though, if the patient happened to have a primary venereal sore on one of his fingers, he might have a bubo just above the elbow, near the inner edge of the biceps, or in the axilla; so that a bubo does not always signify a disease in the groin, as the etymology of the word would imply. But the poison of syphilis may make its way into the system, without exciting any inflammation in the absorbent glands of the groin, or other region of the body; no bubo at all may intervene between the occurrence of the primary sore and the commencement of secondary symptoms. In other terms, the latter are not invariably preceded by a bubo. On the whole, buboes form more frequently after a chancre on the prepuce, than after one on the glans; yet every inflammation of the glands of the groin must not be set down as venereal, for these parts are subject to various enlargements from other causes. Should a bubo occur in consequence of a chancre, before the ulcerating process of that chancre has ceased, Dr. Wallace deems it more likely that such a bubo has been produced by irritation than by absorption of the virus. This fact he considers to be tacitly admitted by those who have had most experience in venereal complaints; for, it is allowed, that buboes are most apt to occur after a lapse of some time from the formation of a chancre, and that, the longer a chancre has continued, the more likely is such bubo to be the forerunner of constitutional symptoms. Mr. Hunter observed, that, when the venereal poison affected one of the absorbent glands, the gland that inflamed was one of the nearest to the primary ulcer. Such, indeed, is the fact; and we never find that the absorbent glands, situated in the

* Op. cit. p. 113.

course of the aorta or iliac vessels, are inflamed, and brought into the state of suppuration by the absorption of venereal matter. The glands of the groin, then, may inflame, suppurate, and ulcerate, but not those within the trunk. Mr. Hunter entertained a suspicion, that another criterion of a venereal bubo was the circumstance of its involving only one gland; but, at the present day, this test is not entirely relied on. Frequently, in venereal cases, several glands inflame; and sometimes, in glandular swellings from irritation, only one gland is concerned. Also, in a bubo arising from scrofula, there may be only one gland affected at first; so that the distinction suggested by Mr. Hunter cannot, I believe, be depended upon. However, Wallace, Ricord, and others incline so far to the doctrine of Hunter on this point, as to represent the *venereal* bubo as most frequently seated in a single gland. "When absorption takes place from a chancre of the genital organs," observes M. Ricord, "the bubo only takes place in the *superficial* glands, and most commonly only in one of them at a time; though several may inflame and swell, both superficial and deep, so that one gland may actually have all the characters of a virulent bubo, while others near it, in which the inflammation may also advance to suppuration, as well as the surrounding cellular tissue, may present only one of a simple kind, quite free from virulence." * Another character, assigned by Mr. Hunter to a venereal bubo, is the quickness with which it generally proceeds to suppuration, and the shortness of time which the matter requires to make its way to the surface. I am afraid that this test, also, is not of much practical importance; for there is great variety in venereal buboes in this respect, some being much more indolent than others. It is far from being the invariable character of venereal buboes to proceed rapidly to suppuration; for while some of them are very acute, corresponding more or less to Mr. Hunter's description, others are of a chronic character, and this frequently cannot be accounted for, either by the influence of scrofula or mercury, the two circumstances which Mr. Hunter believed would generally explain it.

The venereal poison excites inflammation and abscess in the lymphatic glands much more frequently than in the lymphatic vessels.

Such buboes as are supposed to arise from the venereal poison, but have not been preceded by any chancre, are sometimes called *primary buboes*, and by the French *bubons d'emblée*. But, when a bubo follows a chancre, it is occasionally termed a *consecutive bubo*. If the bubo has made its first appearance in the stage of the constitutional symptoms, M. Ricord names it a *secondary bubo*. A *sympathetic bubo* means one not proceeding from the action of the venereal poison, but irritation in the urethra, lower extremity, or other part. Buboes are also divided into *acute* and *chronic*; *inflammatory* and *indolent*; *suppurating* and *ulcerated*.

The pus, formed by a venereal bubo, is well known to be capable of communicating the disease by inoculation; though, for reasons readily understood, if what has been stated by M. Ricord be correct, the matter secreted by the surrounding cellular tissue, or other glands simply inflamed at the same time, will not be infectious, and, consequently, if it happen to be employed, the inoculation will not communicate the venereal disease.

The generality of buboes, not truly venereal, are preceded and accompanied by more or less disorder of the health; and under such circum-

* Ricord, Mal. Vén. p. 40.

stances, if there were no chancre to account for the bubo, we should have reason for suspecting, that the state of the health had brought on the glandular enlargement. It is one good rule when the patient will not admit that he has had a chancre, or we cannot discover any traces of one, always to inquire into the state of the nearest lower extremity, and to ascertain whether there is any inflammation, wound, boil, or sore, about the foot, leg, thigh, or nates; any bunion on the great toe, or any inflamed bursa, or painful corn; for the inguinal glands are liable to inflammation and enlargement, in consequence of any of these causes.

Buboes, which arise unpreceded by chancre (*bubons d'emblée*) or any other cause to which they can be ascribed, except a suspicious intercourse, M. Ricord observes, mostly affect the deep-seated glands; their progress is generally chronic; they have little tendency to suppuration; and, what is especially worthy of notice, the pus which they form never communicates the venereal disease by inoculation. M. Ricord further asserts, that he has never known constitutional symptoms follow a bubo of this description.*

In the treatment of a bubo, if it be a venereal one, we ought to be guided by the same principles as in the treatment of primary sores. The doctrine, that venereal primary sores may be cured without mercury, applies also to venereal primary abscesses and buboes. Although Mr. Hunter referred the efficacy of mercury to a specific action excited by it in the constitution, which action is represented as capable of subduing the venereal complaints; yet he entertained a particular opinion, with respect to the modus operandi of this mineral, in the case of a syphilitic bubo. For instance, he had a high opinion of the usefulness of getting the mercury to pass through the diseased gland, which usefulness, real or imaginary, must have been ascribed in part, at all events, to the direct influence of the mercury on the gland, in its passage through it: he believed, that in this way buboes were sooner cured than when mercury was differently exhibited; and it was therefore a great object with him to rub the mercury upon a surface, from which the absorbents proceeded to the gland affected. This practice is, perhaps, not deemed so essential at the present day; and some very good surgeons even think, that the irritation of the mercury will sometimes actually bring on swellings of the absorbent glands, or aggravate them if they exist. At all events, I may state, that the plan is not universally approved, especially when there is acute inflammation about the glands affected. When, however, the swelling is of a more indolent or chronic nature, the practice of making the mercury pass through, or to the gland, or even of applying it to the groin itself, is frequently adopted; and there can be no doubt, that such method has an influence in dispersing the swelling. On the contrary, if the gland should be much inflamed, and highly painful, the value of the practice is extremely questionable.

How long the use of mercury ought to be continued in the treatment of buboes, and what is the quantity requisite to be given, are questions to which different replies would be made in different schools. I consider myself to be of that party which, while it admits the possibility of curing all the forms of syphilis without mercury, fully admits the general usefulness of this mineral as a means of checking and eradicating the disorder; that it divides with the salts of iodine the repute of being the best means of lessening the risk of secondary symptoms, and of quickening the

* Ricord, Mal. Vénér. p. 149.

cure of many forms of the disease. But, for this purpose, I should say, that long-continued and full courses of mercury are hardly ever requisite. In former times, when buboes yielded with tolerable celerity, it was the common rule to continue the mercury for about six weeks, at the end of which time it was entirely left off, and bark, sarsaparilla, and other tonics, given. Such was the general plan, when buboes yielded in a moderate time. On the other hand, if they subsided very rapidly, then the mercury was given for at least three weeks or a month after the healing of the bubo. But, we often find that buboes will not heal after mercury has been persevered in for a long time, and more especially when the health is much disordered by it. Here the discontinuance of the mercury is necessary, and such other medicines ought to be given as are likely to produce an improvement of the general health. Too long a perseverance with mercury will often retard the cure of a bubo, — nay, will sometimes so derange the constitution, that the ulceration will spread from this cause alone, and assume a most dangerous condition.

In scrofulous constitutions, either the influence of the mercury, or the derangement of the system, arising from the united effects of this mineral and of the disease together, will frequently give rise to scrofulous glandular enlargements. When mercury is so employed for primary venereal sores, as to occasion a full saturation of the system, if there be a tendency to scrofula, this abuse of mercury will frequently act as an exciting cause of the latter disease, and its continuance be sure to render the patient's condition worse. Here the discontinuance of mercury is a *sine quâ non* in any plan likely to be attended with benefit; and, instead of looking up to mercury for a cure, we should confide in remedies of another description, namely, bark, quinine, sarsaparilla, the diluted nitric or sulphuric acids, and narcotics, such as hyoscyamus, conium, opium, the acetate or muriate of morphia, &c. In some cases, also, it will be necessary to use such medicines as are considered to have a peculiar influence over scrofula, namely, iodine, or the carbonate of soda, and to let the patient have the benefit of a change of air.

It is a good rule not to be in too great a hurry to open a suppurated bubo, unless the matter is above a certain quantity, or has a tendency to spread, and then the sooner the swelling is opened the better. The matter is not always within the glands themselves, but often in the surrounding cellular tissue. In common examples, the skin should be suffered to become thinnish before an opening is made, and then a puncture may be made with a lancet or bistoury; but if the skin should be much undermined, and separated from the subjacent parts, some surgeons would prefer opening the abscess with caustic. In this manner a portion of the diseased skin may be destroyed, and a free opening made, well calculated for the ready outlet of the matter, and for obviating all risk of the formation of fistulæ and sinuses. One consideration, in favour of not opening buboes prematurely, is, that, after matter has collected within them, it may be absorbed again from the influence of mercury, or the iodide of potassium, aided by the effect of blackening the skin with the nitrate of silver, and then no opening at all will be required.

When a venereal bubo is much inflamed, antiphlogistic treatment will be necessary, as well as mercury, or the iodide of potassium; for specific inflammations, as well as common, are not out of the control of ordinary antiphlogistic remedies. We ought to apply leeches, and cold evaporating lotions, as in common inflammations; or, if cold applications will not answer, warm emollient ones, as poultices and fomentations, are to be

tried. When a bubo becomes a sore, the local treatment must be regulated by the appearances, character, and condition, which the ulcer may exhibit. In relation to this subject, I have already given general directions in treating of ulcers. When all specific action has ceased in the bubo, the disease is of course only a common sore, or a sore of one of the characters explained in the part of this volume, to which I have just now alluded.

When a bubo is in the form of a deep phagedenic ulcer, the application of a solution of opium, with a proportion of nitric acid in it, will often cause a rapid improvement of it. Even the undiluted nitric acid, applied in the manner adopted for hospital gangrene, will sometimes prove the best application. Dr. Colles, in such cases, brushes the edges of the ulcer with the strong muriate of antimony; and he assures us that, however large the surface, "it will begin to heal, even if the edges alone be touched."*

Sometimes, after a bubo has burst, one of the enlarged glands will protrude above the level of the skin, and retard the healing process. In general, such prominent gland will recede again under the use of mercury, as Dr. Colles represents; but I have seen other cases, in which this has not happened, and the disease became so tedious, that it was judged advisable to cut off the highest part of the glandular protuberance, or to destroy it with caustic. I had such a case in University College Hospital last spring (1839). I do not mean such practice, however, to be adopted, unless the prominent gland should not be reduced under milder plans.

A bubo occasionally leads to the formation of a sinus, commencing at the pubic corner of the ulcer, and descending in the angle between the scrotum and the thigh. If the sinus cannot be cured by pressure, or does not heal under the influence of treatment adapted to improve the general health, we should either lay the sinus open throughout its whole extent, or make a counter-opening in a depending situation, and wash it daily with some stimulating injection, as advised by Dr. Colles. Another troublesome consequence of bubo, described by this last gentleman, is a superficial ulceration, spreading along the inside of the thigh, sometimes even to the anus, or upwards on the abdomen. One edge of this ulcer is deeply and slowly increasing, while the other is thin and may be healing. This has occasionally been named the *horse-shoe ulcer*. Mercury is generally useless or hurtful. The black wash is a good application; and, if mercury be tried, it should be in small doses.†

When the patient has been taking a great quantity of mercury, a bubo, after having burst, may leave the skin in an undermined state, with callous and irregular edges. These are mostly obstinate cases, and will sometimes remain unhealed for months. So difficult is it to bring such ulcers into a favourable condition by common means, that it may be requisite to cut away the hard callous edges, as a measure that at once removes a principal impediment to cicatrisation. Instead of this plan, a strong solution of the nitrate of silver, or a caustic solution of iodine, the undiluted nitrous acid, the nitrate of silver, or the potassa fusa, is sometimes applied to the callous edges of the ulcer. In general, under such treatment, their hardness will gradually subside and disappear; but, in the event of the case resisting this mode of treatment, the hardened and diseased edges of the ulcer should undoubtedly be removed with the knife. In this condition of a bubo, the liquor arsenicalis, sarsaparilla in lime

* Abr. Colles, M.D., on the Ven. Disease, p. 102. † Ibid. p. 103.

water, or cascarilla with hydriodate of potash, or bark with the nitric or sulphuric acid, given internally, change of air, and sea-bathing, will frequently be of essential service.

What treatment ought to be adopted when a bubo arises unpreceded by any chancre? The statements of M. Ricord, already noticed, would of course incline us not to have recourse, at all events, to mercury; yet, if we listen to other authorities, mercurial treatment ought not to be omitted. Thus, Dr. Wallace informs us, — "I have treated certain cases of bubo, which were neither accompanied nor preceded by primary symptoms, but which had followed suspicious intercourse, as if they had been caused by the absorption of the venereal poison; and I have never had occasion to regret the practice. On the other hand, I have known buboes, which were not preceded by primary symptoms, to be followed by secondary symptoms when mercury had not been used in their treatment." Here we observe a positive disagreement between M. Ricord and Dr. Wallace on the question, whether secondary symptoms ever follow *bubons d'emblée?* The former states, that they never do, and, also, that inoculation with the matter of such a bubo cannot communicate syphilis by inoculation. In University College Hospital, we should never think of subjecting a patient to salivation for a bubo of this description, but adopt simple means for its dispersion, and, if this plan failed, try some other, according to the condition of the bubo, and the constitution. If the swelling suppurate, I recommend it to be treated as a common abscess; and either small doses of iodide of potassium with sarsaparilla to be prescribed; or, if there be any febrile disorder, saline antimonial medicines, with five grains of the pil. hydr. chlorid. comp. every night, or every other night, according to circumstances. If the swelling remain chronic, the skin covering it may be blistered, rubbed with the ung. potass. iodidi, or camphorated mercurial ointment, or blackened with the nitrate of silver. In some cases, compression is useful. With this treatment we may combine the internal exhibition of four or five grains of extractum cicutæ once or twice daily, and from ten to fifteen drops of the alcoholic solution of biniodide of mercury (L. P.) once, twice, or thrice a day.

### SECONDARY SYMPTOMS.

Previously to the occurrence of *secondary symptoms*, the constitution may generally be observed to be somewhat disordered; there is more or less fever present, with accelerated pulse, headach, loss of appetite, pains in the limbs, and inability to sleep. Indeed almost all patients are particularly restless for two or three days before the appearance of any secondary symptoms; that is, before they complain of a sore throat, or perceive any traces of cutaneous disease about them. When secondary symptoms take place, which does not always happen under any mode of treatment, and is not invariably prevented by any yet tried, they are more disposed to occur in some parts than others. On this account, Mr. Hunter divides the parts affected into two orders: the first order consisting of those, in which the secondary symptoms usually first show themselves; namely, the throat and skin, with which parts the iris and perhaps the joints are also to be arranged: the second, including parts in which the disease produces its influence at a later period, as the periosteum and the bones, to which may be added the nose, in which an ulceration of the mucous membrane, the ozœna syphilitica, with or without disease of the bones, is very common. In the second order of parts are likewise to be included the ear, the larynx, and the testicle, to

which, however, the effects of syphilis less frequently extend than to the other parts here specified. I believe that Mr. Hunter's statement, respecting the throat and skin, agrees pretty well with general experience, and modern surgeons are inclined to accede to his doctrine in relation to them; though pains in the bones and joints sometimes precede the sore throat and cutaneous eruption. I have seen nodes follow a primary sore as the first secondary symptom, and this has also been noticed by others. I once attended a medical gentleman, who had no sore throat, and no cutaneous eruption; yet he had nodes. It is generally considered, that the interval between the primary and the secondary symptoms is, on an average, from six to twelve weeks; but it may extend to several months, or, according to some reports, to one or two years. The earliest secondary symptoms generally commence within three months from the cure of the primary sore; but they may come on much more quickly, or even before the primary sore is healed. Almost every surgeon has had opportunities of seeing cases, in which there were at the same time an uncured chancre, an unhealed bubo, a sore throat, an iritis, and so forth, all existing together. According to the observations of Dr. Colles, when the primary symptoms have been treated on the mercurial plan, the secondary symptoms are generally later in making their appearance, and are also preceded by less disturbance of the system; but when mercury has been used only for a short time, or has been discontinued as soon as the chancre has healed, the appearance of secondary symptoms will be more early. He adds, that the same will be the case, if febrile action be excited by ordinary causes.*

### AFFECTIONS OF THE SKIN.

The *eruption* presents considerable varieties. A few years ago, it was considered that no eruption was venereal, unless it had a copper-coloured appearance, and was scaly. Mr. Hunter represents the skin as at first becoming mottled, and tells us that such appearance will come out and fade away again repeatedly. Now, this observation must have been overlooked by former surgeons, who endeavoured to prove that, without mercury, syphilitic symptoms invariably proceed from bad to worse; for here we find it stated, by their own great authority, that the eruption spontaneously disappears and then returns; that the disease fluctuates; yet the doctrine that Mr. Abernethy collected by his inquiries from all the most experienced surgeons in London was, that the symptoms of syphilis are continually progressive; and that when there is a true venereal sore, or eruption, it would always continue to get worse till mercury had been given. One form of syphilitic eruption is characterised by being scaly, and of a copper or reddish-brown colour; small copper-coloured spots first showing themselves, and the cuticle then peeling off. Some of these blotches conjoin, so as to form extensive patches; but others of the same colour, and decidedly syphilitic, are, on account of their diminutive size and particular figure, sometimes termed the *lenticular* syphilitic lepra. The venereal eruption, according to Mr. Hunter, consists of copper-coloured spots on the skin, accompanied by desquamation, which leaves the subjacent cuticle thicker and thicker as this process goes on, and of the same colour as the cuticle which peels off. If the disease advance further, scabs will form, suppuration will take place under them, and the result

* Practical Obs. on the Ven. Disease, p. 120.

be a *secondary venereal ulcer*, which, when thus produced, affects principally such parts of the skin as are in contact with other portions of the cutis, like the fold of the nates, the angle between the scrotum and thigh, or the armpit. In these situations, the eruption has a raised surface, from which a whitish matter frequently oozes. These copper-coloured scaly blotches generally first appear on the face, hands, and wrist, and afterwards on the breast and the extremities, where they are particularly numerous, and assume the form of *lepra* or *psoriasis*. Another circumstance deserving of attention is, that when the palm of the hand or the sole of the foot, where the cuticle is very thick, is affected, an appearance is produced, constituting what is often termed the *syphilitic lepra*, and *psoriasis of the hands and feet*. Mr. Carmichael, like Mr. Hunter, regarded the scaly copper-coloured eruption as characteristic of true syphilis; and though, says he, there are other eruptions which are venereal, or the consequence of venereal complaints, yet they are not truly syphilitic. He notices pustular, tubercular, and papular eruptions; but he does not consider these as consequences of a true Hunterian chancre, but refers them to primary sores of other descriptions. The syphilitic eruption seems to him always to consist of scaly blotches, in the form either of lepra or psoriasis, and unattended with fever; or, I should rather say, there is not so much fever present with these eruptions as with either of the others, namely, the papular, the tubercular, or pustular. As already noticed, Mr. Carmichael attaches so much importance to the form of the eruption, that he believes it possible to tell, by the inspection of the cutaneous disease, what has been the character of the primary sore. In short, he divides the venereal disease into four species or varieties. The first of these is the *scaly venereal disease*, or that which is correspondent to the Hunterian description, the chancre having a hardened edge and base; and when the bones are affected, their shafts and harder parts chiefly suffering, the nodes being true ones, and the eruption scaly, in the form either of psoriasis or lepra. The second is the *papular*, so called from the character of its eruption, which consists of inflamed pimples, and may follow gonorrhœa, and what some surgeons call the *gonorrhœal ulcer* of the prepuce and corona glandis. The third is named the *tubercular*, as being attended with an eruption of this character; and the fourth is the *pustular* variety of the venereal disease, so called also from the appearance of the cutaneous affection. The projecting incrustations, which are conical, or in the form of limpet-shells, constitute the appearance known by the name of the *venereal rupia*, which may follow an eruption, originally either tubercular or pustular. One important fact to be remembered is, that papular and pustular eruptions, when they have reached a certain stage, may be attended with a scaly appearance, which is, therefore, not exclusively the feature of lepra and psoriasis. This circumstance may, perhaps, explain some cases, in which the eruption seems to consist of scaly spots, and pustules and pimples, more or less mixed together.

*Secondary venereal ulceration* of the skin is often preceded by an eruption, some part of which, after repeated desquamation and scabbing, is converted into sores; but, in other instances, chronic inflammation takes place, independently of any eruption, and ulceration follows; and occasionally inflammation, suppuration, and secondary venereal ulceration, will occur over nodes. Secondary venereal ulcers have not any regular and constant appearance; they are frequently of a round shape, more or less chronic, and with an irregular, foul, ash-coloured surface; while others

evince the peculiarity of healing in the centre and extending at the circumference, the unhealed part being of a tawny colour, with sharp edges, and a foul bottom. No sooner does an experienced surgeon cast his eyes upon an ulcer of this kind, than he is led to suspect its venereal character; its tawny appearance, its shape, and its situation, will induce him to entertain a suspicion, that it has been preceded by other venereal complaints. But we should never conclude, from the mere look of a sore, that it is certainly venereal; but always take into consideration the history of the case, before a positive opinion is delivered.

Besides these secondary symptoms, presenting themselves as affections of the skin, I must not omit to specify the *ragged ulcerated fissures* and clefts seen on the nates, or about the anus (rhagades ani), and especially in the fold at the lower part of the nates, and between the perineum and the thigh, or sometimes even about the roots of the finger or toe nails. In the latter event, matter forms under the nail, which becomes detached, and the discharge is remarkable for its strong, fetid, and peculiarly disagreeable smell. Such is the *venereal whitlow*, as it is sometimes named.

Some *excrescences* in venereal patients, taking place especially about the genitals, perineum, and anus, receive different names, according to their various shape and consistence; as *warts*, *condylomata*, *fici*, &c. They are frequently accompanied with ulceration, or purulent discharge from the urethra or vagina; and they often grow from parts which have been ulcerated, though now healed. They are not essentially connected with syphilis; for we see precisely the same kind of growths in persons, who appear never to have had the venereal disease. In women they are very common, and some of them do not appear to me to be materially different from particular kinds of hemorrhoidal excrescences. Formerly it was the practice to salivate patients for the cure of these excrescences, and this sometimes more profusely than for a sore throat or a chancre; and it must be acknowledged, that, when the system was thus brought and kept a long while under the influence of mercury, such growths generally dwindled away, and ultimately disappeared. The fact, however, that these excrescences could be as permanently and certainly cured with the knife, ligature, escharotics, and stimulating applications, as by mercury, was well known to some intelligent practitioners nearly half a century ago; and, what is still more to the point, it was known that the cure was radical. On what principle, then, could the severe measure of a long and profuse salivation be vindicated?

### SORE THROAT.

One of the most common secondary symptoms is *ulceration of the fauces, tonsils, and soft palate,* — in other words, a *sore throat.* What has generally been considered as the most unequivocal specimen of syphilitic ulceration of the throat, is remarked to come on without much previous inflammation, to begin on the surface of the part affected, and to extend more and more deeply; so that, when situated on the tonsils, an appearance is produced, as if a portion of them had been scooped away. The sore has a sharp prominent margin, and its excavated surface is covered with yellow adhesive matter, that cannot readily be separated from it. It is not uncommonly believed, that a sore throat, corresponding to this description, is peculiar to true syphilis, or the scaly form of the venereal disease — that disease, all of whose symptoms are sometimes thought more particularly to require larger quantities of mercury for their cure, than other varieties of the venereal disease. On this point, however, I may

observe, that the doctrine, to which allusion has here been made, is not so much insisted upon at the present day as it was some years ago. In fact, this kind of sore throat has frequently been cured with sarsaparilla; and it sometimes follows sores, which have no kind of resemblance to the chancre with an indurated base and circumference. At the same time, the belief prevails, that whenever this kind of sore throat is accompanied by a scaly eruption, or by pains in the shafts of the long bones, or by true nodes, it will be more benefited by mercury than any other medicine. I sometimes employ small doses of the blue pill, joined with iodide of potassium and sarsaparilla. In University College Hospital we do not find it necessary, however, to keep up mercurial action for eight or ten weeks, as sometimes recommended even at the present day.

Besides this description of sore throat, there is another, consisting in superficial but foul and wide-spreading ulcerations of the tonsils, velum pendulum palati, and upper portion of the pharynx, accompanied by considerable pain, restlessness, and fever. On account of its appearance, it is frequently called the *ulcerous excoriation of the throat.* Mr. Carmichael thought he had traced it to be an effect of what he terms the *papular venereal disease*, or that which he conceived to arise from the *simple primary sore*, patches of excoriation on the prepuce, or gonorrhœa virulenta.

Sometimes a patient complains of experiencing severe pain whenever he attempts to swallow; yet the surgeon, on first inspecting the fauces, detects no ulcer, nor appearance of inflammation. In many such cases, there is an ulcer at the back of the pharynx, concealed by the interposition of the velum palati. "We should, therefore (as Dr. Colles directs), desire the patient to inspire as fully as he can; in attempting this, he raises the velum, and, if we then look into the pharynx, we shall generally discover the lower part of an ulcer;" and, to bring this more perfectly into view, the tongue must be depressed and the velum raised with a curved probe. The ulcer has a circular form, sinks deeply into the substance of the pharynx, has rather a foul but not a sloughy surface, and the surrounding inflammation extends only a very short distance from its margin.

An ulcer low down in the pharynx generally presents a foul, and sometimes a sloughy surface; and, according to Dr. Colles, the lower edge of it is very deep, while the upper part of it is superficial.

Another position, in which a sore is sometimes formed, is close to the insertion of the anterior palatine arch into the tongue. The ulcer, so placed, is deep and foul; but not sloughy.

In a few instances, we observe that the voice is rendered very nasal; the patient feels pain in swallowing; frequent desire to draw down the mucus from the back of the nares; and this, when coughed out, is often found slightly tinged with blood. The case is generally accompanied by fever. Under these circumstances, the ulcer is situated behind the velum, high up in the angle, between the upper and back part of the pharynx, or at the junction of its occipital and vertebral portions.*

Certain *ulcers* of the throat have *a truly phagedenic character*, and are disposed, under improper treatment, to destroy the whole of the soft palate, and to extend their ravages to the pharynx, and even sometimes to the larynx, causing necrosis of its cartilages, and endangering life. With this form of sore throat, when the constitution is in an unfavourable

* Abr. Colles, Op. cit. p. 124—126.

state, from the injudicious use of mercury, there is a tendency to the production of caries and necrosis in the bones of the palate, and even in the upper jaw-bone and the ossa spongiosa; but, if the disease be properly treated, and the employment of too great a quantity of mercury be avoided, the patient will generally escape all this serious mischief. Accidental inflammations of the throat from cold, common abscesses, and chronic scrofulous enlargements of the tonsils, must be discriminated from venereal sore throats.

### IRITIS.

One species of *iritis*, or *inflammation of the iris*, is an affection ranking as a secondary symptom of syphilis. After the appearance of disease of the skin, or sore throat, the iris sometimes inflames; this affection, which may follow, or accompany, various kinds of syphilitic eruptions, particularly the papular, and is usually attended with pains in the limbs and joints, I shall notice with other diseases of the eye.

### VENEREAL AFFECTIONS OF THE MOUTH.

The tongue is sometimes the seat of venereal ulceration, which may occur at its base, apex, or edges, or on its dorsum. The characters of the sore are described by Dr. Colles as not being constant. Sometimes the point of the tongue, when this is the place of the disease, is broad and truncated, the surface of the ulcer covered with a thin and rather a soft slough, and the end of the tongue much swollen and indurated. In other instances there may be the same degree of swelling and hardness, but the surface of the sore, though foul, may not be sloughy. An ulcer of the side of the tongue is attended with induration, but less swelling. Occasionally a venereal ulcer of the tongue is attended with an enlargement of one of the lymphatic glands under the jaw. Ulcers on the dorsum of the tongue are generally of a circular form, and as large as a fourpenny piece, with the same characters as are seen in a secondary venereal ulcer of the skin.

The hardness attending a cancerous ulcer of the tongue, is what is termed *stony*, and, in this respect, is believed by Dr. Colles to differ from the kind of induration attending many venereal ulcers of that organ. But, says he, if a slightly elevated narrow ring, of considerable hardness, include an ulcer, whose surface is so clean as at first view to resemble a sore that is about to granulate, we may unequivocally declare it to be cancerous. In all doubtful cases, the patient is to try the effects of a slight ptyalism.

The greater number of ulcers of the tongue, occurring in venereal cases, arise, according to my experience, from the action of mercury itself; but, on this subject, I need not enlarge, as, in the second section of this work, ulcers of the tongue are further considered.

### VENEREAL AFFECTIONS OF THE NOSE.

Ulcers of the alæ nasi may begin in the angle between the nose and cheek; and I fully agree with Dr. Colles, that whenever an ulcer, so situated, shows a tendency to phagedæna, or sloughing, it should be treated with some active caustic. The distinguishing characters of a venereal ulcer in the nose are, perhaps, not known; and are rather to be deduced from the history of the case. A scrofulous ozœna may be mistaken for an effect of syphilis. Dr. Colles refers to cases, as not being venereal, in which an ulcerated opening is formed in the septum nasi, about a quarter

of an inch from its anterior extremity. He describes it as continuing for years precisely in the same state. Numerous ulcers of the septum nasi I find to be most successfully treated by applying the nitrate of silver, or a strong lotion of creosote, or chloride of lime to them, and giving from 3 to 5 grs. of the iodide of potassium in the decoct. sarsæ. thrice a day.

### VENEREAL AFFECTIONS OF THE BONES AND JOINTS.

If the swelling has come on suddenly, seems to be chiefly seated in the periosteum, and the pain is not remarkably aggravated at night, we may generally conclude that the case is not venereal. True syphilitic *nodes* are more indolent in their progress than the swellings to which I have now referred; and the pain of them is always more severe at night than in the day. They are particularly disposed to occur on the central portions of the long cylindrical bones, and on such parts of the bones as are not covered by any great thickness of soft parts. Hence, the front surface of the tibia, the superficial part of the ulna, the sternum, the clavicle, and the cranium, are often the seat of nodes. The swellings, most likely to be mistaken for venereal nodes, are inflammations of the periosteum, and not of the bone itself, attended with pain in their very commencement, and even with redness of the skin; they arise suddenly, and frequently disappear in a short time, without the use of mercury. They have, therefore, more of the inflammatory character about them, than usually belongs to venereal nodes. The best plan, in all doubtful cases, is to inquire particularly into their history; we should consider the other symptoms which may have previously existed; the order in which they have occurred; and the effect of any treatment that has been tried; and we must form our conclusion by connecting the present symptoms with all the other information that can be collected.

I believe that true nodes are rarely produced in syphilis, unless the patient has been using mercury. From this remark I exclude simple periostitis, which has certainly occurred in venereal patients, treated by me in University College Hospital without mercury. The late Dr. Hennen, a man of considerable observation and great experience, affirms that he had never seen more than two cases of nodes in patients who had not taken mercury. I know that some surgeons maintain that the fact is otherwise; but it seems to me, that there is a great deal of truth in Dr. Hennen's observation, and that we seldom meet with patients who have nodes, unless they have been taking mercury. But here the question arises, how far the mercury is concerned in producing these nodes? In considering this question, we should recollect that, though we do not often see nodes in syphilitic patients, unless mercury has been given; yet in liver complaints, for which mercury is often given in considerable quantities, and for an immense length of time, nodes are never produced. On the other hand, if no mercury be given in the treatment of syphilis, nodes will seldom be produced. It seems, then, as if the action of mercury, and the influence of syphilis, together, had a share in bringing on these osseous swellings. At all events, it appears to me, that the venereal disease must be mainly concerned in the production of nodes. Still, there undoubtedly is foundation for the opinion that, unless mercury be given in some quantity or another, great or small, for the cure of that disease, nodes and other affections of the osseous system will rarely be excited. A node, once formed, will often remain for a long while unchanged; no increase of size, no discolouration, and no fluctuation being discoverable. In other instances, however, a node will slowly suppurate; which is observed to

happen more frequently on the skull and tibia than other bones. If the bone be exposed by ulceration, or an incision, a thickish plate of it will sometimes get into the state of necrosis, and the ulcer will not heal till exfoliation has taken place. In other instances, the surface of the bone granulates, and the ulcer heals up, without any perceptible exfoliation having occurred.* I entertain not the slightest doubt, also, that there is some truth in the opinion that *caries* and *necrosis* are not so much the consequence of the venereal disease itself, as of the baneful influence of mercury, when it is rapidly and unskilfully thrown into the system, at a period when the patient is exposing himself to the weather, not confining himself at home, and committing the most imprudent excesses in diet. I believe that, under such circumstances, an individual is far more likely to have his osseous system affected, than one who observes a more prudent regimen during a mercurial course; and it is my firm conviction, grounded on remarks which I have made in practice, that caries and necrosis of the bones of the nose would very rarely occur, if mercury were not given in immoderate quantities, and the patients took due care of themselves while using that medicine. Syphilis much more frequently extends its effects to the bones in cold, than warm countries.

The researches of M. Ricord fully confirm the Hunterian doctrine, that none of the secondary symptoms are capable of transmitting the venereal disease by inoculation. He accedes also to the proposition, that none of the secretions, either normal or abnormal, of individuals affected with constitutional syphilis, will serve for the communication of any venereal complaints by inoculation.†

### TREATMENT OF SECONDARY SYMPTOMS OF SYPHILIS.

Here the same general rules and principles, respecting the use of mercury, are necessary to be attended to as in the treatment of the primary complaints. I may say, then, that mercury will frequently expedite the cure of the secondary symptoms; but that, in some states of the constitution, even when true syphilitic affections are present, or when ulcers, which were originally of this nature, have assumed the phagedenic or sloughing character, and are accompanied by considerable inflammation, or much derangement of the health, mercury is the most pernicious medicine that can be employed. Mercury is also improper when any extraordinary degree of inflammation is present with a secondary sore. No surgeon will ever treat either the secondary symptoms, or any other forms of the venereal disease, with judgment and discrimination, unless he recollect various facts connected with this subject; and one of these is, that mercury will generally benefit not only the ordinary forms of the venereal disease, but many other complaints; it will cure not only syphilis, but many other diseases which resemble it, and many also which are totally different from it. He should likewise recollect that many diseases, which are successfully treated with mercury, iodide of potassium, sarsaparilla, guaiacum, antimonials, mineral acids, the nitro-muriatic bath, creosote, &c., would generally get well of themselves, in the end, if the constitution could bear the requisite struggle. And, with respect to mercury, or any other powerful medicines, be it also remembered that, if they are not administered in such doses as totally to derange the whole economy, if only moderate quantities of them are exhibited, they will not commonly prevent any disease from taking a favourable course, if it be so

* See Colles, Op. cit. p. 184.

† Ricord, Op. cit. p. 161—165.

disposed. Such reflections will render the fact very intelligible how, in forming an opinion of the nature of syphilis, and of the effects of mercury upon the disease, so much deception has frequently occurred. A patient takes mercury in moderation, and his disease gets well, and then the practitioner is confirmed in his idea, that the disease was venereal, and has yielded to the specific remedy. But it will be sufficient to recollect the facts, here specified, to be convinced that mercury is by no means a test of the venereal character of a disease. In the treatment of secondary symptoms, generally, when mercury is given, it is preferable to give it in moderate doses. In particular instances, it may be necessary to push the mercury beyond what may be denominated a mild mercurial course; but such examples are less common than sometimes represented. As a general piece of advice, therefore, I recommend the maxim of not aiming to excite a profuse and violent salivation.

With respect to secondary symptoms, it is a common remark, that when mercury is useful in this stage of syphilis, it generally shows its efficacy with even greater promptitude, than in the first stage, or in the treatment of the primary sores and buboes.

When the cutaneous eruption consists of scaly copper-coloured blotches, presenting the character of either psoriasis or lepra, and not attended with much febrile disturbance of the system, and perhaps associated with that affection of the tonsils, which is sometimes thought to be the greatest test of true syphilitic ulceration in the throat, namely, the deep excavated ulceration, frequently accompanied by pains in the shafts of the long bones, the majority of surgeons agree, that mercury should be prescribed, and employed according to the principles I have explained; namely, in moderate doses, and not so as to excite a profuse and violent salivation, or to bring on severe derangement of the health. But, if the patient's health be much deranged, or he be considerably reduced and debilitated, I never give mercury, but commence the treatment with light tonics, as sarsaparilla, or cascarilla, and small doses of the iodide of potassium; or, if the latter disagree, the dilute nitric acid may be prescribed in lieu of it. Afterwards, when the patient's health is improved, mercury may be employed, if necessary; but, in University College Hospital, the greater number of venereal eruptions are easily cured without mercury, or with small quantities of it, joined with the iodides and other means. The fact has been so often witnessed there, by the numerous body of students always attending that institution, as not to admit of dispute.

Foul or phagedenic ulcers in the throat may be fumigated with the red sulphuret or with the grey oxide of mercury, or washed with a solution of the chloride of soda, the black wash, or gargles containing muriatic acid, or any other detergent gargle. Secondary ulcers in other situations may also be fumigated with benefit, and either poulticed till they granulate, or dressed with various applications, as with the water dressing, watery solution of opium, or henbane, when they are painful, or with the black or the yellow wash; or, if they are of a more indolent character, they may be dressed with the ointment of the nitrate of quicksilver, or with the red precipitate ointment, or touched with the nitrate of silver. I have known a lotion, composed of from four to eight drops of creosote in an ounce of distilled water, make obstinate secondary venereal ulcers of the skin heal, when other applications seemed to fail. The more I see of venereal sore throats, the more I am impressed with the value of the nitrate of silver as an application to them, and this even when the sore is

attended with surrounding redness. In general, foul phagedenic ulcers of the throat are greatly benefited by it; but, if they resist its influence, the nitric acid, or the strong liquid muriate of antimony, may be used. They may be applied with a small camel-hair brush, or a bit of lint well secured to the end of an eye-probe.

When the eruption is papular, and has been preceded by a great deal of fever, and considerable disturbance of the system, and when such eruption ends in desquamation, we may employ bloodletting in the commencement, with the compound calomel pill and saline aperient medicines. The same practice should be pursued if there be pain and swelling of the large joints, accompanied by a diffused redness, and swelling of the tonsils and glands of the neck. Here it is to be suspected, that some particular state of the constitution has had a share in thus modifying the disease, rather than that the modification depends on some other poison different from that of true syphilis; but these still remain questionable points. After continuing the treatment that I have mentioned for a time, it is to be changed for small doses of James's powder, or antimonial powder, with decoction of sarsaparilla. Mr. Carmichael, who is a good practical surgeon, entirely disapproves of the use of mercury in the commencement of the treatment of the *papular form of the venereal disease;* he does not even give the compound calomel pill, which contains but a small quantity of mercury; in short, he expressly avoids administering mercury till the eruption desquamates, and then he admits that such medicine in moderate doses will be superiorly useful. With respect to that form of iritis which is met with in syphilis, often accompanying the papular eruption, mercury is highly necessary, and should be given freely, for reasons that will be explained when we come to the consideration of diseases of the eye. The papular eruption will often readily yield to iodide of potassium, in the dose of three grains, made up into pills, with one or two grains of the pil. hydrarg., and given once, twice, or thrice a day. In our hospital, this combination is often employed with great effect, and less injury of the health, than from the old custom of profuse salivations.

When the secondary symptoms are associated with a *pustular eruption*, we should begin the treatment with alterative medicines, especially antimonials, sarsaparilla, and iodide of potassium. After these medicines have been continued a certain time, we may prescribe bark, and the nitric or sulphuric acid. What is called the *sulphurous bath* is also frequently highly beneficial, and so are the nitro-muriatic acid bath and lotions of the sulphuret of potash. Mr. Carmichael does not give mercury in the pustular form of syphilis, unless the pustules change into scaly blotches; but he chiefly trusts to sarsaparilla and guaiacum, with small doses of James's powder, or of the compound powder of ipecacuanha.

When white aphthous ulcers of the mouth accompany syphilis, they may be touched with a solution of the nitrate of silver, or with diluted muriatic acid: some surgeons particularly recommend the oxymel æruginis, and others the black wash, or a strong solution of the chloride of soda.

It would appear from Mr. Carmichael's researches, that these forms of syphilis, comprising such as are termed *papular*, *pustular*, and I might add *tubercular*, do not require any mercury in their early stages; though it is admitted that, in all of them, after they have lasted a certain time, mercury will come in beneficially, bring the patient completely out of danger, and do what it would not have done, if given in an earlier stage of such

diseases. In University College Hospital, we find, that most of these eruptions readily yield to the decoct. sarsæ., and small doses of the iodide of potassium; but, when they resist, I combine the latter with two or three grains of the blue pill, rarely giving a greater quantity in the course of the day; and few cases cannot thus be overcome, unless there be some manifest derangement of the health, preventive of the usual efficacy of these medicines. Then such derangement, whatever it may be, will require attention.

One observation, made by Mr. Carmichael, agrees with what I have seen; namely, that when the knee joint is enlarged and swollen from any cause connected with venereal complaints, mercury will never do any good, but, on the contrary, render the case decidedly worse.

With respect to the treatment of the *phagedenic ulcers*, which occur in the *advanced* stages of syphilis, and generally accompany or follow either the tubercular or the pustular eruption, they are rarely or never benefited by mercury in their early stages. On some tubercles or pustules scabs form, which assume a conical shape. In Mr. Carmichael's book there is a drawing of one of these conical scabs projecting from the forehead, and so long as to resemble a horn. I believe that, in this form of disease, termed the venereal rupia, mercury is injurious; and that one reason, why the osseous system is so often affected, is the exhibition of mercury in the commencement of phagedenic venereal ulceration. In the early stages, bloodletting should not be omitted, unless there be some peculiar symptom or condition of the health prohibiting it. Antimonials, saline purgatives, and small doses of the compound powder of ipecacuanha, may also be employed with advantage. In all cases of phagedenic venereal ulceration, opium and its different preparations are truly beneficial. Sometimes opium may be combined with conium or hyoscyamus. Bark and the mineral acids are also frequently of particular service in the phagedenic varieties of syphilis; and the nitric acid has long enjoyed great celebrity. Besides these medicines, we have now another powerful auxiliary in the iodide of potassium, which, in the hospital of University College, has completely answered in the cure of phagedenic venereal ulcers, when aided by proper local treatment. How many bad cases have been brought to this hospital from workhouses and other places — cases attended with extreme emaciation, the utmost debility, loss of rest, and urgent hectic symptoms; yet, under the use of small doses of the iodide of potassium, decoct. sarsæ., an opiate at night, and a light nutritious diet, have soon terminated in a perfect cure.

When phagedæna affects the throat, the same general treatment will be of advantage; and, as for applications to the ulceration itself, we may use fumigations with the red sulphuret of mercury, or apply the black or yellow wash as a gargle, or touch the parts affected with the nitrate of silver. Another good plan is to touch the sore with diluted nitrous acid, applied by means of a camel-hair brush. The solution of the chloride of soda is another application which is now very much in favour. Sometimes phagedenic ulceration of the throat extends to the mucous membrane of the larynx, and even necrosis and exfoliation of the cartilages may be produced. When we have reason to suspect this sort of mischief to be going on, we should apply a blister over the larynx, or rub the neighbouring skin with antimonial ointment, so as to produce counter-irritation. In the treatment of the secondary symptoms attending the phagedenic form of the venereal disease, we should always try alterative medicines, as antimonials, guaiacum, sarsaparilla, conium, the nitrous acid, or nitro-

muriatic bath, &c., before having recourse to mercury; for, under such treatment, the health will get into a more favourable state for the reception of mercury; and though at first we cannot advantageously give this medicine, yet, when the health has been improved, it may become of important service, if prescribed with moderation.

The treatment of *nodes*, and of *swellings of the periosteum*, is to be regulated by the history of the case, and by attending to various circumstances already specified. When the pain or inflammation in a joint or bone seems to be more acute than belongs to the character of syphilis and true nodes, the best plan is to employ leeches and fomentations and poultices, with aperient and antimonial medicines, or small doses of the compound powder of ipecacuanha, followed up by the iodide of potassium, and some light tonic. Such treatment will mostly give considerable relief. After the affection has been rendered more chronic, if it be still obstinate, we may try blisters, which should sometimes be kept open for two or three weeks. In some cases, pus will form under the periosteum, and then nothing will afford relief but making an incision, and forming an outlet for the matter.

True nodes require either a course of mercury, or of the iodide of potassium, or the latter medicine joined with very small quantities of the blue pill; but it is erroneous to think of continuing mercury till the bones are reduced to their natural level. If, after mercury has been employed to a certain extent, the nodes become stationary, all pain has ceased, and all appearance of specific action is at an end, the practice should be changed. Of course, at this period, the patient's health is generally a good deal reduced, and therefore we are called upon to endeavour to rectify whatever derangement of the constitution may be obvious. Such derangement is partly, perhaps, the effect of syphilis, but certainly, in many instances, more the effect of the mercury that has been given. We may, therefore, give the compound decoction of sarsaparilla, bark, or the sulphate of quinine, with or without the mineral acids; but, with respect to the nodes, we must now trust chiefly to local treatment, and, with this view, we may try frictions with mercurial ointment over the part, or with an ointment composed of ʒj. of mercurial ointment and ʒj. of the hydriodate of potass, or ʒj. of the tincture of iodine, blended with an ounce of soap liniment. Many practitioners are in the custom of covering nodes with the empl. ammoniaci cum hydrargyro. Nodes, which lead to suppuration and ulceration over them, may be followed by caries, or necrosis of the enlarged portion of the bone, and even of a more extensive part of it; and occasionally matter forms in the medullary cavity.

### ENLARGEMENT OF THE TESTICLE FROM SYPHILIS.

This disease occurs in the more advanced stages of constitutional lues, being mostly chronic, and coming on without much pain. The enlargement is at first confined to one testicle; but afterwards both are sometimes implicated. There is, however, as Mr. Cusack * has described, an acute form of the disease, accompanying venereal hectic, pains in the bones, and scaly or other eruptions. I attended one horrible case with Mr. Doughty of Kensington, formerly one of my pupils, in which, after a most inveterate phagedenic ulceration and sloughing of the penis, both testes enlarged, suppurated, and at length sloughed away, with a con-

* See Dublin Journ. of Med. Science, vol. viii. p. 306.

siderable portion of the scrotum. The case had been under the care of an eminent surgeon at Brighton. This patient ultimately died. Mercury will not be of any service in the form of disease here adverted to; but, were I to meet a similar case, I would prescribe the iodide of potassium, with opium and tonics. The common venereal sarcocele yields to calomel and opium, and other means noticed in the observations on diseases of the testicle in our second section.

### DISEASE OF THE LARYNX FROM SYPHILIS.

In the advanced stages of syphilis, and especially where phagedenic ulceration of the throat has continued some time, and has been wrongly or inefficiently treated, the larynx becomes involved in the ravages of the disease. Its lining becomes thickened and ulcerates, and sometimes the cartilages are attacked with necrosis. This state is usually attended with great emaciation, extreme weakness, loss of rest and appetite, night sweats, frequent cough and expectoration of matter, loss of the voice, and paroxysms of difficulty of breathing, sometimes ending in asphyxia. So far as I have seen, mercury is more hurtful, than useful in cases of this description. Tonic medicines, as bark and quinine, with the mineral acids, or sarsaparilla, with the iodide of potassium, are to be preferred, opium being given at night if required. A blister, or seton, may also be put in front of the larynx; and a discharge of matter kept up. In some instances, the prevention of immediate suffocation would justify tracheotomy. Portions of the cartilages have been known to exfoliate, and to be removed from an external abscess.

### SYPHILIS IN INFANTS.

Syphilis is occasionally communicated to the fœtus in utero, through the medium of the blood of the mother. The effects of the syphilitic poison, thus developed in infants, may be said, therefore, to be secondary ones, as they arise from the introduction of the poison into the circulation of the fœtus, such poison not having been applied directly to the parts affected;—of course, then, the fœtus must receive the infection through the medium of the blood. Whether the child is ever primarily affected, that is, whether at the time of birth it ever contracts syphilis, in consequence of the direct application of the virus of a chancre with which the mother happens to be affected, is a questionable point. When the infant is actually *born with the disease*, the latter mode of communication is, of course, out of the question. I have already observed, that, in adults, with the exception of the parts of generation and of the mucous texture of the eyeball and eyelids, the venereal virus will not operate upon the general surface of the body, unless there has been some excoriation or wound at the period of its application. But if it be the fact, that an infant may contract a primary sore on any part of the general surface of its body, by such part coming in contact with venereal matter in the birth, then the remark which I have made, however true in relation to adults, cannot be extended to infants. But I believe, that few or no unequivocal cases, illustrative of this mode of communication from the adult to the child, are on record. On this point, however, Dr. Wallace declares, that there is no doubt that the child may be contaminated by the mother both *in utero*, and *at the moment of parturition*.*

The symptoms of syphilis in the new-born child, or soon after birth,

* See Wallace on the Venereal Disease, p. 125.

are mostly a universal desquamation of the cuticle, which peels off very extensively and freely; copper-coloured blotches and scaly eruptions over a considerable part of the body; various rednesses and superficial ulcerations about the anus and nates, and sometimes about the parts of generation; also ulcerations and fissures at the corners of the mouth, and in the mucous membrane of the fauces, and sometimes on the eyelids. Besides these symptoms, there is frequently an obstruction of the nostrils, with a thick yellow secretion, so that the child cannot breathe freely, and the respiration is attended with a snuffling noise. There is also an extraordinary degree of emaciation, the infant continuing to lose flesh daily; and, if not speedily relieved, it soon perishes. Abroad it is usual, in these cases, to give mercury to the mother, so as to affect the infant through her; but in this country, the cure of the disease is accomplished with such facility by certain preparations of mercury given to the child, that the latter plan is commonly adopted. We find that the disease readily yields to calomel, in half-grain doses, or to five-grain doses of the hydrargyrum cum creta. The latter, as the milder preparation, is perhaps the better medicine of the two; it hardly ever fails.

On the subject of the influence of syphilis, an interesting question arises, whether the child, that has received the infection from its mother in the womb, is capable of communicating the disease to others? We find many cases on record of wet nurses having contracted venereal sores on their nipples, by suckling pocky children: and, if the statements be correct, the fact is curious; for syphilis exists in such infants, as it were, in the secondary form, and the occurrence would therefore prove that, in them syphilis, even in that form, is capable of propagating itself, which is at variance with the Hunterian doctrines, and with what is commonly believed with reference to its nature in adult subjects.

When a pregnant female has chancres, she should be put under the mild influence of mercury, which will not only cure her, but save the child from contamination, or, if it be already infected, cure it also. Violent salivation, however, as likely to cause abortion, is to be condemned.

END OF SECTION I.

THE

# FIRST LINES

OF THE

# PRACTICE OF SURGERY.

## SECTION II.

### Injuries and Diseases of particular Organs and Regions.

### INJURIES OF THE HEAD AND THEIR CONSEQUENCES.

This important subject will here be considered, as it relates,
1st, *To superficial injuries*, i. e. *wounds and contusions of the scalp;*
2dly, *To fractures of the skull;*
3dly, *To wounds of the brain;*
4thly, *To compression of this organ;*
5thly, *To concussion of it;*
6thly. *And to inflammation of the brain and its membranes from external violence.*

#### SUPERFICIAL INJURIES.

In consequence of the free intercourse, subsisting between the vessels of the pericranium and those of the dura mater, through the medium of the diploe of the skull, inflammation on the outside of the cranium is apt to be propagated to the dura mater. This is one reason why injuries of the scalp, especially contusions and contused or lacerated wounds of it, are generally more serious than similar injuries merely affecting the common integuments of other parts of the body. Indeed, it is a maxim in surgery, that no wound of the head is so trivial as not to require the strictest attention.

The scalp is often the seat of erysipelas, which, in certain constitutions, will be brought on by a very slight cut or contusion; the inflammation spreading rapidly, and soon involving not only the scalp, but the forehead, eyelids, and greater part of the face. Too often also, notwithstanding the most judicious treatment, delirium, or coma, comes on, and the case has a fatal termination. I know of several instances, in which the removal of very small encysted tumours from the head led to the production of phlegmonous erysipelas, in so violent a form that the loss of life was the result.

*Contusions of the head* frequently give rise to an effusion of blood under the aponeurosis of the occipito-frontalis. The swelling is gene-

rally soft in the centre, and hard at its circumference; hence the feel of it may lead an inexperienced surgeon to suspect, that the accident is a fracture of the skull, with depression of the bone. In other instances, the extravasated blood may lie immediately under the scalp, and cover all the upper part of the head, raising up the soft parts in a manner that creates an alarming degree of disfigurement. In general, however, these accumulations of blood under the scalp, from blows on the head, subside very favourably under the use of a few brisk purgatives, and the application of lotions, containing a proportion of the muriate of ammonia, diluted acetic acid, and camphorated spirit. If, however, inflammation and abscess were not to admit of being prevented, fomentations, poultices, free openings, and washing out all the matter and putrid blood with a syringe and tepid water, would be the proper treatment.

When the scalp is wounded, or severely contused, the hair should always be cut off immediately; and, in many cases, it is a matter of prudence to shave the whole scalp, not merely that the wound may be rightly and conveniently dressed, but that every part of the oustide of the head may be seen and duly examined, and every mark of external violence detected. Hæmorrhage is, of course, to be stopped, and the wound freed from extraneous substances, and clots of blood; rules applicable to wounds in general.

Frequently the *scalp* is not merely *wounded*, but *lacerated, bruised,* and *more or less extensively separated from the subjacent parts.* In many instances, not only is the scalp thus torn and detached, but a portion of the skull completely denuded, the aponeurosis of the occipito-frontalis muscle and the pericranium being torn up together with the scalp. Here the raised portion, or flap, of the scalp, however torn and irregular it may be, should never be cut away, but be immediately replaced, and laid down upon the exposed portion of the cranium. The scalp is exceedingly vascular, and nature is more successful in repairing its injuries, than circumstances would sometimes lead us to anticipate. At all events, the chance of its preservation and reunion should be taken; for, if we succeed, we materially lessen the risk of necrosis of one or both tables of the skull. We thus expedite the patient's cure, and obviate the deformity which would ensue, either from cutting the flap away, or leaving it more or less displaced from the parts with which it was naturally connected. If slips of adhesive plaster and a bandage be not sufficient to maintain such flap in the proper position, we ought to avail ourselves of the assistance of the interrupted suture, making as few stitches as possible, because they are a source of irritation, and, in this situation, likely to promote the occurrence of erysipelas. For the same reason, when they have been employed, they should be cut and withdrawn at an early period, that is to say, on the removal of the first dressings.

When *erysipelas* follows wounds of the head, it is to be treated according to the rules delivered in the first section of this book. Cold washes ought to be applied to the head, copious venesection practised, the free use of leeches not omitted, and the exhibition of calomel, James's powder, and saline aperient medicines, actively followed up in the early stages of the case. When abscesses seem likely to form under the tendon of the occipito-frontalis muscle, and to bring on sloughing of that aponeurosis, a free incision down to the bone should be made without delay. It is an observation made by Dupuytren, that, in phlegmonous erysipelas of the head, the integuments hardly ever mortify, like the skin of the leg from the same disorder; and the reason which he ascribes for

the difference is an anatomical fact; namely, that in the leg the integuments receive blood only by ramifications from the tibial and fibular arteries, which lie very deep, while the skin of the head has the occipital, temporal, and frontal arteries directly under it; consequently, it is not so easily destroyed by the mischief produced under the aponeurosis of the occipito-frontalis muscle, as the skin of the leg is by similar mischief between it and the fascia.

In the *treatment of suppurating wounds of the scalp*, one object constantly requires our vigilance; namely, that of preventing the matter form spreading widely in the cellular tissue under the scalp, or in that under the tendon of the occipito-frontalis muscle. We must, therefore, be careful to make with promptitude the free openings, which may be required for this purpose, and to apply pressure, with the view of preventing fresh accumulations.

Frequently, when a portion of the scalp has been separated from the subjacent parts, and replaced, it will unite at every point; but in other instances, the union may not be general, and collections of matter may form in certain places. Here one principal indication is, to procure a ready outlet for the matter; for if we neglect to do so, it will not only destroy whatever union may have taken place, but diffuse itself to a great extent, and lead to a vast increase of mischief and danger. The loose cellular tissue, connecting the tendon of the occipito-frontalis to the pericranium, may also be the seat of extensive abscess, and that aponeurosis itself mortify; though the scalp itself will not generally slough, for reasons already stated.

## FRACTURES OF THE SKULL.

When the solution of continuity is very fine, it is termed a *capillary fissure;* when more open, a *fracture.* The broken portion of bone may either continue on a level with the rest of the cranium, or be beaten in, or, as we say in the language of surgery, depressed. The inner table, being more brittle than the outer one, is usually more extensively broken than the latter; and occasionally, violence, applied to the head, will fracture the inner table, and actually cause a depression of it, though the outer table may not be at all broken.

The most important distinctions are those of *depressed* and *undepressed fractures, comminuted fractures,* and *fractures of the inner table alone.*

In young subjects, *depressions of the skull without fracture* sometimes happen; a circumstance owing to the softness and elasticity of the bones of the cranium in the early periods of life; and now and then cases present themselves, in which the bones of the cranium are separated from one another at the sutures.

When violence is applied to the skull, the fracture may not happen to the part which is *immediately* struck, but in some other situation more or less remote from it: this kind of accident is termed a *counter fracture,* or, more commonly, a *counter fissure.* Fractures of the base of the skull are sometimes produced in this way, but not always; for a blow on the occiput or temporal bone may cause a fracture extending from the part actually struck to the base of the cranium.

It was formerly the custom to inquire of candidates for a surgical diploma the symptoms of a fracture of the skull; and I have no doubt that, in the times to which allusion is now made, certain replies of the most erroneous kind were expected and given; for vertigo, paralysis, stupor, loss of sense—circumstances specified by writers and lecturers,

about thirty years ago, as symptoms of fractured skull—really denote injury of the brain, or disturbance of its functions, and not a fracture of the skull. The simple solution of continuity in the bone, were it not accompanied by other mischief, would not be attended with any particular circumstances denoting its existence; and, in fact, every experienced surgeon knows, that many fractures of the skull are, on this account, completely overlooked—never discovered; and the patients get well without a single bad symptom. A mere crack in one of the bones of the cranium, *abstractedly considered*, is not more likely to produce any serious complaints, than a simple fissure in any other bone; and if symptoms of consequence do frequently attend the accident, they proceed either from the bone being beaten inwards, so as to press upon the brain, or from the mischief done to the parts within the skull by the same force that broke the bone itself. The same violence which breaks the cranium, may occasion a concussion of the brain, an extravasation of the blood in or upon it, or subsequent inflammation of that organ and its usual consequences.

In Klein's *Chirurgische Bemerkungen* (p. 161.), we find a remarkable proof of the truth of these observations. A man's skull was so badly broken, that, after death, the left half of it could with very little trouble have been separated from the right; yet, after the patient had recovered from the first stunning, which lasted an hour, he remained twenty-four hours without a single bad symptom.

A fracture *without depression*, then, is not, in itself, productive of any dangerous effects, or of any symptoms peculiar to it, or by which its existence may be known. Hence, if the scalp be free from wound, the accident is not likely to be detected at all; but the want of precise information on this matter, I should say, ought to be of no importance in practice, because the treatment should be regulated by other considerations. Thus, if the symptoms indicate concussion or compression of the brain, or a tendency to inflammation of this organ, we are to act accordingly, whether the bone be broken or not. We are led to adopt rigorous antiphlogistic treatment, or to examine the bone, with the view of making a perforation of it, by entirely different reasons than the existence of a *simple undepressed fissure* or *fracture*. However, when the symptoms indicate pressure on the brain, and the part struck is denoted by a wound, or ecchymosis of the scalp, we are then called upon to make an incision, for the purpose of ascertaining *whether any fracture with depression exists;* and, if this should not be the case, such incision may still be useful, because, if the symptoms call for the trephine, the part that has been struck is generally the proper one for its application, as being the most likely situation for any effusion of blood, and for any splintering or depression of the inner table. However, when we trephine under these circumstances, in the expectation of finding blood extravasated under the part to which the violence has been directly applied, we sometimes learn that this is not the case, and that the pressure is neither produced by an effusion of blood on the dura mater in this situation, nor by any fracture and depression of the internal table. Experience proves, that blood is frequently effused in or upon the brain, in situations more or less remote from the part of the head which received the blow.

We are not to suppose, then, that fractures *without depression* are not often accompanied by bad symptoms, but only that the mere injury of the bone itself is not the cause of them. The same violence which

breaks the bone may cause a concussion of the brain, an extravasation of blood in or upon it, or a subsequent inflammation of it or its membranes. But fractures *with depression* are a very frequent cause indeed of dangerous symptoms, because necessarily attended with compression of the brain. Yet, it is a curious fact, that the symptoms do not appear to be constantly in a ratio to the degree and extent of the depression of the bone. Sometimes fractures with a manifest and visible depression of the skull are not accompanied with any bad symptoms, or any of those effects known usually to arise from pressure on the brain. I was once called to a hackney coachman, a patient under the care of Mr. Hooper, of the London Road, in one of whose parietal bones a depression as large as a crown-piece had been occasioned; yet he had no urgent symptoms of pressure on the brain, and ultimately got well without an operation. We are not, therefore, to employ the trephine in every example of fracture with depression, but only in those cases which are made urgently dangerous by the existence of such pressure on the brain as this organ cannot quietly endure. I believe it to be an excellent general rule in surgery, *never to trephine a patient for a fracture of the skull, unless he be actually labouring under coma, paralysis, and other symptoms of compression in an urgent and dangerous degree*, excited either directly by the pressure of the bone itself, or by blood effused under it, or by suppuration under it, the consequence of a subsequent inflammation of the dura mater. One exception to the foregoing rule, sometimes specified, is a depressed fracture, occasioned by a pointed weapon, or a punctured fracture, as the injury is often termed; and the reasons assigned for such practice are, first, that this kind of injury of the bone is always attended with a splintered state of the inner table; and, secondly, that the patient will have the best chance of recovery, if the bone be removed before inflammation and suppuration of the dura mater have had time to take place.

*Fractures of the base of the skull* are cases of so perilous a nature, that they are generally regarded as inevitably fatal. Whether the opinion be true to this extent, is not an easy point to determine, because we never know positively, while the patient lives, whether the fracture has been of this kind or not; and if he recover, we have no opportunity of ascertaining the point by examination. Fractures of the base of the skull are mostly produced by the application of great violence to the lateral parts of the head, or to the vertex and base through the spinal column. If a person fall from a great height, and the top of the head come to the ground, the skull is operated upon by two forces — the resistance of the ground, and the pressure of the body upon the base of the cranium: the bones are seldom displaced to any extent; the dura mater is generally lacerated; the substance of the lower surface of the brain itself wounded; and blood, consequently, effused at the base of the brain. Indeed, such has been the degree of violence, that we generally find blood effused, not merely in this situation, but in others. I have opened many persons who died with fractures of the base of the skull, and the mischief noticed within their heads corresponded in every respect to what has now been described.

Bleeding from the nose, mouth, or ears, when attended with other circumstances, evincing the receipt of a violent injury of the head, and much consequent disturbance of the functions of the brain, has been frequently insisted upon as denoting a fracture of the base of the skull. Sir Benjamin Brodie relates one example of such a fracture, which was attended with hæmorrhage from the ear, and where the source of the blood was

found, after death, to be the lacerated cavernous sinus. Perhaps, however, no great degree of importance can generally be attached to this symptom; for such bleeding sometimes comes on from slight injuries, not at all affecting the cranium or its contents; while other cases are met with, where, on dissection, extensive fractures are found of the petrous portion of the temporal bone, and of the sphenoid and ethmoid bones, though no bleeding at all had occurred from the ears, nose, or mouth.

*Treatment of Fractures of the Skull.* — If the fracture be unattended with depression, or with symptoms of a dangerous degree of pressure, either from this cause, or from extravasation of blood, we must direct our views to the prevention of another source of peril, namely, inflammation of the brain, which may, perhaps, sometimes, be caused by the mechanical irritation of the inequalities of the fracture, but generally by the same violence which broke the bone itself. When the broken bone is not depressed, we can scarcely venture to trephine on the supposition that the inflammation of the dura mater and brain, which often follows such an injury, is owing to the mechanical irritation of the irregularities of the fracture; and, if this should not be the cause of the inflammation, as I believe it seldom is, then the infliction of additional mechanical injury by the operation would be the least rational and advisable measure that could possibly be adopted. Here, it appears to me far more prudent to be content with antiphlogistic treatment, such as cold washes to the head, venesection, arteriotomy, leeches, the free exhibition of calomel, with tartarised antimony, saline purgative medicine, and barley water or tea for sustenance. Nor should the antiphlogistic regimen be altogether discontinued till three or four weeks have elapsed; for the records of surgery prove, that a disposition to inflammation of the brain and its membranes lasts a considerable time after the application of external violence to the head; and such disorder has attacked and proved fatal to many who, supposing all risk over, have returned, prematurely, to their usual mode of living.

Some very interesting cases, illustrating this fact, are contained in Pott's works, and Klein's *Chirurgische Bemerkungen* (12mo, Stutgard, 1801, p. 113., &c.). In some of these examples, the patients remained well and sensible more than a month after the receipt of a blow on the head, and were then seized with fever, shivering, convulsions, paralysis, &c., which soon destroyed them. What is particularly worthy of notice is, that, in some of the cases, though the symptoms began thus late, and perhaps proved fatal in two or three days, a large portion of the brain and its membranes was inundated with matter; parts of it destroyed; its membranes considerably thickened, and even broken. We must here suppose, either that such disease was going on for a time, without producing any particular bad symptoms, or that its progress was most rapid after it had once begun.

A doctrine has arisen, that fractures of the cranium, attended with a wound of the scalp directly over the injury of the bone, are accompanied by much greater danger than other fractures of the skull, uncombined with such a wound. In short, it is alleged, that there is the same difference in this respect as prevails between simple and compound fractures of the bones of the extremities. This is the belief entertained by that highly respected surgeon Sir Astley Cooper, whose views of every part of surgery have great experience for their foundation. The point is important, because the doctrine might deter us from examining the state of the skull by an incision, and applying the trephine, when

the patient's safety, perhaps, depended very essentially upon such measures not being postponed. Surgeons, who subscribe to this view of the subject, will naturally be as much afraid of cutting down to a fracture of the cranium when there is no wound, as of cutting into a simple fracture of the leg, and making it compound. They will be inclined to avoid this proceeding, and, of course, to refrain from trephining, whenever the fracture is not accompanied by a wound; while, if the fracture happen to be already exposed by the accident, they would probably apply the trephine for precisely the same symptoms as they conceive would not justify it when no wound of the scalp exists. If I feel certain of any thing in surgery, it is that *the decision for the operation of trephining should depend upon the symptoms of pressure on the brain being urgent, dangerous, and unequivocally manifested;* and, I believe, whether there be a wound of the scalp or not conjoined with a fracture of the skull, it is our duty, under those circumstances, always to examine the state of the bone, and not to let our conduct be at all influenced by any analogy, whether true or not, between these cases and simple and compound fractures of the limbs. If the doctrine be true, however, which I am by no means prepared to deny, it should certainly teach us not to use the knife without any real occasion for an inspection of the bone.

In the time of the French Academy of surgery, it was customary to employ the trephine, or rather the trepan, in almost all cases of fractured skull, not merely for the removal of any urgent symptoms present, but with the view of *preventing their occurrence at all.* The absurdity of the latter doctrine received a complete exposure from the facts and observations published by the late Mr. Abernethy, whose investigations into this difficult part of surgery contributed very essentially, as I think, to its improvement, more especially by showing in what cases the application of the trephine might do good, and in what instances the operation should not be undertaken. Even at the present day, his advice is sometimes neglected; for I am continually hearing of persons being trephined under circumstances in which, according to the principles established by his researches, they cannot possibly be benefited by the removal of any part of the cranium. Here, so far as I can judge, the nature of the symptoms actually existing should be the guide; and, instead of admitting the wisdom of the old rule of trephining, in anticipation of bad symptoms which are only apprehended, but may never occur, I should say that the plan is altogether contrary to the dictates of reason and experience. As Mr. Abernethy observed, if the brain will, in the first instance, bear a certain degree of pressure without ill consequences, whether from fracture or effusion,—if it will, at first, bear it without the production of urgent symptoms, or irritation of the dura mater by the inequality of a fracture,—why should it not continue to do so subsequently? Dupuytren records the case of a banker at Paris, who was lately living in perfect health with a considerable depression of the cranium, though the accident took place many years ago. Yet Velpeau's observation on this and other similar facts is, that, for one patient who gets well under such treatment, ten would die. It is also not to be denied that, in some instances, the leaving of the bone depressed has been followed, at a subsequent period of life, by severe, and even fatal, affections of the brain and nervous system. It may be asked, then, why do I not approve of trephining every fracture with depression, whether attended at first with urgent symptoms or not? My answer is, that I cannot recommend this plan, partly for the reasons

stated by Abernethy, and partly because I doubt whether the cases of subsequent inconveniences, or dangers, from the continuance of the bone below its proper level, when the depression caused no bad symptoms at first, are numerous and common enough to be a foundation for what ought to be the general plan. Supposing the scalp were wounded, and the fracture of the skull comminuted, we ought to extract all the loose fragments; for they are already detached, and might cause irritation of the dura mater. This practice would be conformable to the general rules relative to the treatment of all wounds, wherever situated. But, if the pieces of bone were not completely detached, so that they could not be removed without an operation, and no bad symptoms existed, I should be inclined to join those surgeons, who do not recommend an operation under these circumstances.

One consideration which influences me in defending the principle, that the trephine should not be used in injuries of the head, unless bad symptoms actually exist, and are of that description which may be relieved by this measure, is, that the operation itself, viz., the removal of a portion of the skull, and the exposure of the dura mater, are proceedings attended with some considerable risk of bringing on bad, and even fatal, consequences. The late Mr. Ramsden was rather fond of operating; and I remember very well two cases, in which he tried what the trephine would do for the relief of a long-continued fixed pain at one part of the head. A piece of bone was sawn out in each case; inflammation of the dura mater ensued; and, in two or three days, each patient fell a victim to the experiment. The removal of a portion of the cranium is also followed, in a certain number of examples, by a gradual protrusion of the brain through the aperture — a *hernia cerebri*, which generally has a fatal termination.

### WOUNDS OF THE BRAIN.

Many fractures with depression produce a laceration of the membranes, and even of the substance, of the brain. This organ, important as are its functions, is frequently wounded without the event being immediately productive of those perilous symptoms which might be expected; but there is a difference in this respect, the reason of which is not at present satisfactorily understood: in some cases, a comparatively slight wound of the brain gives rise to severe and rapidly fatal consequences; while, in others, the same degree of injury, so far as can be ascertained, occasions no serious symptoms. In the Memoirs of the French Academy of Surgery are detailed various recoveries from most serious injuries of the brain; such cases as would *à priori* have been regarded as completely hopeless. If we look over the annals of surgery, we find numerous cases in which the patients were cured, notwithstanding the brain had not merely been wounded, but portions of it torn away, or separated. In one of the volumes of the Medical and Chirurgical Transactions of London are the particulars of a boy, through whose frontal bone the linch-pin of a gun was driven with such violence that it lodged in the anterior lobe of the brain. Directly after the injury, he walked several hundred yards, and then fell down, and was seized with convulsions. No suspicion was at first entertained of the passage of a foreign body into the brain. Venesection and other antiphlogistic measures were put in practice; and, on the following day, the urgent symptoms had abated. The boy was treated on this system until the 27th day, when a piece of iron was noticed at the bottom of the wound, and ex-

tracted. It proved to be the linch-pin of a fowling-piece, a substance of considerable size and weight. A cure ensued, with the exception of an amaurosis of one eye. A French soldier was wounded at the battle of Waterloo: a musket-ball entered at the anterior portion of the squamous suture, lodged in the substance of the brain; and on the fifth day, after an enlargement of the wound, and the removal of several fragments of bone, it was extracted from the posterior lobe of the right hemisphere of the brain, where it had rested upon the tentorium. Headach and partial deafness of the right ear were the only bad symptoms. A recovery took place. However, I believe the history of this part of surgery will warrant me in representing wounds of the brain as generally attended with vast danger; and that, even if no bad symptoms occur directly after the accident, they mostly come on and prove fatal afterwards. Paroisse gives an account of twenty-two French soldiers, from whose skulls portions of bone, with the scalp and slices of the upper part of the brain, had been separated by sabre wounds. All these men ultimately died; but at first they had no bad symptoms, and actually performed a journey of ninety miles after the receipt of their wounds, one half of which distance they travelled on foot.

Surgeons may be called upon to perforate the cranium for the removal of balls lodged within its cavity. Larrey relates some extraordinary examples of this practice; and it was he who first suggested the necessity of sometimes making a counter-opening in the bone for the accomplishment of this purpose, when the ball had passed to some point of the surface of the brain remote from the opening by which it had entered. He introduces an elastic gum catheter along the track of the ball, and makes a perforation with a trephine over the part where he feels that it is lodged. Now, one of these histories is very curious; for, after having removed a portion of the skull with the trepan, he took out an iron ball, that weighed seven French ounces, which was lodged upon the anterior lobe of the right hemisphere and against the orbitar process and spine of the os frontis. The patient suffered a painful sense of weight in his head; and whenever he inclined it backward he was seized with syncope. Here, also, the case ended in the recovery of the patient.

In *the treatment of injuries of the head,* attended with a *wound of the dura mater* or *substance of the brain itself,* if no particular symptoms or circumstances immediately demand the trephine, our chief reliance should be upon rigorous antiphlogistic treatment; the same plan as already advised for fractures unattended with urgent symptoms of compression. The external wound itself is to be treated on common principles; it is to be made clean; foreign bodies, or fragments of bone, are to be taken out, and its sides brought together. Such cases commonly end fatally; but we must not absolutely despair of them, for the injury, and even a considerable loss of substance in the upper part of the hemispheres, may occur, as we find in the cases which I have quoted, without being necessarily fatal, or even productive of very alarming symptoms.

Wounds of the dura mater and brain are sometimes followed by hernia cerebri, which then often appears to have a considerable share in occasioning the patient's death.

### COMPRESSION OF THE BRAIN

May arise from fracture with depression, from an extravasation of blood within the cranium, or from a collection of matter in the substance of the

brain, or between the inner table and the dura mater, in consequence of previous inflammation, the symptoms of which must then precede those which usually accompany the injurious effect of pressure on the brain. Compression of the brain may also be produced by the lodgment of balls within the cranium, or by the formation and growth of tumours. When such pressure exists, it cannot be expected that the symptoms will be alike in all cases, because the pressure not only differs in respect to its cause, its degree, and its situation, but it differs also in another important point of view, namely, that relating to the kind and quantity of other injury, or mischief, with which such pressure may be conjoined. For we find in practice, that every case of pressure, following external violence, is not so clear as many writers would lead us to suppose; and that we do not always have mere pressure to deal with, but often pressure combined with concussion, with inflammation, or with a wound or laceration of the membranes or substance of the brain. In short, we frequently have to exercise our judgment on what may be called *mixed*, or *complicated*, cases, in which the symptoms do not correspond altogether to those either of compression, concussion, or inflammation singly. Yet, if we understand the general character of the symptoms resulting from each of these states, we shall be in a great measure qualified to judge of the effects likely to be the result of their happening to be coexistent.

It may be thought that apoplexy will give us the best illustration of the symptoms of simple compression of the brain; yet this is perhaps not precisely the case, because apoplexy is often preceded by disease of the brain; and, at all events, as good an illustration of them is afforded by certain cases, in which, after the receipt of a blow on the head, the patients recover from their stunned state, immediately following the blow, and shortly afterwards begin to labour under the effects of an effusion of blood, gradually going on within the head.

The *symptoms of compression of the brain* are headach, stupor, and drowsiness; and, while the quantity of effused blood is small, they may be the chief symptoms. Afterwards, when it increases, and the pressure on the brain is greater, there will be a *loss of all sensibility*, and of *all power over the voluntary muscles*. The eyes will remain half open, the retina will be perfectly insensible, the pupils will generally be dilated, and the iris quite motionless, even when a candle is brought close to the eye. The patient may be pinched or pricked, but he is perfectly unconscious of it: the bladder, being paralytic, cannot empty itself; or its sphincter and that of the anus being in this state, the urine and fæces come away involuntarily. The pulse is slow, and respiration carried on with difficulty and a stertorous noise.

The observations, already delivered respecting mixed or complicated cases, enable us at once to perceive that, even when compression of the brain exists, and this in an unequivocal manner, the symptoms may be modified by the particular complications attending it. Thus, frequently, one pupil may be contracted, and the other be dilated; or the patient may be paralytic on one side, and convulsed on the other. My experience teaches me, that convulsive twitches of the muscles are rather a symptom of laceration of the brain, than of simple compression. They often attend fractures with depression.

In compression, there is usually no sickness and no vomiting. This fact is well exemplified by cases, in which the patient is free from these symptoms until he has been trephined, and then the removal of the pressure is sometimes immediately followed by the rejection of the contents of the stomach.

Another fact which deserves notice is, that, when pressure exists only on one side of the head, the paralysis generally manifests itself in parts on the opposite side of the body. Complete hemiplegia, however, is much more rarely the consequence of accidental injuries of the head, than of apoplexy; a difference, perhaps, referable in these cases to the difference in the situation of the effused blood.

With respect to paralysis, though it is a common symptom of pressure, various facts prove, that it may also arise from concussion.

Too much attention cannot be paid to one circumstance, frequently throwing considerable light on these cases. I allude to the patient sometimes *recovering his senses, after having been stunned by the blow, and then relapsing into a drowsy condition, which is soon followed by all those symptoms already specified as denoting compression of the brain.* That these symptoms cannot depend upon concussion is manifest; for then *the patient would not have regained his senses for a time*, a fact proving that the stunned condition of the patient, or the immediate effect of the concussion, had subsided. That the symptoms cannot depend upon a depressed fracture is equally manifest, because the *patient would have been senseless from the first, and have continued so without remission.* That the same symptoms cannot depend upon the lodgment of matter beneath the skull is certain, *because there has not been time enough for inflammation and suppuration* to occur. The real cause of the return of the loss of sense, then, under these circumstances, becomes tolerably evident, and is accounted for by the extravasation continuing slowly to increase, and to produce more and more pressure, and its usual consequences, notwithstanding it had not advanced sufficiently at first to prevent the return of the mental faculties, on the subsidence of the immediate effects of the concussion which the brain had sustained.

When no interval of sense takes place, but the patient lies insensible and motionless from the first, then we can only form a judgment of the cause of this state of the system by the consideration of other symptoms. Frequently cases of this kind are particularly unfavourable, as being complicated ones, combining concussion and compression together; and not only these evils, but a wound or laceration of the brain, and even a fracture at the base of the skull or elsewhere.

Extravasations of blood between the dura mater and base of the cranium are mostly fatal. When the blood lies between the dura mater and the tunica arachnoides, it is often widely diffused, so as not to admit of being effectually discharged. When situated on one of the hemispheres, between the cranium and the dura mater, however, it is often circumscribed, and may be discharged by a perforation of the bone.

There is frequently extreme difficulty in forming an opinion about the precise situation of extravasated blood, even when symptoms indicate such extravasation. Generally we know not whether the blood lies on the dura mater or in a deeper situation, or under what part of the cranium. Now, if the symptoms be urgent, the rule is, that *we are to be guided in the choice of a place for the application of the trephine by any mark of violence on the scalp, or any wound or fracture showing the part on which the violence has acted;* for it is directly under it that the extravasation is frequently, though not constantly, situated. We should also consider on which side of the body the paralytic effects show themselves, as the probability is, that the pressure is on the hemisphere of the brain of the opposite side. But, supposing there were twitches, or spasmodic action, of the muscles of the arm or leg of the opposite side, with paralysis of

the limbs on the same side, as the mark of violence, the surgeon should not trephine in the expectation of the blood being effused under that part of the skull which received the blow. In University College Hospital, I have had several cases, confirming the correctness of this advice.

Sometimes there is no mark of external violence on the head, no wound to guide us, no restriction of paralysis to one side of the body, no interval of sense. Here circumstances are desperate, and we have no choice, but either that of trusting to means calculated to stop the further effusion of blood in the head, viz., cold washes and venesection, or that of perforating the cranium without any kind of clue to the situation of the effused blood.

Under these circumstances, the generality of practitioners would be content with bleeding and antiphlogistic treatment; while others, knowing that when a considerable quantity of blood is effused on the surface of the dura mater, it is generally poured out from the middle meningeal artery, might feel disposed to trephine in the track of that vessel. Were there any guide to the side of the head on which the extravasation lay, this bold measure might be warranted; but many surgeons would rather confide in antiphlogistic treatment, and it is not for me to pronounce such decision erroneous. Often the blood is on both sides, or at the base of the skull likewise; and sometimes not only so, but not under the part struck.

*When dangerous compression of the brain arises from a fracture with depression*, the indication is to elevate or remove the portion of bone forced below the level of the rest of the cranium. For this purpose, we are to adopt certain modes of proceeding, which will be explained when I describe the operation of trephining.

Also *when suppuration occurs on the surface of the dura mater, and produces urgent symptoms of pressure*, the same operation is indispensable; but this case is generally not one of simple compression, — it has been preceded, and is usually still accompanied, by inflammation under the cranium, affecting not merely the dura mater, perhaps, but the brain itself. In the museum of University College is a cranium in which a small exfoliation has commenced, in consequence of suppuration on the dura mater. It is one of Pott's cases, as they are called, in consequence of his having particularly described them. In this instance, the trephine was applied, and the dura mater found red and spongy. But the case was not one of simple pressure; for besides the disease of the dura mater, another preparation, taken from the same patient, exhibits a deeply-seated abscess in the brain, about an inch below that part of the skull which is undergoing exfoliation.

The patient, before exhibiting the symptoms of pressure, must have had those of meningeal inflammation, — he must have had severe pains in the head, shiverings, an accelerated pulse, and disturbance of the intellects, followed by coma, and loss of sense, and generally a puffy circumscribed tumour of the scalp, and detachment of the pericranium, corresponding to the extent of the abscess between the inner table and the dura mater. Or, if there were an external wound, its lips would have lost their vermilion colour, become pale, flabby, and swollen, and the discharge changed to a scanty fœtid ichor.

Such a case calls for the immediate perforation of the bone, and rigorous antiphlogistic treatment, copious bleedings, leeches, the repeated exhibition of calomel and James's powder, and saline purgatives, with abstinence and quietude.

## CONCUSSION OF THE BRAIN

Has many degrees, as may readily be conceived, when the great difference which exists between its two extremes is recollected,—the slight transient stunned condition of the patient, the sudden effect of a moderate blow on the head, and that complete disorganisation which, at the moment of the injury, permanently annihilates all the powers of life.

When the concussion is slight, the patient may be stunned only for a few seconds, or minutes, and a degree of headach, followed by acceleration of the pulse, vertigo, and sickness, may take place; but, in general, none of these effects continue long if depletion be employed. However, in some examples, a very slight blow on the head will bring on inflammation of the dura mater, and this sometimes long after the accident, when all apprehension of danger has ceased.

When the violence applied to the head is greater, the patient is immediately stunned: his extremities become cold; his pulse is feeble, slow, and intermitting; his respiration difficult, but generally without stertor; and his sensibility and power of motion are entirely abolished.

This is the *first stage of concussion*, or the first effects produced by severe degrees of it. Such a state cannot last long, for the patient either dies in a very short time, or the effects which I have been describing gradually subside, and are succeeded by others, which may be said to constitute the *second stage of concussion*.

In this the pulse and respiration improve, and, though not regularly performed, are sufficient to maintain life, and to diffuse warmth over the extreme parts of the body. The nervous influence is also now so far revived, that if the skin be pinched the patient is conscious of the injury; and in many cases the contents of his stomach are thrown up; but he lies in a dull stupid state, quite inattentive to slight external impressions. In proportion as the first effects of the concussion subside a little more, he becomes capable of replying to questions put to him in a loud tone of voice. So long, however, as the stupor remains, the inflammation of the brain is moderate; but as the former abates, the latter seldom fails to increase, so as to bring on the *third* or *inflammatory stage of concussion*.

In this *third stage*, if the eyelids be opened, the patient will shut them again in a peevish manner; the pupils are contracted, and a strong light is very offensive. The patient is sleepless; talks much and incoherently; and, if not restrained, will get out of bed, and act with frantic absurdity. As the delirium increases the pulse becomes small, very quick, and even rapid; and, if the inflammation of the brain be not checked, suppuration, or effusion, will occur within the head, preceded by rigors, and the foregoing symptoms change into others, arising from the pressure of the fluid on the brain.

The dangers, then, of concussion depend upon its original violence, which may be such as to kill the patient at once, or upon the inflammation of the brain and its consequences often following the injury.

With respect to the sickness and vomiting, they are generally early symptoms, and seldom continue after the patient has recovered from the first shock of the accident.

Concussion and compression, we know, are often combined; and this fact will explain why the symptoms frequently have not the simplicity we might expect from some descriptions given of them.

Patients, who recover from severe degrees of concussion, sometimes

remain variously and curiously affected by the accident during the remainder of their lives. Imbecility, loss of memory, and a marked change in the character are sometimes the permanent consequences. The patient may have loss of hearing, or partial paralysis. In consequence of an accidental concussion of the brain, a patient, previously a lunatic, has been known to recover his reason. In other instances, the patient, at first, can only remember circumstances with which the mind had been lately impressed, but afterwards recollects nothing but what happened in his childhood. Sometimes one effect is the total forgetfulness of a language, with which the patient was previously familiar. Mr. Liston attended a woman, who recovered her hearing entirely from the accidental effects of a concussion of the brain. I lately attended a lady in the Regent's Park, who met with a concussion of the brain from her horses taking fright and galloping away with the carriage till it came in contact with some iron railings: in this example, the patient has not the slightest recollection of having met with any accident in the Park; nor does she remember the circumstance of the horses galloping away with her, or the fall of her coachman from the box. During my attendance on her, with the late Dr. Pinckard, she never adverted to the injury of her head, but repeatedly to a slight burn of her neck, which she had met with two or three days before the other more serious injury.

I believe there is great practical utility in dividing *concussion of the brain* into the three stages which I have described, because the treatment should be regulated accordingly. In the *first stage*, the taking away of blood must be improper and dangerous, the powers of life being already reduced to the lowest ebb; and, consequently, an attempt to reduce them further would be contrary to the dictates both of reason and experience. The patient, in fact, is already in danger of dying, without any reaction taking place in the system, and nothing would be more likely than bleeding to render the risk of this termination still greater. On the contrary, the indication is to endeavour to rally the depressed state of the system, for which purpose warmth should be applied to the surface of the body, and especially to the epigastrium and extremities, and stimulants to the nostrils. These I consider safer means than the internal administration of cordials and spirituous medicines, which, after the revival of the patient, always begin to have the most pernicious effects. However, some practitioners venture to give ammonia or ardent spirits by the mouth, or even to throw up turpentine clysters. From these plans I should always abstain myself, and be content with external stimulants, which can be discontinued directly they are no longer needed, without any hurtful prolongation of their action.

In the *second stage*, in which the freedom of the circulation has been restored, and a disposition to inflammation of the brain commences, all sources of excitement should be removed. The patient should be kept perfectly quiet in a darkish room, the head should be shaved and covered with cold applications, blood be taken away, the bowels freely opened with calomel and antimonial powder, and the functions of the bowels and skin promoted with saline aperient draughts. When the circulation rises a little more, the pulse quickens, and the fever and cerebral excitement have taken place, the lancet, assisted with leeches, small repeated doses of tartarised antimony, and cold washes to the head, may be said to be the sheet-anchor. At this period, we should bleed fearlessly, as often as the pulse rises above a certain point; for if we do not check the disturbance of the circulation, the inflammation in the head will certainly in-

crease, and the patient die. It is in cases of this description that arteriotomy is frequently practised.

The *third stage* is that of complete phrenitis, requiring quietude, bleeding, purgatives, calomel, tartarised antimony, and cold evaporating lotions on the head, and, after a time, blisters on the scalp, or the application of the antimonial ointment to it. When bleeding can no longer be continued, and there is risk of effusion upon the brain, we should give calomel freely, or employ mercurial frictions, so as to excite a salivation.

When all risk of arterial excitement is over, and certain imperfections and infirmities of the intellectual and muscular systems remain, seemingly as consequences of effusion, or some other permanent changes in the brain, the patient should be put under the influence of mercury, and the scalp blistered, or rubbed with the ointment of the iodide of potassium.

### HERNIA CEREBRI, OR ENCEPHALOCELE.

As a subject intimately connected with the consideration of injuries of the skull, I will now make a few observations on *hernia cerebri*, or *encephalocele*, as it is sometimes called, which signifies a gradual protrusion of a portion of the brain through a preternatural opening formed in the skull, either by the trephine, or by the exfoliation of a portion of bone in the state of necrosis. In children, indeed, the protrusion has been known to happen through an opening in the skull, left by its incomplete ossification. When hernia cerebri follows the application of the trephine, or the loss or removal of bone from other causes, some days generally elapse before the brain begins to protrude through the aperture; and this occurrence is preceded by ulceration, or sloughing, of the dura matter, without which circumstance probably there would be no protrusion at all in ordinary cases; I mean such as follows the removal of bone by the trephine. The tumour soon attains the size of a pigeon's egg, and its circumference is pressed upon by the edges of the opening. There is great tendency to hæmorrhage from the surface of the protruded mass, and consequently the tumour is usually covered with layers of coagulated blood. In some few cases, the patients do not lose their senses; though in by far the greater number of examples they lie in a comatose state; and if coma does not exhibit itself at first, it always comes on in the advanced stage of the disease. The immediate cause of hernia cerebri is obscure and unsettled, no completely satisfactory explanation of it having yet been given by any pathologist. It is said to arise in consequence of the removal of bone; but this is not the only cause, for if it were so, the protrusion would always follow such loss of bone, which is contradicted by experience. The ulceration of the dura mater, and other changes, appear to be concerned. The cortical and medullary portions are often distinctly visible in the protruded mass, and the pia mater is seen dipping down into the sulci, and enveloping the convolutions. Occasionally the tumour ceases to enlarge, acquires a brownish colour, pours out a fœtid matter, and breaks into several pieces, which afterwards separate, and are thrown off; and then granulations will sometimes arise, and the patient recover. This favourable termination, however, is rare; and I have seen so few patients get well who had hernia cerebri, that the prognosis seems to me very unfavourable, more especially when our ignorance of its proximate cause is taken into the account. In France, it used to be the practice to dress the swelling with a pledget dipped in wine. Such an application, one would suppose, could not pro-

mise to be very serviceable; yet Larrey and others prefer it. In this country, pressure in moderation has sometimes been tried, and even the bolder method of slicing off the protruded part of the cerebral mass. As a linen compress cannot be so exactly applied as a plate of metal, I should conceive that when the surgeon means to resist the return of the protrusion, the latter should be preferred. In removing a hernia cerebri with the knife, there is frequently profuse hæmorrhage; but though copious at first, certain cases on record prove, that it stops after a short time, and is not itself productive of danger. The liberties taken with the protruded portion of brain, without any apparent ill consequences, are truly surprising: the facts demonstrate, at all events, that the superficial parts of the hemispheres will bear a great deal of injury and mutilation, without life being destroyed or recovery prevented. We cannot wonder that this disease should be so often fatal, when we remember, that, in most cases, it is complicated with extensive and deep-seated injury of the brain. Dissection shows, that there is generally blackness and sloughing of the dura mater for some extent around the tumour; and that, in many cases, the substance of the brain has a softened and broken-down appearance. A fœtid dark-coloured fluid is also found between the dura mater and arachnoid membrane, which latter part is often thickened and opaque.

### FUNGOUS TUMOURS OF THE DURA MATER.

Fungous tumours sometimes grow from the external surface of the dura mater, and, after destroying the superincumbent portion of the cranium, make their appearance in the form of an external swelling under the scalp. They are generally preceded by a blow, or fall on the head, and occur at the part to which the violence was applied. As the fungus grows larger, its pressure against the skull, and particularly its pulsatory motion derived from that of the brain, occasion a slow and gradual absorption of the bone, just in the same way as an aneurismal tumour destroys any part of a bone against which it happens to press. The portion of the cranium immediately over the swelling being absorbed, the fungous excrescence meets with less resistance; it quickly protrudes through the opening in the skull; forms a prominent tumour under the scalp; and enlarges with increased rapidity. The severe pains in the head, which precede the external appearance of the disease, become still more violent as soon as the fungus protrudes through the opening in the bone, and is irritated by the sharp inequalities of its edge. The swelling has a manifest pulsation, corresponding to that of the arteries; and when compressed, it either returns entirely within the cranium, or is considerably lessened. The pain then subsides, the tumour being no longer irritated by the irregular circumference of the opening in the skull. If the size of the fungus be large, no relief can be thus obtained; for, when an endeavour is made to reduce the tumour, all the alarming symptoms of pressure on the brain are immediately excited.

Fungous tumours of the dura mater constitute a very dangerous form of disease, and mostly prove fatal.

Before a fungus of this description has made its way through the cranium, and projected under the scalp, so that its nature and existence can be ascertained, the practitioner has no opportunity of attacking the disease with any effectual means. The ordinary treatment of the severe pain occurring in certain parts of the head, after blows or falls on the cranium, and before the fungus protrudes, has consisted of bleeding and evacuations. But when the disease has manifested itself in the form of

an outward swelling, the nature of which is recognised from previous circumstances, as well as from the pain which attends it, and subsides on its reduction, and its pulsatory motion, the head should be shaved, a crucial incision made in the scalp covering the fungus, the angles dissected up, and the whole of the tumour and the margin of the opening through which it protrudes fairly exposed. But, as it is impossible to get at the entire root of the fungus, while it is closely embraced by the cranium, it becomes necessary to saw away the surrounding bone. This object can be best accomplished with one of Hey's saws. The root of the fungus being thus exposed, the next business is to cut it away from the dura mater. Fungous tumours of the dura mater have occasionally been extirpated with a ligature. The first operation which I ever saw in St. Bartholomew's Hospital, was the excision of two or three of such tumours, which was performed by the late Mr. Ramsden. The patient did not recover.

## DISEASES OF THE EYE AND ITS APPENDAGES.

This part of surgery being now cultivated with minute care, no surgeon, who values his own reputation, will neglect the study of it. Were it not a subject disfigured by too many harsh and barbarous terms, I should say, that it is one of the most inviting departments of surgical pathology and practice — one, in which we may often actually see the changes of disease exactly as they occur, and estimate their nature and character with wonderful precision.

For the sake of method, I will divide it into three parts; the first comprising *diseases of the lachrymal organs*, the second *those of the eyelids*, and the third *the diseases of the eye itself*.

### DISEASES OF THE LACHRYMAL ORGANS.

The lachrymal gland is not itself very liable to disease. In scrofulous children, it is occasionally the seat of inflammation and suppuration; but such a case is uncommon. The proper treatment would be leeches, purgative medicines, a cold evaporating lotion, and other antiphlogistic remedies. If suppuration could not be prevented, the cold lotion should be exchanged for poultices and fomentations; and, as soon as matter had formed, a puncture ought to be made, if possible, through the conjunctiva, under the outer portion of the upper eyelid; or, if this were impracticable, through the skin.

Another disease is an *indolent scrofulous enlargement of the lachrymal gland*. When I speak of any disease of the lachrymal gland, the case, whatever it may be, must be an uncommon one; and this we shall be convinced of when we hear, that the Reports of the London Ophthalmic Infirmary, for twelve successive years, contain no example of any disease of the lachrymal gland. If we were to meet with an indolent enlargement of it, we ought to treat it with the general remedies recommended for other scrofulous diseases, especially the repeated use of leeches, the compound calomel pill at night, and aperient medicine in the morning; or, what might be still more advisable, we should have recourse to friction with iodine ointment, prepared according to Lugol's formula, the patient taking at the same time the iodine solution, made according to his directions.

*Scirrhus of the lachrymal gland* is mentioned by most surgical writers; but doubts are sometimes entertained, whether a certain chronic induration of the lachrymal gland, generally described as scirrhous, be truly of

this nature; for the disease is remarked not to affect the lymphatic system; never to undergo malignant or cancerous ulceration, independently of that of the eyelids or conjunctiva; not to be followed by relapse after extirpation; and that the lachrymal gland is not very prone to assume any malignant change, may be inferred from the fact, that when the globe of the eye and the other contents of the orbit are extensively diseased, the lachrymal gland usually remains unaffected. The same fact is commonly noticed in cases of medullary disease of the retina, even when it has advanced to that degree which makes the removal of the eye necessary. The gland may be rendered as large as, or even larger than, a walnut; but when removed, its texture, though hardened, does not always exhibit the peculiarities of the scirrhous structure. However, the best authorities differ on this subject; for some of them contend, that the lachrymal gland, conjunctiva, and eyelids are the parts about the eye peculiarly liable to cancer; and there is no doubt, that the lachrymal gland is sometimes involved when these other parts are attacked. A truly scirrhous affection of the lachrymal gland alone is undoubtedly a rare disease. In the examples, recorded by Mr. Todd and Dr. O'Beirne, the structure of the diseased gland seems to have corresponded to that ordinarily described as characteristic of scirrhus.

What is reputed to be *scirrhus* of the lachrymal gland, is not attended with that preternatural dryness of the eye which has frequently been supposed to be an unavoidable consequence of such a disease; for in the cases of it, recorded by Mr. Todd and Dr. O'Beirne, in the 3d vol. of the Dublin Hospital Reports, there was actually an increased secretion of tears; an *epiphora*, as it is technically called. The symptoms characterising it are, lancinating pain in the external and upper part of the orbit; enlargement of the gland, till it forms a prominent, hard, lobulated, tumour, quite perceptible under the tense skin of the upper eyelid, and displacing the eye-ball in a greater or less degree, downwards, inwards, and forwards; dulness of the cornea; dimness of sight; double vision; dilatation of pupil; and at length complete blindness. In the worst stages, the temporal side of the orbit is dilated, or the eye so pressed upon as to be destroyed by ulceration and the evacuation of its humours.

As for the treatment, with the view of reducing and dispersing what is termed scirrhus of the lachrymal gland, the means proposed are leeches, followed by a succession of blisters, alternately to the neighbouring part of the forehead and temple; or friction with Lugol's iodine ointment, assisted by the internal exhibition of the iodine solution.

Were these plans to prove ineffectual, and the tumour to become a source of considerable annoyance to the patient, or of mischief to the eye, it would be necessary to remove the diseased gland. The operation cannot be easily done from beneath the upper eyelid, as it is sometimes recommended, unless an incision be made through the outer commissure, so as to let that eyelid be turned completely up, and the conjunctiva be sufficiently exposed. Hence surgeons, who have occasion to remove the lachrymal gland, have generally preferred cutting directly down to the tumour, making a crucial incision over it, raising the angles of the wound, and then taking hold of it with a tenaculum, and dissecting it out.

The return of vision, and of the eye into its place again, does not always take place immediately; and the sight may, indeed, never be recovered. In one case, reported by Dr. O'Beirne, the eye resumed its proper position, and vision was restored. In another instance, the particulars of which are given by Mr. Todd, though the protrusion of the eye

was gradually rectified after the operation, the blindness continued. In one or two examples, which were under Mr. Lawrence, the operation was followed by a considerable improvement of the sight.

*Diseases of the Caruncula Lachrymalis.* — The caruncula lachrymalis and semilunar fold of the conjunctiva are liable to inflammation, and sometimes matter collects in the substance of the former. The treatment consists in the removal of the cause, which may be the pressure and irritation of the eyelashes, or the presence of some extraneous substance; but the most common cause is exposure to cold. The caruncula is to be frequently bathed with tepid water, and opening medicines administered. In the early stage of a severe case, a leech might be put on the caruncula; and, in the event of suppuration, a bread and water poultice, included in a little muslin bag. The abscess should be opened early; and if fungous granulations arise, they are to be repressed with the nitrate of silver.

*Encanthis* signifies a chronic enlargement of the caruncula lachrymalis. Two forms of it are usually described; one, a *simple* indolent swelling of the part; the other, a *scirrhous* affection of it, disposed to degenerate into cancerous ulceration, but, fortunately, so rare that some surgeons, who have had the greatest opportunities of seeing this department of surgery, have not met with a single example of it. The inconveniences necessarily resulting from an encanthis, are considerable; as chronic ophthalmy, an impediment to the complete closure of the eye, and an interruption of the passage of the tears into the nose by the compression and displacement of the puncta lachrymalia. Hence the tears are continually dropping over the cheek, so as to produce the complaint technically named *stillicidium lachrymarum*, which is not to be confounded with *epiphora*: for while this last consists in so profuse a secretion from the lachrymal gland that the tears cannot wholly pass down into the nose, the *stillicidium* is a dropping of the tears over the cheek, in consequence of an impediment to their passage from the eye into the lachrymal sac. From the various causes, which I have explained as accompanying encanthis, the eyesight itself must be considerably weakened and disturbed.

When an encanthis cannot be reduced by applying to it the vinous tincture of opium, or a solution of the nitrate of silver, and especially when, from its great pain and disposition to bleed, it evinces a cancerous tendency, or, at all events, a propensity to become a very painful and troublesome disease, it should be removed without further delay. Some operators pass a ligature through it, by means of which they draw it out, while they perform the requisite incisions with a small scalpel; but taking hold of it with a tenaculum will enable us to cut it away with facility.

In the encanthis of the large inveterate kind, an elongation of it upon the inside of each eyelid may be seen, requiring to be separated with the knife in the commencement of the operation, before the main part of the tumour is separated. The surgeon should be careful not to encroach upon the conjunctiva, and, if possible, he should save a small portion of the caruncula, sufficient to prevent a perpetual dribbling of the tears over the cheek, after the cure of the disease. The eye is to be bathed with tepid water, and afterwards mild ointments, and astringent collyria, &c., are to be employed. If the granulations rise too much, the nitrate of silver is to be applied.

*Of various Diseases of the Lachrymal Organs, formerly confounded together under the Name of Fistula Lachrymalis.* — It is only within a few years, that any discrimination has been introduced into the views taken

by surgeons of the diseases of the lachrymal organs. Nearly all these complaints were supposed to be essentially connected with obstruction of the nasal duct; and hence its removal was generally the principal thing contemplated in the treatment. It was too much looked upon as a cause, and not as an accidental accompaniment or consequence, of certain affections of the lachrymal parts of the eye. The truth is, obstruction of the nasal duct is sometimes merely the temporary effect of inflammation; and, I might say, that in the greater number of diseases affecting these parts, such obstruction either does not really exist, or, at all events, has no share in the original production of the inconveniences which the patient is experiencing. Thus, if the disease be simply a morbid change in the secretion of the mucous lining of the lachrymal sac, the *blennorrhœa sacculi lachrymalis*, as it is termed, — or if the case be merely an extreme relaxation of the part, the *hernia*, of it, as it is sometimes called, the absurdity of opening the sac with a knife, and thrusting a probe, bougie, or style down into the nose, must be obvious.

*Inflammation of the lachrymal sac* may extend, more or less, down it into the nasal duct. The affection may be *acute* or *chronic;* the latter being more common than the former. In the acute, a swelling, shaped like a horse-bean, and attended with a degree of redness, presents itself just below the tendon of the orbicularis palpebrarum muscle. The swelling of the skin is at first confined to the part over the lachrymal sac, but afterwards spreads to the eyelids, which present an œdematous appearance. Now, in consequence of the lining of the sac and nasal duct becoming thickened, the passage for the tears into the nose is obstructed; so that, partly from this cause, and partly from the shrunk contracted state of the puncta lachrymalia, usually noticed at the same time, the tears do not descend into the nose, but fall over the cheek; consequently there exists what is termed a *stillicidium lachrymarum*. However inflamed the skin may be, we may always distinctly feel the swelling of the lachrymal sac beneath it. In healthy individuals, this kind of inflammation of the lachrymal sac rarely leads to the permanent obliteration of the nasal duct by the effusion of fibrine, though in scrofulous subjects such a result is possible.

The pain attending acute inflammation of the lachrymal sac and lining of the nasal duct, is more severe than might be expected from the small extent of the part affected. The headach is excruciating, and the fever considerable. Frequently the case advances to suppuration. The sac, and the parts by which it is covered, being incapable of any further distention, sometimes slough; but, more commonly, in the middle of the swelling a yellowish soft point is observed, which soon gives way. Then, the collection of pus and mucus within the sac makes its way through the orbicularis palpebrarum and the integuments; but, by this opening, merely the thinner parts of the matter are discharged, and the tumour is for a time somewhat lessened. Soon afterwards, when pressure is made upon the superior part of the sac, not only pus and mucus are discharged from the opening, but occasionally a quantity of pure tears; a proof, at all events, that the conveyance of the tears into the sac is now re-established. In other words, the action of the lachrymal puncta and canals has again commenced. This is always a favourable circumstance, as it denotes that now the only question relates to the state of the nasal duct. For some time after the discontinuance of suppuration, a morbid secretion, somewhat like pus, is kept up from the mucous membrane of the sac; but this also ceases in its turn, and healthy mucus is again formed

in the natural quantity. Sometimes the opening in the sac now heals up either spontaneously or by the aid of common surgical treatment. Most frequently it contracts at first to a very minute size, through which, if the nasal duct should not have become duly pervious again, the tears and mucus will occasionally be discharged. Should this minute opening close, and the nasal duct still remain impervious, the patient is obliged several times in the day to press upon the sac, in order that the mucus and tears collected in it may be discharged through the lachrymal puncta and canals. In other instances, the swelling of the lining of the sac and duct lessens with the inflammation; the passage for the tears is restored; and a complete cure is the result.

From what has been stated, it is manifest, that it is not every inflammation of the lachrymal sac that terminates in the production of an external opening indisposed to heal, or a *fistula lachrymalis*, as it is termed. Whether such an opening form or not, and whether, when formed, it will become fistulous or not, will materially depend upon the treatment.

If, when the lachrymal sac is violently inflamed, the case be neglected or wrongly managed, a complete or partial closure of the nasal duct by the adhesive inflammation is likely to be the consequence. There may also be produced an obliteration of the lachrymal canals, in which event, the absorption of the tears, and their conveyance from the eye into the sac, may be for ever impeded, and the patient remain during the rest of his life afflicted with a *stillicidium lachrymarum*.

In the *first stage*, the plain indication is to endeavour to subdue the inflammation; and it is by combating this affection, and not by attacking one, or even several of the symptoms, or effects, that we shall have the greatest success in curing the patient. For instance, what would here be more absurd than the scheme of dilatation, by the introduction of probes through the lachrymal canals into the sac, or even through the nasal duct into the nose? This would only be subjecting the inflamed parts to a new cause of irritation, and increasing the risk of greater mischief than is actually impending. Hence, instead of trying to insinuate instruments from one of the puncta lachrymalia down into the nasal duct, —a method, as I think, never advisable as a common practice, on account of its injurious effect upon the delicate organization of the lachrymal puncta and canals; and, as Dr. Mackenzie attests, rarely successful in any cases; we should have immediate recourse to antiphlogistic treatment; applying leeches freely and repeatedly to the inflamed part and its vicinity, covering it either with a cold evaporating lotion, or applying poultices and fomentations, and prescribing saline aperient medicines, followed by the exhibition of calomel, and antimonial powder. A very low diet will always be requisite; and, when the pain is severe, venesection.

Two principles I wish particularly to inculcate: 1st, that it is not every inflammation and temporary obstruction of the lachrymal sac and duct, which require the introduction of instruments down the duct into the nose: 2d, that when the obstruction is permanent, we should puncture the sac, and attack the obstruction in this manner. This is much better than throwing lotions into the sac through the lachrymal puncta and canals, whereby we should be more likely to destroy the right action of these delicate organs, than remove the stoppage of the flow of the contents of the sac into the nose.

In the *second stage*, when resolution is no longer practicable, the cold lotion may be laid aside for emollient applications; and when the sac is

so distended with mucus and pus that the centre of the swelling begins to soften, and a fluctuation to be perceptible, a puncture should be made large enough for the ready discharge of the contents of the sac. Having made an opening, I would merely inject tepid water with Anel's syringe down the nasal duct; a plan, which may be repeated every day, if the fluid can be made to pass into the nose. If it cannot, the obstruction should be removed with a probe.

When, by means of antiphlogistic treatment, the inflammation of the membrane of the sac has subsided, and by this and other measures the mucous secretion from it has been brought into a healthy state, and all the induration has disappeared, we may then think of adopting some plan for the re-establishment of the passage through the nasal duct, if it should not have already become free again under the treatment here recommended.

What I have now said principally relates to acute inflammation of the lachrymal sac; but this part is still more liable to *chronic inflammation.* Sometimes, and especially in scrofulous subjects, the lachrymal sac becomes distended with mucus, without any previous active inflammation in it. This is the stage which Dupuytren calls the *lachrymal tumour*, and which begins almost imperceptibly, the swelling being at first scarcely distinguishable, and situated under the inner canthus, and below the tendon of the orbicular muscle. It is circumscribed, and at first unattended with pain, or any change of colour in the skin. The inconvenience, first noticed, is a weakness of the eye, from the tears collecting at the internal canthus. Whenever the patient looks at minute objects, he finds a tear ready to drop over the cheek; and, to relieve himself from this annoyance, he is obliged to press upon the sac, so as to expel its contents, which either regurgitate through the puncta, or, what is less common, pass down into the nose. In this case, the nostril is generally drier than in the natural or healthy state of the lachrymal organs. Things go on in this way a considerable time, until at length the tears cannot any longer be made to descend by pressing upon the tumour in the corner of the eye; but, instead of doing so, they regurgitate entirely by the puncta lachrymalia, mixed with pus and mucus, and the whole of the lachrymal secretion falls over the cheek. The mucous membrane of the sac is the chief seat of this chronic inflammation. Sometimes the lachrymal canals, the sac, and the nasal duct are all affected together; and occasionally the lachrymal canals alone. After a certain period, the effects of the inflammation generally extend, more or less, to the mucous membrane of the eyelids, and even to the eye itself. The edges of the former are swollen, and adhere together in the morning; and the vessels of the conjunctiva are always more injected with blood than in the healthy state of the eye. In many individuals, the complaint disappears during summer, but returns at the commencement of cold or wet weather.

The complaint may continue in the above state for a long time; but, at last, a period arrives, when the parietes of the tumour become very thin, when the swelling can no longer be emptied by pressure, and the skin over the sore is red, hot, and painful. Frequently the inflammation extends to the eyelids, cheek, nose, and forehead. A fluctuation is now felt in the tumour, which points and bursts; and the opening, if neglected, is converted into a true *fistula lachrymalis.* In most patients, the stillicidium lachrymarum is now materially lessened, in consequence of the tears finding an outlet through the new opening, which the nasal duct did

not previously afford them. The discharge from the sac is a mixture of tears, mucus, and pus.

The *treatment of chronic inflammation of the lachrymal sac* consists in endeavouring to remove the inflammation; and, if we succeed in this purpose early enough, we prevent suppuration and ulceration of the sac, the formation of a *fistula lachrymalis*, as it is called; the nasal duct will not be permanently obstructed; and the tears and mucus will gradually resume their proper course into the nostril.

If, after the cure of the inflammation, the passage should not be free, and the sac remain distended, we may endeavour to press the fluid, with which it is filled, down into the nostril, placing the finger for this purpose between the puncta and the sac, and pressing from the puncta towards the nose. We may also instil into the corner of the eye, every day or every second day, a few drops of a lotion containing 2 grs. of the nitrate of silver, or from 2 to 4 grs. of the sulphate of zinc, to an ounce of distilled water; and in order that such fluid may be absorbed by the lachrymal puncta, the patient should lie upon his back, and continue quietly in this position during, and for a short time after, the operation.

When the conjunctiva of the eyelids and the Meibomian glands are affected, we may employ salves, the best of which are the ointment of the nitrate of quicksilver, in the proportion of one third of it to two thirds of spermaceti ointment; the red or white precipitate of mercury ointment in the proportion of one scruple of the powder to an ounce of lard; or the nitrate of silver ointment, from five to ten grains to an ounce. Undoubtedly, when suppuration cannot be prevented, emollient poultices and fomentations are advisable; and, as soon as the abscess is distinctly formed, a puncture should be made in it.

On examining the nasal duct, we now generally find it contracted at one or several points; and, for the removal of the obstruction, we are next to introduce a probe, and then employ a *nail-headed style*, in order to remove the disposition of the passage to close again. This instrument may be worn for an unlimited time without any material annoyance. The eyelids being drawn outwards, so as to put the orbicularis palpebrarum on the stretch, we are to make a puncture in the sac with a lancet, or a narrow sharp-pointed bistoury, along the surface of whose blade the style will pass into the sac, as on a director; a convenient method, which, I observe, was practised by Dupuytren, with his cannula, and which I have seen Mr. Liston adopt, in University College Hospital, with great skill, as soon as the puncture had been made. It is the method to which I usually give the preference. Before making the puncture, we ascertain the precise situation of the nasal edge of the orbit, and of the tendon of the orbicular muscle; for it is between these points that the knife should be introduced, carefully avoiding to go below the margin of the orbit, where the sac will not be found: a large quantity of mucus and puriform matter will be immediately discharged. A common silver probe is then to be passed into the sac, and thence down the nasal duct into the nostril, so as to clear away the obstruction. It should be introduced horizontally, till it touches the nasal side of the sac; it should then be raised into a vertical position, and its point directed downwards and a little backwards. If it meet with an obstruction, we must not immediately conclude, that there is an obliteration of the duct; but should press the probe down a little more strongly, turning it round between the fingers, and giving it different directions. In this way, the obstacle

may frequently be overcome, and the probe will suddenly descend. The probe is then to be withdrawn, and a little tepid water injected; after which the style is to be introduced sufficiently far to bring its head in contact with the skin. I see no utility in making a formal extensive incision: all that is required is a puncture to let out the matter, and to allow the style to be introduced, which is to be withdrawn, once or twice a week, and tepid water, or some slightly astringent lotion, injected through the nasal duct.

After the style has been worn a little time, the *blennorrhœa of the sac*, as it is termed, disappears almost entirely. The tears and mucus, absorbed by the lachrymal canals, would seem to be conveyed along its surface through the nasal duct; and thus the functions of the parts being restored, the inflammation and discharge quickly subside. The curious fact of the fluid taking its natural course, when a solid style is thus kept in the nasal duct, seems to Mr. Lawrence to be explained by what happens in the urethra; namely, by the enlargement of that canal round a catheter, which is left in it.

Sometimes, after the style has been worn one, two, or three months, it is discontinued, and the opening heals up; but a relapse takes place, and it is necessary to introduce the style again, and to continue it for some weeks longer. What proves how little inconvenience is commonly felt from its presence is, that the patient will often express a preference to wearing it a very long time, rather than subject himself to the slightest chance of a return of the disorder.

When the head of the style is covered with black sealing wax it causes little or no disfigurement. The instrument must occasionally be taken out and cleaned. After the parts have become habituated to it, I find that taking it out once a-week is quite sufficient. If left in too long, without being cleaned, it would be corroded, and likely to break in the part.

When the style, on being first used, creates much irritation, it is better to withdraw it, and after clearing away all obstruction in the nasal duct once more with a probe, we are to be content with injecting tepid water through the nasal duct by means of Anel's syringe, using at the same time leeches, emollient applications, and aperient medicines. Instead of a style, a tube made of gold, or silver, is employed by some practitioners. Baron Dupuytren prefers a tube of this kind, which is introduced into the nasal duct by means of a steel stilet, bent at a right angle at the portion beyond the bend corresponding to the cavity of the tube. The latter must be fairly lodged in the duct, with its upper or expanded portion occupying the lower part of the sac. The puncture soon heals, and the tube serves as an artificial channel for the tears. It is calculated, that Dupuytren treated 3000 cases in this way, and that, in nine out of every ten, the cure was accomplished, without any inconvenience from the continuance of the tube in the duct. In some instances, however, it became displaced, rising too high, or sinking into the nostril, through the lower opening of the duct. The first occurrence brings on inflammation, ulceration, and abscess, which render the extraction of the tube necessary. The second inflames and irritates the mucous membrane of the nostrils, and sometimes excites ulceration and sloughing of it, and the end of the tube may even perforate the roof of the mouth. Dupuytren has suggested very good plans for extracting the tube in each of these events; but as the style, preferred in this country, is not liable to the

inconvenient consequences here specified, I need not enter into any further details.

When a probe cannot be got through the obstruction in the nasal duct at the first trial, a piece of catgut, or bougie, may be left in the passage, and the attempt to overcome the stoppage daily repeated. If the obliterated portion of the nasal duct should still prevent success, perhaps the right practice would be that of rendering the nasal duct pervious again, by means of a small triangular perforator. This, I think, would be better than drilling a hole in the os unguis, and removing any portion of this bone with forceps, or destroying it with the cautery. If the perforated part of the duct should not admit of being kept open after the style has been worn a long time, the patient must continue to wear either it or a silver or gold tube. Caries of the os unguis, so frequent formerly, is now rarely met with, a proof that it was generally occasioned by wrong treatment. In the Leçons Orales of Baron Dupuytren is an instance, however, where such caries took place, even before the lachrymal tumour had burst, or any fistula had been formed.

With respect to *general treatment.* — In scrofulous cases, chronic inflammation of the lining of the sac and nasal duct will sometimes not yield, unless an attempt be made to improve the state of the constitution, by alteratives, tonics, especially the sulphate of quinine, and iodine medicines. We may also usefully combine with such treatment blisters behind the ears, or a seton in the nape of the neck, and iodine lotions, according to the formulæ given by Dr. Lugol.

*Obstruction of the Puncta Lachrymalia and Lachrymal Canals.* — The puncta lachrymalia are sometimes congenitally deficient; such a case is hopeless. Sometimes the puncta and canals are constricted, but pervious; and occasionally they become blocked up with calcareous matter deposited from the tears. The most frequent cause of their obstruction is a thickening of the membrane lining them, a consequence of previous inflammation.

When calcareous matter is present, it must be removed, as soon as its presence has been detected, by means of Anel's probes, made expressly for the purpose of examining the lachrymal puncta and ducts, and for removing any slight obstruction in them. When they are stopped up with mucus, they may, with these instruments, easily be made pervious again. In examining the superior punctum and lachrymal duct, we are to introduce the point of the probe first from below upwards, till it reaches the angle of the canal. It is then to be directed circularly downwards and inwards. In examining the inferior duct, we are to direct the point of the probe first from above downwards, and then horizontally towards the sac.

When, with these instruments, we cannot decidedly make out whether there is an obstruction in the puncta or not, we may put into the lacus lachrymarum a drop of an aqueous solution of saffron, while the patient lies upon his back. If the canals execute their office, this coloured fluid will disappear, without falling over the cheek.

When the puncta and canals are completely obliterated, the case is irremediable; for, were we to think of forming new puncta and ducts, we could not give them the organisation essential to make them of any use.

Sometimes cases present themselves, in which a *stillicidium lachrymarum* arises from atony and relaxation of the lachrymal puncta and canals, in consequence of previous inflammation, or the too frequent irritation of

them with probes and syringes. The puncta are seen to be widely open, and incapable of contraction.

For the cure of this form of disease, an astringent collyrium, made of distilled water and a small proportion of the sulphate of iron, and camphorated spirit, or the tinct. opii, is to be dropped out of a pen, or director, into the inner angle, frequently in the course of the day; the patient being kept for some time on his back after each application.

In old persons, this kind of stillicidium is attended with more or less separation of the lower eyelid from the eye. It may be somewhat relieved by astringent collyria; but never admits of a perfect cure.

## DISEASES OF THE EYELIDS.

*Inflammation of the eyelids* is not so disposed to involve the eyeball, as external inflammation of the latter is to extend itself to the former. However, if the inflammation of the eye be restricted to its internal textures, then the eyelids are not affected. When abscesses form in the cellular tissue of the eyelids, an early opening should be made in them, as the most likely means of preventing the extension of the disease, and subsequent eversion of the part. Passing over wounds, phlegmonous and erysipelatous inflammation of the eyelids, the treatment of which is regulated by general principles, I shall first consider —

### CATARRHAL INFLAMMATION OF THE EYELIDS,

Which affects their mucous membrane and the glands of Meibomius, and begins near the margins of the eyelids, which become sore, and are affected with heat and dryness. Their lining assumes a red, thickened, and villous appearance, and, if everted, looks like a piece of scarlet velvet. When the eyelids are moved, the pain is severe, because then the inflamed surface rubs against the globe of the eye; and hence, in every severe case, the patient keeps the eye more or less shut, and the eyelids motionless. In the beginning of the attack, the natural mucous secretion is suppressed, and a sensation of dryness and stiffness is experienced; but, after a little while, this feeling subsides, because now the secretion of mucus recommences, and is even more abundant than natural, though altered in quality, and somewhat like pus. The secretion from the Meibomian glands is also changed, so that it has a share in making the eyelids stick together in the night, and in the morning the patient cannot open his eye.

Catarrhal inflammation of the eyelids is mostly produced by atmospheric causes, and such as usually bring on inflammation of other mucous membranes. But inflammation of the lining of these parts is sometimes owing to its being habitually exposed to the irritation of smoke, or of an atmosphere impregnated with gas or vapour of a stimulating kind, minute particles of lime, &c. The influence of any of these causes will be rendered more powerful, if the patient be uncleanly or intemperate.

In the early stage, during which the inflammation is always more or less acute, antiphlogistic remedies are proper, as leeches, tepid lotions, and the unguentum cetacei, to the edges of the eyelids, in order to keep them from becoming adherent in the night time. The bowels are to be kept well open; and, at first, some brisk purgative medicine should be given. These means, if the case be one of sufficient severity, are to be followed

up by a blister on the nape of the neck. When the acute form of the complaint has been subdued, we are to employ astringent lotions, and stimulating applications, especially the vinum opii, and the ung. hydrarg. nitratis, which latter is to be melted, and put on the edges of the eyelids with a camel-hair pencil. At first, it ought to be weakened with an equal quantity of the ung. cetacei.

### OPHTHALMIA TARSI, OR PSOROPHTHALMIA,

Is merely a chronic inflammation of the lining of the eyelids, or rather of their margins, occasioning their adhesion together in the night, a degree of soreness and itching in the parts, and a falling off of the eyelashes. The Meibomian glands are considerably implicated. When the lining of the eyelids has been frequently in the state of chronic inflammation, especially in old subjects, not only are the eyelashes lost, but the edges of the lids, instead of being angular, become rounded, and present an habitually raw and red appearance, which is technically named *lippitudo*, or *bleariedness*.

When ophthalmia tarsi has continued for a long while, or been neglected, the orifices of the ducts of the Meibomian glands, placed along the inner margin of one or both eyelids, may be partially or totally obliterated; and it is chiefly in such examples that the eyelashes are lost, and the edges of the lids are rounded off. Sometimes an eversion of the lower eyelid takes place, from a contraction of the frequently excoriated parts of the adjoining skin of the cheek, or an inversion of the part, from the effect of previous ulcerations on the inside of it.

When a person is troubled with ophthalmia tarsi, or psorophthalmy, he should never attempt to open his eyes in the morning, till the glutinous matter, which makes the eyelids and eyelashes adhere together, has been properly softened and dissolved, so that it may be done without pain. For this purpose, the margins of the eyelids and the eyelashes should be anointed with a small quantity of spermaceti cerate. Then a piece of soft sponge, wrung out of hot water, is to be held over the eyelids for a few minutes, after which the eye may be opened without pain. All the gummy matter should be tenderly removed, because, so long as it remains, no eye-water nor salve can be brought in contact with the principal seats of the complaint.

The first indication, or that of diminishing inflammation, may be further promoted by fomenting the eyelids with a decoction of camomile flowers, applying leeches to the eyelids, and giving aperient medicines.

In bad cases, the eyelids may be covered at night with a bread and water poultice, included in a bag of fine muslin, the margins of the eyelids being first smeared with a little spermaceti ointment.

The second indication, or that of healing the ulcerated and excoriated parts of the lid, is fulfilled by applying to them the unguentum hydrargyri nitratis, more or less weakened at first with a proportion of lard; or salves containing the red or white precipitate of mercury, in the proportion of 10 or 12 grains of the former, or 30 grains of the latter, to an ounce of lard.

When small ulcerations are noticed along the margins of the eyelids, they are to be touched with the nitrate of silver, or a strong solution of it; and, in bad cases, it is best before using the caustic, to extract the eyelashes, for if their bulbs are suffered to be destroyed by the ulceration, they will not be reproduced.

The *third indication*, or that of improving the general health, requires

the employment of tonic and alterative medicines, sea bathing, pure air, and regular exercise.

### THE HORDEOLUM, OR STYE,

Is generally compared to a little boil, of about the size of a barleycorn, projecting from the eyelid. It is of a deep red colour, attended at first with itching, and afterwards with a considerable tenderness, and even more pain than might be expected from so trivial a swelling. Sometimes the irritation is such that the conjunctiva is partially inflamed, and the motion of the eyelid productive of great annoyance. It is the nature of a stye to suppurate very slowly; but at length it does suppurate, points, and bursts; and after discharging a minute quantity of curdy matter and disorganised cellular membrane, it usually subsides and disappears. But if any of the sloughy matter remain within it, the disease is apt to return, or to degenerate into a hard, white, chronic tumour, that is very slow in undergoing any change, and is technically named *grando*, from having been compared to a hailstone. Young persons are often annoyed for several weeks by a succession of styes, one forming as soon as another is cured.

In the beginning, cold applications, as the lotio plumbi acetatis, or a cold bread poultice, made with the same, or iced water, may be tried, though we rarely succeed in dispersing the swelling altogether in this way. However, we may first try what cold applications and aperient medicines will do; and when suppuration is obviously taking place, exchange them for warm poultices and fomentations. As soon as we see a white speck on the apex of the little tumour, provided the tumour is slow in bursting of itself, we may make a small puncture in it; but this should not be done unnecessarily, or prematurely, as it would only increase the inflammation, without obtaining any discharge of the contents of the stye. The pus and sloughy cellular substance are then to be pressed out, and a poultice applied again. When the sloughy cellular membrane is very slow in coming out, the cavity may be touched with lunar caustic, or with the end of a probe dipped in sulphuric acid.

The best way of treating the tumour, termed *grando* or *chalazion*, is to open it, press out its contents, and touch the interior of the cyst with lunar caustic, scraped to a point.

### ENCYSTED TUMOURS OF THE EYELIDS

Are not unfrequent, their seat being generally in the cellular tissue, connecting the integuments of the lid with the orbicular muscle; but they may be more deeply placed, so as to be covered not only by the orbicularis, but by the levator muscle. The more fluid kinds sometimes grow to the size of a pigeon's egg; but the steatomatous ones rarely become larger than a filbert. They often contain, besides the ordinary matter of encysted swellings, small short hairs, entirely destitute of bulbs and tubes.

The encysted swellings, not closely connected with the tarsal cartilage, are to be treated precisely on the same principles which apply to ordinary swellings of a similar character in other situations; but if they should be intimately connected with that cartilage, a formal dissection of them out would be difficult without cutting a portion of the cartilage away. Such operation may be rendered unnecessary, by everting the eyelid, and making at the point where it appears to be thin and most closely connected with the base of the swelling a free puncture through the car-

tilage, by which the contents of the swelling, if fluid, will be discharged, but if found not to be fluid, a second cut may be made across the first and the four angular flaps snipped off with scissors.

### ECTROPIUM, OR EVERSION OF THE EYELIDS,

Is a case productive of vast annoyance and considerable disfigurement. The lower eyelid is most frequently affected, its edge falling downwards and forwards away from the eyeball, which is no longer duly covered and protected. This exposure of the lower portion of the eye, and of the conjunctiva of the eyelid, produces in these parts a degree of inflammation, attended with constant pain and redness, and thickening of the membrane, which is at length converted into a hard callous substance, lying just under the eyeball. As the flow of tears, towards the inner angle, and through the puncta lachrymalia, is also obstructed, they fall over the cheek, which is apt to become excoriated.

Ectropium may arise from various causes, which considerably influence the treatment; for it may be either a permanent or only a temporary deformity, which will subside of itself on the abatement of the inflammation that has given rise to it. Thus we meet with *ectropium from acute inflammation of the conjunctiva.* When it affects the upper lid, it is in some degree accidental. A child, for example, is labouring under acute purulent ophthalmy, and the surgeon, in order to examine the eye, or remove the copious discharge, everts the upper eyelid; the child begins to cry violently, and all attempts to reduce the lid to its natural position are found to be ineffectual. It soon becomes greatly distended with blood; and even if it admit of being replaced, it is generally everted again as soon as the child begins to cry. When this variety of ectropium affects the lower eyelid, it is not produced in this accidental way, but by the swelling and protrusion of the inflamed conjunctiva.

The *treatment of ectropium from acute inflammation of the conjunctiva* requires, 1st, scarification of the everted conjunctiva; 2d, after the swelling of the eyelids has been lessened by the discharge of blood, the part may generally be reduced; 3d, if the inflammation be not very acute, the lid is to be kept from quitting its natural position by means of a compress and roller. In the contrary case, every thing must be avoided likely to make the child cry; and the attendants are to be instructed how to replace the eyelid, if it should happen to become everted again. A collyrium containing alum, the nitrate of silver, or sulphate of copper, must be applied frequently, for the purpose of checking the purulent discharge.

When scarifications fail to remove or prevent the eversion, we may cut away a portion of the swollen conjunctiva. The bleeding which follows will prove of great service. Afterwards strips of plaster passed from the upper to the lower lid, and a compress and bandage, will prevent the return of the displacement.

*Ectropium of the lower eyelid from relaxation* is most frequent in elderly persons, as a consequence of *chronic inflammation of the conjunctiva* and Meibomian glands. From constant exposure, the inside of the everted lid becomes red, firm, and almost insensible, and the lower punctum lachrymale displaced forwards. These various circumstances are necessarily productive of a weeping of the eye, a *stillicidium lachrymarum,* and of various degrees of inflammation of the eyeball itself.

The *treatment of ectropium of the lower eyelid from relaxation,* consists, first, in removing the inflamed state of the eyelids and conjunctiva, and

then in applying escharotics to the exposed conjunctiva, for the purpose of obviating the tendency to a return of the displacement. After having scarified the inflamed conjunctiva, we may apply the sulphate of copper, or nitrate of silver, and a compress and roller. In inveterate cases, a portion of the thickened and relaxed conjunctiva is to be removed.

*Ectropium of the lower eyelid, consequent to excoriation of it and the cheek, resulting from long-continued ophthalmia tarsi or lippitudo,* is one of the most common forms of the disease. The palpebral conjunctiva becomes thickened by long-continued and repeated inflammations; while the skin excoriated, or even ulcerated, shrinks, becomes shortened, and thus draws the edge of the lid outwards. In this case, the edges of the lid are rounded off, the orifices of the Meibomian glands partially or completely obliterated, the eyelashes destroyed, and a considerable portion of inflamed conjunctiva exposed to view. The ophthalmia tarsi is to be removed by the means already explained. For the removal of the chronic lippitudo, Mr. Lawrence finds that no application answers better than the red precipitate ointment, which may be freely applied to the thickened and everted surface, as well as to the ciliary margin of the lid. It reduces the swelling of the conjunctiva, and rectifies the secretion of the tarsal glands. Ectropium, even when accompanied with much thickening of the conjunctiva, may be remedied in this manner. In more obstinate cases, the skin of the everted lid is to be smeared with zinc ointment, and the exposed conjunctiva scarified and touched with nitrate of silver. Should these means not prove effectual, a portion of the conjunctiva must be removed. In bad cases, resisting this treatment, the practice of cutting out a portion of the cartilage of the shape of the letter V is sometimes adopted.

*Ectropium of the lower eyelid from disunion of it from the upper one at the temporal angle* is seldom seen, except in old persons who have been long afflicted with inflammation of the margins of the eyelids, and have had a succession of ulcers near the outer commissure. The treatment requires an operation similar in principle to that performed for the cure of harelip, namely, — the edges of the disunited commissure are to be cut off, and the parts then brought together by means of a suture. The diseased state of the eyelids, however, should be first previously removed.

*Ectropium from the contraction of a cicatrix.* — The deformity is not an unfrequent consequence of a wound, an abscess, an ulcer, or a burn. In slight cases, the simple operation of removing a fold of the conjunctiva may be sufficient; but some examples are met with, in which the degree of eversion is very great, the length of the eyelid in the transverse direction much increased, and its outer surface fixed by adhesions. Here the cicatrix must first be divided, in order to loosen the lid from its unnatural position, and then a portion of the conjunctiva is to be removed; but, for the purpose of counteracting the morbid elongation of the lid from one canthus to the other, it is sometimes necessary to remove a portion of the whole thickness of the tarsal cartilage, shaped like the letter V, and then to bring the edges of the wound together with a suture. Or, in some examples, we might imitate Jaeger in completely detaching the everted eyelid from the cheek, or superciliary ridge, leaving it connected at the angles only. The details of this operation may be found in Mr. Lawrence's "Treatise on Diseases of the Eye," p. 350.

### ENTROPIUM.

Amongst the numerous diseases of the eyelids, I have next to explain one which is exactly the reverse of the preceding; namely, *entropium*, or *inversion* of the eyelids, which is mostly seen in old subjects, in whom the skin of these parts is loose and redundant, destitute of a proper degree of elasticity, and thrown into folds. When the upper eyelid is inverted in the slightest degree, a considerable irritation of the eye is produced; but when a large portion of it is so displaced, the case becomes truly afflicting. The friction of the eyelashes against the eye is incessant, attended with immense suffering; the eye itself inflames, the cornea ulcerates, or becomes opaque, and the eyesight is ultimately destroyed.

The inversion may be either temporary or permanent, the former chiefly affecting the lower lid, and occurring in chronic external ophthalmia, or sometimes even more acute cases. The ciliary margin becomes contracted from repeated inflammation; a spasmodic action of the orbicular muscle is produced, and the eyelid being thus forced inwards, retains its unnatural position. The temporary inversion may be generally remedied by putting a small compress against the lower portion of the eyelid, and fixing it there with adhesive plaster, placed transversely over it. If this plan be continued for twelve or twenty-four hours, the inversion will not return.

Permanent entropium may be mostly cured by cutting away a fold of the integuments near the edge of the tarsus. We first take up a portion of them with the entropium forceps, and observe whether what we hold is sufficient to bring the eyelid into its right position; if so, we cut it off with a small pair of curved scissors, and unite the edges of the wound with one or two sutures, which may be withdrawn the next day, as the wound will then have united.

Another mode of cure is that of producing a contraction of the skin of the eyelid, by cautiously applying across its central part a little sulphuric acid, by means of a thin bit of wood dipped in it, and rubbed upon an oval space a little longer than the extent of the inversion, and from three to six lines in breadth. Three or four applications will generally suffice.

But more difficult cases sometimes arise from an alteration in the shape of the cartilage of the eyelid. For these, the common plans will not answer, and we must try others. One consists in making two perpendicular incisions in the broad margin of the tarsus, at the sides of the inverted part, and then making a transverse cut through the lining of the eyelid, from the extremity of one of the first wounds to that of the other. The inverted portion of cartilage, thus comprised within the incisions, is then to be put into its right position, and retained in it with sticking plaster.

When the vicious shape of the tarsal cartilage makes the adaptation of it to the eye impracticable, its total excision has been occasionally performed.

Sometimes it seems as if entropium depended upon the cartilage being too short; for if a cut be made through the outer commissure, the eyelid no longer presses against the eye. Another operation, adopted by Jaeger, of Vienna, consists in paring away the edge of the inverted tarsus.

### TRICHIASIS

Signifies the growth of the eyelashes in such a direction, that they rub against and irritate the eyeball.

We seldom find all the eyelashes turned towards the eyeball, except when trichiasis is really accompanied by an inversion of the eyelid itself. The inconveniences of the complaint are severe; for the friction of the eyelashes against the eye brings on inflammation of that organ, and, in time, and under neglect, opacity of the cornea and blindness. The wrong direction of one or more of the eyelashes is often overlooked, and the effect, the inflammation, only attended to: but here, as in every other part of surgery, we should search for the cause of the disease, and not disregard it in the treatment; for its removal will alone frequently suffice to bring about a cure.

One plan of treatment consists in removing, one after the other, all the inverted cilia by means of forceps. Each eyelash is to be laid hold of as close as possible to the skin, and pulled out quickly in a straight direction; but, in general, the result is only a temporary relief, as the hairs grow again. Hence, I believe, the best way is to pare off as much of the ciliary margin of the eyelid as will include the bulbs of the inverted eyelashes.

When trichiasis is merely an effect of entropium, the eyelashes need not be extracted, as the cure is brought about by the measures applicable to the entropium.

*Distichiasis* means a double row of eyelashes; but, in fact, the supernumerary cilia are never arranged in this regular order; nor do they usually extend the whole length of the eyelid, but are scattered at different points, between the natural place of the eyelashes and the orifices of the Meibomian glands. Cases also sometimes present themselves, in which strong hairs grow from the inner concave surface of the eyelids.

The only effectual mode of treatment is to extract the hairs and their bulbs.

### PTOSIS.

An inability to raise the upper eyelid, which hangs loose and pendulous over the globe of the eye. In some examples, this depends upon excessive distension and inflammation; but what is more commonly understood by ptosis is that form of it, which is accompanied by paralysis of the levator palpebræ superioris. If the eyelid be lifted from the eye, it gradually sinks down again by its own gravity, being often slightly œdematous, the eye looking dull, the iris being less irritable than natural, the pupil dilated, and the eye frequently amaurotic.

Ptosis is generally symptomatic of disease of the brain, and the treatment must be regulated accordingly. With due attention to the cause, however, there is no objection to rubbing the eyelid with camphorated mercurial ointment, or with liniments containing ammonia or camphor, or to blistering the neighbouring part of the forehead.

### PARALYSIS OF THE ORBICULAR MUSCLE

Sometimes follows operations performed near the lower extremity of the parotid gland, and producing injury of the branches of the portio dura of the seventh pair of nerves. So far as the eye is concerned, the consequences are not usually serious, and the inconvenience is that of not

being able completely to shut the eye; a state, to which the term *lagophthalmos* is applied, whether arising from palsy of the orbicular muscle, or a shortening or retraction of the upper eyelid itself. However, lagophthalmos, when it exists in a considerable degree, may bring on inflammation of the conjunctiva, opacity of the cornea, and even staphyloma.

### GRANULAR CONJUNCTIVA

Is mostly an effect of severe purulent ophthalmy, and consists of a rough, hard, granulated state of the lining of the eyelid, attended with a thin or puriform discharge, a varicose affection of the vessels of the sclerotic conjunctiva, an increased vascularity and opaque appearance of the cornea, great tenderness of the eye, and an incessant epiphora, or copious effusion of tears. The mechanical friction of the granulations against the cornea, has the effect of changing the texture of the delicate layer of the conjunctiva extended over it. In recent cases, leeches may be applied near the eye, and other means adopted to lessen inflammation of the organ. Then the granular surface of the eyelid is to be smeared with the melted ung. hydr. nitratis, or a strong solution of the nitrate of silver, twenty or thirty grains to one ounce of water, by means of a camel-hair pencil, or rubbed with the sulphate of copper, or nitrate of silver. For this purpose, the eyelid should always be completely everted, as there is sometimes a semilunar fringed excrescence at the angle where the conjunctiva passes from the globe to the eyelid, which might otherwise escape attention. After caustic has been used, the eyelid must be bathed with tepid water before it is returned into its natural position again.

Sometimes, when the granular productions are remarkably hard, callous, and pendulous, excision is preferred.

### CONCRETION OF THE EYELIDS.

Two varieties are met with: in one, the inside of one or both eyelids is adherent to the eyeball (symblepharon); in the other, the edges of the two eyelids are connected together (anchyloblepharon). This last case is sometimes, though rarely, a congenital malformation; and, when it occurs, it is mostly as the result of violent inflammation or burns. The treatment consists in dividing the adhesions with a knife, guided along a director, so as not to injure the eye itself, and keeping the edges of the wound asunder. If the cornea be known to be opaque, such an operation is useless.

As for adhesions of the eyelids to the eyeball, it is only when they are loose and of limited extent, and not situated over the cornea, that the division of them can be of any service.

## DISEASES OF THE EYE.

I now proceed to consider *diseases of the eye itself;* and first, *inflammation of it*, termed *ophthalmia*, the most frequent of all its disorders, and that, indeed, which may likewise be connected with any other complaint of the eye, either as a cause or an effect. It is only of late years that the various inflammatory affections of the eye have been well discriminated; for ophthalmia used to be a term applied to every inflammation of the eye, or parts appertaining to it, whether the eyelids, the conjunctiva, the sclerotica, the iris, or the retina, were the structure

chiefly concerned; and although the epithets *mild* and *severe*, *dry* and *humid*, *external* and *internal*, were in common use, the more valuable distinctions, deducible from the structure principally affected in different examples, the characteristic symptoms of each variety, and its most appropriate treatment, were altogether overlooked. In whatever parts inflammation occurs, we know, that its effects are always modified by the structure affected. Now the eye, small as it is, contains a great variety of textures, each possessing both physical and vital properties peculiar to itself, and consequently exhibiting, under the process of inflammation, phenomena which are peculiar to it. The modifications of inflammation, arising from differences of texture, are often beautifully displayed in the eye; and this in so distinct a manner, that its appearances and changes under inflammation are commonly cited by the pathologists of every school, as presenting, perhaps, the very best illustration that can be found of several most important points, relative to the nature of this interesting process.

One thing, which I conceive it is very useful to understand, is, that inflammation of the eye generally commences in one structure, to which it is at first restricted, and beyond which, if it be rightly treated, it may not materially extend. But if it be neglected, or wrongly treated, it soon exceeds its original limits, and perhaps ultimately invades every part of the organ. The conjunctiva, the sclerotica, the cornea, the iris, the crystalline capsule, and the retina, all severally exhibit a series of the modifications of inflammation, dependent upon peculiarity of texture. The *mucous tissue* of the conjunctiva secreting a profuse quantity of purulent matter, as in the ophthalmia of new-born infants; the *fibrous sclerotica*, affected for months with rheumatic inflammation; the *transparent fibro-cartilaginous cornea* becoming opaque, or being destroyed, layer after layer, by ulceration; the *erectile iris* losing all power of executing its motions of expansion and contraction; the *crystalline capsule* pouring out coagulable lymph from its serous surface, and this lymph forming the medium of morbid adhesions; the *nervous retina*, too deeply seated to be immediately observed, but, in a few hours, losing its inconceivably delicate and specific sensibility, are all so many circumstances illustrating the modifications of inflammatory action, and the various consequences of it in different textures of the eye.

Inflammations of the eye, besides being modified by differences of texture, are also much influenced by peculiarities of constitution, constitutional diseases, and certain artificial states of the constitution; and they are subject to innumerable variations from the influence of those inscrutable connections called sympathies. Scrofula, syphilis, gout, disorder of the digestive organs, and that deranged state of the system which is sometimes termed *mercurialism*, are each of them either capable of exciting inflammation in different parts of the eye, or, at least, of communicating to an inflammation, excited by other causes, such differences in character as shall often render the recognition of the disease difficult, though we may be perfectly familiar with it in its more simple form.

With respect to the treatment of inflammation of the eye in general, I may observe that, if the disorder be not speedily checked by efficient and active means, it will soon extend from the texture originally attacked to others, and that its continuance beyond a certain period will permanently impair the delicate structures of the organ, or even cause a total annihilation of its functions. Hence the necessity of adopting very active treatment; and this, not on account of any danger to life, or any extraordi-

nary suffering, great as this may be, but to prevent those changes of structure which would weaken or destroy the eyesight. Hence we are frequently called upon to take away as much blood from the system for an inflammation of the eye, as for an inflammation of the pleura or lungs, stomach, or brain, or any other most important internal organ. If prompt and vigorous treatment be not adopted in the early stage of inflammatory affections of the eye, we frequently find lymph effused, or opaque matter deposited in the transparent parts of the eye ; or the retina more or less impaired in texture and sensibility ; the pupil rendered irregular, the motions of the iris prevented by adhesions; or the complaint degenerated into a chronic form, sometimes difficult of cure, and always lessening the chance of such a recovery as leaves behind it no defect or weakness of the eye, either with reference to its moveable, its transparent, or its nervous textures.

*External inflammation of the eye* may be seated in the conjunctiva only, or in the sclerotica and cornea. Simple inflammation of the conjunctiva is a much less serious complaint than that of the sclerotica. Yet, specific inflammations of the conjunctiva are exceedingly urgent cases, as, for instance, violent purulent and gonorrhœal ophthalmies, which, if unsuccessfully treated, soon involve the organ in incurable mischief. In sclerotic inflammation, the implication of the cornea, and the ready transition of the inflammation to the iris, always expose the organ to considerable danger.

From these preliminary remarks, I proceed to the consideration of the chief varieties of ophthalmy, beginning with —

### INFLAMMATION OF THE CONJUNCTIVA,

Divided into the following kinds : —

1. Simple or catarrhal.
2. Purulent, or Egyptian.
3. Leucorrhœal, or the ophthalmy of new-born infants.
4. Gonorrhœal.
5. Scrofulous.

1. *Simple inflammation of the conjunctiva. — Catarrhal ophthalmy*, as it is often called, generally commences with stiffness and smarting of the eyelids, or a sensation as if sand had got under them, an increased secretion from the lachrymal gland, giving a watery appearance to the eye, with some degree of redness and uneasiness upon exposure of the organ to the light. When fully developed, the disease is characterised by considerable redness, and the increased lachrymal discharge is exchanged for one of a thin whitish mucus ; but the pain is generally slight, and now there is no intolerance of light. The redness is superficial, and the tint a bright scarlet, forming a striking contrast to the rose or pink colour which belongs to inflammation seated in the sclerotica. The distended vessels form a network, and the redness is in patches; though, in the fullest development of the affection, the whole surface of the conjunctiva becomes of a bright red, the redness first showing itself at the circumference of the eyeball, and gradually advancing towards the cornea. In severe cases, small ecchymoses, or effusions of blood, may be noticed in the conjunctiva ; and sometimes little vesicles, filled with a serous fluid, arise upon it, near the margin of the cornea.

The conjunctiva is seldom considerably swollen, and never in the degree exemplified in what is termed *chemosis*, or that remarkable elevation of the conjunctiva, which is sometimes caused in other ophthalmies by

effusion of lymph underneath it. There is, however, a certain quantity of serum poured out under it, whereby it is somewhat raised up from the sclerotica.

As soon as the lachrymal discharge, observed in the very commencement, stops, its place is supplied by an increased secretion of mucus, which is at first thin, but becomes thicker, as the inflamed conjunctiva goes through certain stages, assuming a whitish or yellowish appearance, and even that of pus. It is this altered secretion which, drying on the eyelashes in the night-time, makes the eyelids adhere together, so that the patient has a difficulty in opening them in the morning.

In every well-marked case of catarrhal ophthalmy, the eyelids participate in the affection; and whenever the attack is severe, other mucous membranes suffer. Hence pain and sense of weight about the frontal sinuses and antrum, disordered stomach, foul tongue, chills, succeeded by heat, and other febrile complaints.

Simple inflammation of the conjunctiva is distinguished from common inflammation of the external tunics by its catarrhal origin; the diurnal remission and nocturnal exacerbation of the symptoms; the absence of pain and of intolerance of light, even when there is great general redness; the bright scarlet colour of the membrane; the distended state, and areolar arrangement of its vessels; and the altered mucous secretion from the lining of the eyelids. From purulent ophthalmy it is distinguished by its milder nature; its indisposition to do mischief to the cornea, or the deeper textures of the eye; its not being infectious or contagious; its having no tendency to cause chemosis; and its freedom from all the severe sufferings which attend bad forms of purulent ophthalmia.

The origin of this complaint is generally ascribed to atmospheric causes—exposure to draughts of air or cold winds—sudden changes from heat to cold. Frequently it prevails as an epidemic in certain towns and districts, owing to particular states of the air, not precisely ascertained; or shows itself extensively in schools. For its relief, mild antiphlogistic treatment will generally suffice; and it is not necessary to reduce the patient so much as in some other inflammatory affections of the eye; unless the patient be of a full habit, or both eyes be severely attacked. We need not therefore always have recourse to venesection. In ordinary cases, cupping and leeches will answer the purpose. The bowels, however, should be freely opened; and if the tongue be foul, an emetic ought to follow the loss of blood. Saline and sudorific medicines, as a solution of the sulphate of magnesia, with a proportion of tartarised antimony in it, may then be given repeatedly, and the feet put into warm water at night. In a case of severity, we might, after depletion, put the patient, in the evening, into a warm bath, and, directly he is taken out of it, give him a full dose of the pulv. ipecac. comp.

℞ As local applications, we may foment the eye with a decoction of poppy-heads; but afterwards, when the inflammation is on the wane, astringent lotions, containing three or four grains of the nitrate of silver or sulphate of copper, in ℥ iv. of distilled water, will be beneficial. These, with blisters on the nape of the neck, or behind the ear, will generally soon complete the cure: if not, the remains of the disorder may be got rid of by introducing into the eye, once a day, a drop of the vinum opii, or of the liq. plumbi acetatis. To prevent the agglutination of the eyelids in the night, their edges may be smeared at bedtime with spermaceti ointment.

2. *Purulent*, or *Egyptian ophthalmy*, reputed to be *contagious*, is one of the most violent forms of ophthalmia. The first stage, that in which no pus is secreted, never surpasses thirty-six hours, and is often of shorter duration. At the end of this time, purulent matter is always found on some portion of the conjunctiva. Frequently the patient makes no complaint, till he finds that his eyelids adhere together in the morning, or till the sensation of some extraneous substance in the eye becomes distressing. In some cases, a sudden attack of darting pain in the eye-ball or forehead is the first thing experienced; while, on other occasions, the increased vascularity of the conjunctiva first excites notice. The right eye is more frequently attacked than the left. It is also in general more severely affected, and the sight of it oftener lost. In some instances, only one eye suffers, but more commonly both; although there is often an interval of several days before the second becomes inflamed. A considerable itching is first felt in the evening, or a sensation as if there were dust in the eye, which becomes watery. This is succeeded by a sticking together and stiffness of the eyelids in the morning, which parts appear more swelled than natural. Their internal surface is inflamed, tumid, and highly vascular; and the caruncula lychrymalis enlarged and reddened. Generally, in about twenty-four or thirty-six hours, the discharge from each eyelid is already considerable. It is at first thin, but soon becomes viscid and opaque, and lodges particularly about the internal angle. There is also a frequent gush of tears, an *epiphora*, especially when the eye is exposed to a current of air. The patient always complains of a sensation as if the eye were full of sand, but seems to experience, comparatively speaking, little uneasiness from the light.

In the second stage, the discharge becomes truly purulent, and, in many cases, so abundant, that, on the patient opening his eyes, the matter instantly flows over the cheek, irritating and excoriating it. The quantity of discharge sometimes amounts to several ounces in the day. The whole texture of the conjunctiva may be seen to be swollen and thickened; its vascularity is increased; and its colour an intensely bright red. Its mucous surface is rendered villous, pulpy, and granular, like the villous surface of the fœtal stomach, and from the secreting surface, thus produced, the puriform discharge flows. If not checked by effectual treatment, this species of ophthalmy soon attacks the layer of the conjunctiva, extended over the cornea, thickening it, and rendering it more or less opaque. By these changes vision is much diminished, and very frequently the opacity and consequent diminution of vision continue after all the acute symptoms have ceased. But the change in the cornea is not confined to this affection of the delicate layer of the conjunctiva covering its surface; there is often an interstitial deposition between its layers, producing a still worse kind of opacity; and frequently its texture sloughs or ulcerates; the anterior chamber being opened, and a discharge of the humours, and a prolapsus of the iris, being the too frequent consequences. In this manner, both the function and form of the eye may be destroyed.

In some cases, the inflammatory process is still more severe; extending even to the internal textures of the eye, accompanied by a deep throbbing pain in the eye, coming on in paroxysms; but, occasionally, without any remission till the cornea gives way. The duration of the paroxysms of pain, and their recurrence, are irregular. They come on, however, most frequently from ten to twelve at night, with an increased

secretion from the lachrymal gland, and a diminution of purulent discharge.

Sometimes the swelling of the conjunctiva is such that the upper eyelid cannot be raised, and projects so enormously that the lower eyelid is entirely concealed by it, attended with a great deal of redness of the integuments, extending even to the cheeks and forehead.

In many instances, the conjunctiva forms a prominent red swelling all round the cornea, so as to give the appearance of a thick ridge of flesh encircling the latter membrane, which seems as if it were sunk in the eye, with only a very small portion of its centre discernible. This state is technically named *chemosis*. If the purulent matter be allowed to lie some time upon the cornea, it may acquire a thick consistence, and so resemble sloughy membrane that an inexperienced surgeon may suppose the cornea has been destroyed.

Whether the infection can be propagated from one person to another, through miasmata in the air, arising from the diseased eye, is a contested point; but that it can be transmitted by direct application of the discharge from a diseased to a sound eye, is tolerably certain. In the Royal Military Asylum, and some other public establishments, the matter of purulent ophthalmia has occasionally been applied inadvertently to the eye of another person, and the disease been excited. Yet it is curious, that the surgeons of the French army in Egypt never suspected its contagious nature. In Egypt, and some other countries, in which it prevails to a great extent, the origin of it is usually ascribed to the combined effect of exposure of the eye to vivid light and heat, reflected in the daytime from a sandy soil, followed by exposure of the organ to the damp, cold, nocturnal air.

The constitutional symptoms are, generally speaking, influenced by the degree of pain and inflammation, and are a frequent but soft pulse, not much heat of the skin, the tongue white, not much thirst, the appetite good, the bowels torpid. On the whole, the constitution suffers less than might be expected.

The following are some of the differences of this disease from catarrhal ophthalmia: — 1st. The peculiar change of structure in the lining of the eyelids; 2d. The frequently long continuance of the complaint; 3d. The disposition to relapses; 4th. The tendency to chemosis; 5th. The greater swelling of the eyelids; 6th. The great increased vascularity and redness of the conjunctiva; 7th. The copious purulent discharge.

The *treatment* is strictly antiphlogistic — beginning with bleeding, which, in young, strong persons, may be carried at once to the extent of thirty or forty ounces. This is absolutely necessary if *chemosis* already exist; leeches should also be applied about two hours after venesection, which is to be repeated according to circumstances, the renewal of inflammatory action, and the state of the pulse. So long as there is a throbbing pain in the eyeball and orbit, the repetition of bleeding is generally proper. Mr. Tyrrell has published an account of "a successful plan of arresting the destruction of the transparent cornea from acute purulent inflammation." * The cornea appears to him to mortify from the strangulation of its blood-vessels by the chemosis, or the elevation and tension of the conjunctiva, which covers the sclerotica. Hence, he was led to try what benefit might be obtained by some means, which would immediately relieve the tension of the conjunctiva arising from the che-

* F. Tyrrell, in Med. Chir. Tr. vol. xxi. p. 414.

mosis. A free division of it, practised *with due regard to the course of its principal vessels*, was what seemed to him worthy of trial. The method consists in raising and securing the upper eyelid, and then making free incisions in the sclerotic conjunctiva, and the subjacent loaded cellular tissue, without injury to any other textures of the eye. It is essential, that the incisions extend close to the margin of the cornea, where the tension and pressure are greatest, and that the direction of the wounds correspond to the intervals between the insertions of the recti muscles, so that the principal vessels of the conjunctiva may not be injured. The old plan of scarifying the conjunctiva, which never proved very successful, differed from the latter, inasmuch as the incisions were made circularly, in the direction of the margin of the cornea.

*Purgatives* are to be given; as a dose of jalap and calomel, followed by a solution of sulphate of magnesia, containing in each dose one fourth of a grain of tartrate of antimony. When severe nocturnal pain is experienced in the orbit, much benefit has resulted from giving every night two grains of calomel and one of opium, until the mouth is sore; but, under other circumstances, the free use of mercury is of no service in purulent ophthalmia. In the chronic stage, when the patient is much debilitated, and the discharge profuse, bark and other tonics are sometimes prescribed. When the cornea is threatened with sloughing, the same medicine is occasionally given.

The local treatment is fully as important as the constitutional. The first thing is completely and frequently, in the course of the twenty-four hours, to clean away the puriform discharge from the eyes. This is to be done partly with a bit of sponge, and partly with a small syringe, and a weak alum lotion ʒ ss. to half a pint, or with a tepid solution of one grain of the bichloride of mercury in eight ounces of distilled water. The best astringent application for checking the secretion is now generally allowed to be a solution of the nitrate of silver — from four or six grains to an ounce of distilled water, and applied once, or at most twice, in the twenty-four hours. Dr. Ridgway even ventured upon twelve grains to an ounce of water, and published a report in favour of this strength; while Mr. Guthrie gives the preference to an ointment containing ten grains of it to ʒ j. of lard. In the early stage, relief will also be derived from anodyne fomentations, the compound powder of ipecacuanha at night, and a mild ointment to prevent adhesion of the eyelids.

3. *Purulent ophthalmia of new-born infants* is often believed to arise from the eyes coming in contact with leucorrhœal discharge in the birth. In a great proportion of cases, the mother has vaginal discharge: exceptions are met with, however; and then the influences of draughts of cold air, or of exposure of the young eye to vivid light, usually fall under suspicion. Mr. Hugh Carmichael, who has commented on the little foundation there is for the opinions, prevailing about the causes of the disease, observes, that the bowels are always more or less deranged, and that this may possibly operate as a cause.*

In general, the eyelids are first remarked to be glued together about the third day after birth, but sometimes much later. On opening them a drop of thick white matter is discharged, and their inner surface is found to be swollen and vascular. If the disease be not checked, the swelling of the conjunctiva rapidly increases, and the inflammation extends from the conjunctiva of the eyelids to that of the eyeball. The

* See Dublin Journ. of Med. Science, vol. xv. p. 210.

purulent discharge becomes copious, and the skin of the eyelids assumes a dark red colour. Light is now exceedingly painful; the child turns its head from it, and resists every attempt to open the eye. In this state, the eyes may continue about a week, without any affection of their transparent parts, except a slight haziness of the cornea. About the twelfth day, however, suppuration generally takes place between the layers of the cornea, its texture becomes destroyed, it ulcerates, the humours are discharged, and the iris protrudes.

If the disease be seen before the cornea has suffered, the prognosis is favourable. If the cornea has sloughed or ulcerated, the loss of sight is inevitable.

In the third stage, there is a gradual abatement of all the symptoms; the redness, swelling, and discharge are diminished; the light can be endured; and the eye is more easily examined.

*Treatment.* — One or two leeches may be put on the swollen upper eyelid. The bleeding from the bites will often seriously reduce an infant, and perhaps, in ordinary cases, it is best to be content with a single leech. The discharge is to be washed away with a tepid weak solution of alum, or bichloride of mercury. The lids are to be gently opened, and the discharge removed with a small bit of sponge. The upper lid has a tendency to remain everted, but it may usually be replaced, if the swollen conjunctiva be first pushed back with a probe into its right situation. For checking the discharge, we may use a solution of the sulphate of copper, or nitrate of silver; four grains of the latter, or six grains of the former, to an ounce of water, applying it once or twice a day, with a large camel-hair brush, to the whole surface of the inflamed conjunctiva. Mr. Hugh Carmichael prefers, however, weaker collyria, such as one grain of the nitrate of silver, or two or three grains of alum, to the ounce of distilled water. Neither must we forget to apply the ung. cetacei, to keep the eyelids from sticking together in the night. If there be a tendency to chemosis, one or two leeches are never to be omitted; the bowels are to be opened with castor oil; and a blister put behind the ear. In tedious cases, I usually give small doses of calomel. The vinum opii is one of the best things for removing the relaxation of the conjunctiva, left after the cessation of the discharge. Sometimes the disease has been successfully attacked with the nitrate of silver ointment, ten grains to one ounce of lard. The granular state of the conjunctiva generally yields to astringents, or the nitrate of silver, or sulphate of copper.

From the connection existing between this inflammation of the eye and the state of the bowels, Mr. Hugh Carmichael recommends giving the hydrargyrum cum cretâ, in grain or half-grain doses, twice or thrice a day. In obstinate cases, he also advises the nurse to be changed, because her milk may be keeping up the bowel derangement. He objects to pap composed of bread and milk, as likely to become sour. The bread should be of the best quality, and first washed; and the milk be blended with equal, or two parts of water, and sometimes a little calcined magnesia mixed with it. Four grains of calomel and four drops of tinct. opii, divided into four or six papers, one of which is taken every night, he commends, as often the source of much benefit.

Blisters are mostly disapproved of for infants of tender age; but if two or three threads of worsted be greased with the blistering ointment, and placed in close behind the ears, the practice is found by Mr. Hugh Carmichael to be safe, and productive of great benefit. When the cornea suppurates, Mr. H. Carmichael relies on leeches, potassio-tartrate of an-

timony in doses of one sixth or one eighth of a grain three times a day, the application of blistering ointment in the way described, the alum wash, or alum curd. If the cornea has sloughed, he joins Mr. Saunders in praise of the extract of bark, given to the extent of sixteen or eighteen grains a day, mixed with pap.

4. *Gonorrhœal ophthalmia in its acute forms* is a violent inflammation of the mucous membrane of the eyeball and lids, attended with profuse discharge of matter, closely resembling in all its sensible properties that which issues from the inflamed urethra in clap, and occurring in some kind of connection with the latter complaint.

It is the most severe and rapidly destructive inflammation to which the eye is subject, but fortunately one of the most rare. It is not the consequence of the sudden suppression of gonorrhœa; for, in a great majority of examples, the gonorrhœal discharge is not stopped, though, when the affection of the eye begins, the clap may be on the decline. As gonorrhœa is so common, and this species of ophthalmy so rare, doubts have often been raised about its connection with gonorrhœa at all. Indeed, the mode of infection has not often been unequivocally traced; but that the discharge from the urethra of one individual, applied to the eye of another person, will bring on the disease, seems well proved by facts collected by Mr. Lawrence; and even that the matter of clap, applied to the patient's own eye, will bring on this destructive ophthalmia, is exemplified in the consequence of the vulgar custom of attempting to cure sore eyes by washing them with the patient's own urine; for, if he happen to have gonorrhœa on him, the matter is then applied directly to the eye, and a destructive purulent ophthalmia is the result, as related in Mr. Lawrence's work "On the Venereal Diseases of the Eye." The symptoms are those of purulent ophthalmy in the severest form, intense redness, extensive swelling, chemosis, and profuse discharge of thick yellow fluid, quickly followed by ulceration, sloughing, or opacity of cornea.

The *treatment* is not essentially different from that of other severe purulent ophthalmies. The boldest antiphlogistic measures are called for; as copious venesection, cupping on the temples, numerous leeches, &c.; followed by blisters, and warm or cold collyria, according to the patient's feelings. A strong solution of nitrate of silver, ten grains to an ounce, or the strong ointment of the same, has sometimes had the effect of checking the disease.

When the cornea sloughs, and the patient is reduced, we may prescribe bark. In gonorrhœal ophthalmy, the structure of the palpebral conjunctiva is not changed; that is, it does not become granular; one eye is often affected; and the disease may begin on the sclerotic conjunctiva. These characters are all different from such as are usually noticed in ordinary purulent ophthalmy of adults.

### SCROFULOUS INFLAMMATION OF THE CONJUNCTIVA.

The symptoms characterising it are slight redness, great intolerance of light, and pimples or small pustules on the conjunctiva. It seldom attacks infants at the breast, but children at some period between weaning and the eighth year. At the commencement of the disease, the redness of the conjunctiva is very slight, and in patches or clusters of vessels; but, afterwards, it increases, and becomes more uniform, and the sclerotica appears to participate in the inflammation. At the apex of each of the clusters of blood-vessels, one or more minute pustules arise; sometimes a single elevated point, of an opaque white colour, near the centre

of the cornea; and sometimes numerous pustules, scattered over different parts of the conjunctiva. In some cases, they are small, and filled with a thin colourless fluid, when they are termed *phlyctenulæ;* in others, they are larger, and contain fluid more like pus. It is not known whether there is any specific difference between the phlyctenular and the pustular cases; but it has been observed by Dr. M'Kenzie, of Glasgow, that the pustular cases are in general attended with less intolerance of light. The phlyctenulæ and pustules may be absorbed, and then, if situated on the cornea, they leave behind a white opaque speck — the effect of that effusion of lymph which surrounds every circumscribed abscess, but which in time generally disappears. Sometimes, however, a vascular speck is left, which is more difficult of removal.

Quite as frequently these pimples burst, and are converted into ulcers, sometimes superficial and considerable in extent, more commonly deep and funnel-shaped. If they happen to penetrate the cornea, the aqueous humour is discharged, and a small piece of the iris protrudes, and unites to the sides of the aperture, which is closed by an opaque indelible cicatrix, partially or entirely obstructing vision; but the cicatrix of a superficial ulcer may leave no permanent opacity.

The *excessive intolerance of light*, attending scrofulous ophthalmy, is one of the most distressing symptoms. The child is quite unable to open its eyes in ordinary daylight; and every attempt to look up instantaneously brings on a strong spasmodic contraction of the eyelids. The pain from the light is most severe in the morning; for, in the afternoon, the intolerance of it is sometimes so far lessened that the eye can be opened. Notwithstanding the violent suffering produced by light, there is frequently an insignificant degree of redness, and the cornea often remains perfectly transparent, or with merely one minute opaque speck upon it, and a few red vessels running over the sclerotica. The intolerance of light is always attended with *epiphora*, a gush of tears following every attempt to open the eye. Hence, the eyelids and cheeks are sometimes excoriated and swelled. Occasionally the disease is conjoined with iritis; but more frequently with ophthalmia tarsi, and other scrofulous complaints.

In the *treatment*, powerful antiphlogistic remedies are less necessary, than in some other inflammations of the eye. In the first stage, which is short, we may apply a few leeches, followed by a blister behind the ears, or on the nape of the neck. The secretions of the skin and alimentary canal are to be restored; for which purpose we may prescribe the liq. ammon. acetatis, combined with the vinum antimonii, and a small quantity of the syrup of poppies. Or we may give rhubarb and carbonate of soda, in equal parts, with or without a little of the hydr. c. cretâ. For the ulcerations on the cornea, the solution of nitrate of silver is the best application. The eye should be protected ftom the light with a green shade, or by darkening the room. If the cornea be opaque, calomel, or the blue pill, should be given, so as slightly to affect the system. After the first inflammatory stage is over, tonics are generally found beneficial, especially the sulphate of quinine, with light nutritious diet.

The best applications to the eye itself are slightly astringent lotions, used tepid; as the decoction of poppy-heads, with a small quantity of spirit of wine in it; or a weak solution of the acetate of ammonia, or a solution of one grain of the bichloride of mercury in eight ounces of distilled water. In France, the collyria for scrofulous affections of the eye frequently consist of a weak solution of iodine in distilled water, with a small quantity of hydriodate of potash.

### INFLAMMATION OF THE EXTERNAL PROPER TUNICS

Is characterised by a great deal of external redness, pain, and intolerance of light, soon followed by increased lachrymal discharge and febrile disturbance. The redness begins on the front of the globe, immediately round the cornea, where it forms a red zone, to which numerous vessels proceed from the back of the eyeball. In inflammation of the conjunctiva, the redness begins at the circumference of the organ, its anterior part being at first free from it, and the sclerotica retaining its natural white appearance: the discharge is also of a mucous or puriform kind.

The redness is quite different in the two cases: in inflammation of the sclerotic coat, the vessels seen through the conjunctiva exhibit a pink colour, or a lively carmine appearance, which forms a striking contrast to the bright scarlet tint of the vessels in conjunctival inflammation. The vessels of the sclerotica always follow the motion of the eye, while those of the conjunctiva are capable of being moved, independently of the eyeball. The distended vessels of the inflamed sclerotica run in straight lines forwards to the edge of the cornea; but those of the inflamed conjunctiva have no such distribution, as they are reticulated. However, the conjunctiva soon participates in the inflammation of the external proper coats, and the cornea looks dull. The eye feels dry and stiff, with a burning or aching pain, and feeling of tension, pressure, or as if sand were lodged in the eye. As the disorder increases, the pain grows more severe, and extends to the back of the head and nearest temple. Intolerance of light is a strongly-marked symptom of inflammation of the sclerotica, another feature in which it particularly differs from conjunctival inflammation.

Although the eye may be at first dry and stiff, the lachrymal secretion is soon restored, and even increased, so that whenever the eye is opened there is a considerable effusion of tears. In unfavourable examples, attended with chemosis, the cornea first turns greyish, then white and cloudy, and lastly yellow, as if pus were deposited in its texture. The yellow matter, however, is not fluid; neither does it make its way to the surface, like pus; but the cornea ulcerates, and the deposited matter is removed by ulceration. A similar deposit may take place in the anterior chamber, producing what is termed *hypopium*. When the whole cornea is thus affected, the ulceration may penetrate the anterior chamber at several points, the aqueous humour escape, and the iris either protrude or become adherent to the inflamed cornea.

The degree of danger will depend on the state of the cornea: when this is only slightly affected, there is no danger; when chemosis is present, and the cornea is grey or white, or when a yellow deposit takes place in its texture, followed by ulceration and escape of the aqueous humour, sight will be impaired, and perhaps totally lost.

Before speaking of the treatment, I may as well describe

*Inflammation of the entire eyeball*, or *ophthalmitis*, for the practice in each of these cases is founded on the same principles. Common inflammation, seated both in the external and internal structures of the eye, when fully developed, is characterised by considerable pain, increased external redness, more or less swelling of the organ; at first dryness of the eye, but afterwards augmented secretion from the lachrymal gland; and redness and swelling of the upper eyelid. The pain is not confined to the fore part of the eye, but is deep-seated, and extends to the eye-

brow, cheek, temple, and back of the head. At first, the redness is inconsiderable, and chiefly in the vessels of the sclerotic coat; but the conjunctiva very quickly participates in the inflammation, and the distention of its vessels produces the bright scarlet colour, which conceals the fainter pink or carmine tint of the sclerotica. The conjunctiva then begins to swell, and a deposit of coagulating lymph takes place, not only in the texture of that membrane, but in the loose cellular tissue uniting it to the sclerotica. This red circular projection of the conjunctiva round the cornea, giving the latter membrane a sunk appearance, and even materially concealing it, receives the name of *chemosis*.

Light is very offensive, so that the pupil contracts to exclude it, and the eyelids are spasmodically closed. In a more advanced stage, the colour of the iris is altered, its brilliancy disappears, and its usual motions in the different degrees of light are interrupted; the pupil diminishing and losing its clear black colour. The cornea becomes more or less opaque, and vision is lost, sometimes from this cause and the closure of the pupil, sometimes from injury of the retina, as when the sight is destroyed, though the cornea and pupil do not completely obstruct the light, and frequently from all these circumstances together. Sometimes the thickened eyelids protrude, an ectropium of the lower one taking place, and a portion of the conjunctiva projecting in the form of a piece of red flesh.

So violent an affection of a vascular and sensible organ, situated in the immediate vicinity of the brain, necessarily produces a great deal of sympathetic inflammatory fever. If the disorder be not checked, suppuration of the eye occurs, preceded by severe throbbing and rigors; then no relief is experienced till the cornea bursts, and the matter is discharged, the vitreous humour and crystalline lens usually passing out at the same time. The eye next shrinks into the orbit; its form is completely destroyed, and its functions annihilated. When the disease does not proceed quite so far, the patient escapes, perhaps, with opacity of the cornea, a closure of the pupil, or injury of the retina.

With respect to the prognosis, if chemosis be formed, the cornea cloudy, the colour of the iris changed, and the pupil contracted, the eyesight is in considerable danger.

The *causes* of inflammation of the proper coats of the eye may be wounds; the irritation of extraneous substances lodged under the eyelids; exposure of the eye to a draught of cold air; immoderate exertion of the organ, particularly in the examination of minute shining objects, and in hard study by candle-light; and certain states of the atmosphere. As predisposing circumstances, I may mention a full habit, or plethora; a disordered state of the digestive organs; intemperance; and costiveness.

*Treatment of Inflammation of the External Proper Coats of the Eye, and of Ophthalmitis, or General Inflammation of the Eyeball.*—1. The first indication is *to remove*, if possible, *the cause;* as, for example, extraneous substances. The eye should be examined in a good light; and, if nothing be discovered on it, the lower eyelid should be depressed, and the inferior portion of the globe brought into view by the patient looking upwards. If no particle of extraneous substance can be detected in this way, the patient should turn the eyeball downwards, and the upper eyelid be raised, so that the upper portion of the globe may be seen. In most cases, the extraneous body lodges in the concavity of the upper eyelid, which must then be everted. The eyelashes are first to be taken hold of,

and the eyelid drawn downwards; a nd while steady pressure is mae against its upper part, by placing a probe across it, its ciliary margin is to be carried upwards and backwards.

When small particles of metal stick in the cornea, they should be removed with the point of a cataract needle.

Next to the removal of the exciting cause, bleeding is the chief means of subduing these forms of ophthalmic inflammation. Venesection is to be practised, and from twenty to forty ounces should be drawn; and, after two or three hours, if the pain return, we should take away from twelve to fifteen ounces more without delay. The blood may also be taken from the temple or nape of the neck, by cupping, or from the temporal arteries. The eye is to be guarded from the light with a green shade, or the room darkened.

Neither must we omit the repeated application of leeches, which are to be put on the temple, eyebrow, or just below the inner angle. We should also prescribe purgatives, with saline antimonial medicines; and, after depletion, have recourse to calomel and blisters.

With respect to topical applications, if the case be attended with violent headach, the decoction of poppy-heads may be used as a fomentation. In other instances, we may bathe the eye, in an eye-cup filled with tepid water, or with a warm collyrium, containing five grains of the sulphate of zinc, or acetate of lead, dissolved in four or six ounces of rose-water. In proportion as the irritability of the eye lessens, the application may be used colder.

When the acute stage has completely subsided, we may introduce between the eye and eyelids, once or twice a day, two or three drops of the vinous tincture of opium; but, while much tenderness and aversion to light continue, its use must be deferred, and depletion repeated.

When there is risk of effusion, or opacity, I always give calomel and opium freely, and keep open a blister. Two grains of calomel, with half a grain of opium, four times a day, may be administered, until the mouth becomes sore.

For the cure of any remains of chronic inflammation, astringent applications, blisters, the occasional use of leeches, and the free exposure of the eye to the open air and daylight, are generally the right measures.

### RHEUMATIC OPHTHALMIA. SCLEROTITIS.

There are two remarkable forms of inflammation of the eye, most frequently arising in adults from atmospheric influences, viz. — the *catarrhal* and the *rheumatic*. The *catarrhal* is an affection of the conjunctiva; the *rheumatic*, of the albuginea and sclerotica, occasionally extending to the iris. In the *catarrhal*, the red vessels give a reticular appearance; in the *rheumatic* they are radiated, or in the form of a zone, and seated under the conjunctiva. *Catarrhal* ophthalmy is an inflammation of a mucous membrane, and attended with an increased secretion from it; *rheumatic* ophthalmy attacks the fibrous membranes of the eye, and is not accompanied by any morbid secretion from its surface. The pain in catarrhal ophthalmy is like that of sand under the eyelid, does not extend to the head, and is felt chiefly in the morning, or when the eyes begin to be moved. The pain in rheumatic ophthalmy is throbbing and deep-seated, not in the eye chiefly, but round the orbit, and is severely aggravated from sunset to sunrise. In catarrhal ophthalmy, there is little intolerance of light; in sclerotitis, a great deal.

Rheumatic inflammation is by no means a good name for the complaint,

as it is not connected with a rheumatic constitution; it is a primary affection, and not the result of any transfer of rheumatism from other parts to the eye. *Sclerotitis* may be a better term. At all events, this inflammation only resembles rheumatism in its exciting causes, its accompanying pain, its exacerbations, and its treatment.

In sclerotitis, the fasciculi of distended vessels advance in radii towards the edge of the cornea, and sometimes even a little beyond it. They are of a bright red colour, and the degree of inflammation in the conjunctiva itself is never such as to conceal them. In general, there is no tendency to chemosis, nor do the eyelids take part in the disease; but there is a haziness of the cornea and pupil, attended with a slightly contracted state of the latter opening, and a sluggishness in the movements of the iris. The iris may even become a little discoloured, and lymph be effused from it; but a severe degree of iritis seldom attends rheumatic sclerotitis. Suppuration and ulceration also rarely or never follow this affection of the eye; but there is a considerable degree of symptomatic fever, increasing with the nocturnal paroxysms of pain. The digestive organs are deranged, the bowels confined, and the excretions morbid.

*Treatment.*— Blood is to be taken from the arm, and leeches afterwards applied to the forehead and temples. Calomel and opium are effectual in lessening the severe pain in and around the orbit. Two grains of calomel and one of opium may be given every evening till the gums are affected, when the calomel may be omitted, and ten grains of the compound powder of ipecacuanha administered in lieu of it. The forehead and temple may be rubbed with a mixture of olive oil and extract of opium, or with warm laudanum; and, in chronic cases, with equal parts of laudanum and tincture of cantharides. Blisters are likewise to be put behind the ear, or on the temple, or nape of the neck. Great benefit will be derived from mild purgatives and the warm foot-bath at night, with sudorifics.

I believe that, in rheumatic sclerotitis, the iris should be kept moderately under the influence of belladonna, either by smearing the moistened extract upon the eyebrow and eyelids every evening at bedtime, or by infusing ʒj. of the extract in each ounce of the laudanum used for rubbing the forehead, eyelid, and temple.

In *chronic cases*, we may give small doses of sulphate of quinine; and, in old mismanaged ones, from three to ten drops of the liquor arsenicalis, three times a day.

Local applications have little effect. The lunar caustic solution, which is almost a specific for catarrhal ophthalmy, is decidedly injurious in rheumatic sclerotitis; but, when all painful and febrile symptoms are gone, and little more than chronic redness and weakness of the eye remains, the vinum opii may be dropped once or twice a day into the eye.

### CATARRHO-RHEUMATIC OPHTHALMIA

Affects both the conjunctiva and the sclerotica. The feeling of roughness, or sand, between the eyelids and eyeball, and the secretion of a puriform fluid, indicate the participation of the conjunctiva in the disorder; while the nocturnal accession of racking pain in and around the orbit marks the affection of the sclerotica. In this case, chemosis is by no means uncommon, and the eyelids generally adhere together in the morning, from the thickened state of the Meibomian secretion. There is also considerable intolerance of light, with epiphora.

The cornea frequently ulcerates, or pus is effused between its layers, constituting what is termed *onyx*. In bad cases, the ulceration makes its way into the anterior chamber, the aqueous humour escapes, and the iris protrudes. There is also commonly, just before this state of things, an effusion of fibrine in the pupil; the iris changes in colour, and the pupil is often obliterated. The pulse is generally quick and sharp, the tongue white, and the nocturnal pain prevents sleep.

*Treatment.* — 1st. Venesection — from ten to thirty ounces, and repeated.

2d. Leeches to the temple.

3d. Scarifications are sometimes advised for the chemosis, and if practised, should be so in the way noticed in the remarks on purulent ophthalmy.

4th. Calomel and opium every night.

5th. Opiate frictions about an hour before the expected attack of pain in the orbit.

6th. Pupil to be kept dilated with belladonna.

7th. Blisters behind the ear.

8th. Purgatives; a brisk dose of calomel and jalap at first, and afterwards mild laxatives.

9th. Sudorifics; liq. ammon. acet., warm diluent drinks, and the pediluvium.

10th. In the chronic stage, the sulphate of quinine and mineral acids.

11th. Local applications: the solution of from two to four grains of the nitrate of silver in an ounce of distilled water, dropped upon the conjunctiva once a day, relieves the painful feeling of sand, and speedily removes the other symptoms of conjunctivitis.

The eye is to be bathed three or four times a day with a tepid solution of the bichloride of mercury, one grain to eight ounces of distilled water.

The edges of the eyelids are to be smeared with the ung. hydr. nitratis, weakened. If onyx take place, it is not to be punctured, as such practice would be followed by protrusion of the iris and opacity.

### SCROFULOUS CORNEITIS

Is a slow disease, occupying weeks and months, and sometimes years. The conjunctival covering of the cornea, and substance immediately under it, are chiefly affected. The redness of the sclerotica is not considerable; the vessels are minute, and arranged in a zone round the cornea. Not unfrequently, there is a reddish ring at the circumference of the cornea, with red vessels extending to the centre of this membrane. In some cases the conjunctival covering is thickened, and reddened, so as to look like a piece of red cloth, whence the term *pannus*. The cornea is more or less opaque and rough; sometimes only hazy, sometimes marked with white streaks or specks, sometimes uniformly white. Occasionally its convexity is increased; the pupil is not unfrequently dilated, with a tendency to amaurosis; there is not much intolerance of light—a striking contrast of this form of scrofulous inflammation of the eye to what is noticed in the pustular variety. In a few cases, however, the patient cannot endure the light, and there is epiphora. The pain is not very severe, and the complaint soon becomes chronic, especially after the cornea has become opaque. The pulse is especially quick, the patient restless at night, and the skin harsh and dry. The disease is most common in subjects about puberty, and often accompanied by symptoms of struma.

*Treatment.* — Leeches are to be applied and repeated; but not so as o weaken the patient. We may also try small doses of tartarised antimony, and then the sulphate of quinine, and Dover's powder at bedtime. Calomel, combined with opium, so as to affect the mouth, after the acute symptoms have ceased, has great effect in clearing the cornea. Colchicum, sarsaparilla, and elm bark, are useful as alteratives in scrofulous corneitis, but not generally equal to sulphate of quinine.

The *local applications* are fomentations with poppy decoction, and the steam of hot water, with a little laudanum in it. Blisters are productive of great benefit. The best *stimulating* applications, after all acute inflammation is over, are the vinum opii, a collyrium of the nitrate of silver, or a weak solution of iodine in distilled water, according to Lugol's formula. When there is any tendency to iritis, the pupil is to be kept dilated with belladonna. When the cornea is very convex, denoting an unusual accumulation of the aqueous humour, the discharge of this fluid is sometimes recommended, but rarely adopted.

## IRITIS.

When we recollect, that the iris receives its supply of blood by the two long ciliary arteries, the external and internal, which are but little connected with the arteries of the other textures of the eye, we may readily conceive that inflammation of this organ is likely sometimes to exist without much inflammation in other parts of the eye. The danger of iritis chiefly depends upon its partaking of the nature of the adhesive inflammation, by which the pupil is apt to become, under the least neglect, completely and irremediably obliterated by the effusion of coagulating lymph. Iritis is, indeed, attended with a degree of inflammation in the sclerotic coat, the front layer of the capsule of the crystalline lens, and too often with inflammatory action in the choroid coat and retina; yet the iris is plainly the focus of diseased action, the affection commencing on its pupillary margin, and other parts becoming subsequently affected.

Iritis is divided into *idiopathic* and *symptomatic*, *acute* and *chronic*, and into several *specific* varieties. Some common symptoms, however, characterise iritis, from whatever cause it may originate.

1. In the early stage we discern minute red vessels, running in radii in the sclerotica to the edge of the cornea, where they form a red zone, while the rest of the sclerotica retains nearly its natural paleness, its vessels under the conjunctiva only presenting a pale pink colour, which increases, however, as the iritis makes progress. The vessels of the conjunctiva in the anterior part of the eye soon enlarge; and, in violent cases, there is a uniform redness. Together with change of colour, the iris loses its natural brilliancy; it becomes of a dull appearance; and the beautiful fibrous arrangement, so characteristic of it in the healthy state, is either confused or entirely lost. These changes begin in the pupillary margin.

2. Then, another symptom, common to every iritis, is a change of colour in the iris: if naturally blue, it turns greenish; if dark-coloured, it changes to a reddish brown. This is owing to the deposit of fibrine in its texture, and to the effusion of the same plastic substance upon its surface. Hence we frequently notice irregular tubercles, or masses, formed either at the edge of the pupil, or upon the iris itself.

3. Another symptom, noticed in every iritis, is a tendency to contraction, irregularity, and immobility of the pupil.

4. We also frequently remark an effusion of fibrine into the pupil and posterior chamber, and sometimes into the anterior. In rheumatic iritis, however, fibrine is more sparingly effused than in venereal iritis.

5. Considerable intolerance of light, accompanied by increased lachrymal discharge, is another effect of iritis in general; but much greater in rheumatic than syphilitic iritis.

6. In every iritis, there is a disposition to the production of adhesions between the pupillary margin of the iris and the capsule of the lens; and sometimes between the iris and cornea, or even between the posterior part of the iris and the ciliary processes. Such adhesions are usually of a dark colour, like that of the edge of the uvea.

7. Together with these common effects of iritis, the patient has dimness of sight, and sometimes total blindness.

8. Pain in the eye, the orbit, and forehead, are likewise invariable attendants on iritis, and often subject to nocturnal exacerbations.

Notwithstanding what has now been stated, iritis, if combined with amaurosis, may be accompanied by a dilated pupil.

Exposure to atmospheric changes, very strong light, syphilitic disease, scrofula, gout, rheumatism, wounds of the eye, may each be a cause of iritis, which may be *acute* or *chronic*. When acute, the inflammation, beginning on the pupillary margin of the iris, quickly extends over its whole surface, and affects the external as well as internal tunics. In chronic iritis, the inflammation sometimes begins at the ciliary margin of the iris, whence it may be slowly propagated to other internal textures. Chronic iritis, however, sometimes produces effusion of fibrine, and adhesion of the edge of the iris to the capsule of the lens, without any perceptible inflammation of other textures of the eye. Between this slowly creeping chronic iritis, and the most acute form of it, we meet with numerous other cases, in which every gradation of the inflammatory process is exhibited.

The constitutional disturbance is different in different cases. Acute iritis is generally attended with headach, restlessness, a full and strong pulse, white tongue, thirst, loss of appetite, and costiveness. At the same time, it must be confessed, that, in some cases, which would be regarded as acute, such symptoms prevail only in a slight degree.

The *prognosis* is favourable, when the affection is recent and confined to the iris, without too close a contraction of the pupil, or organisation of the effused fibrine; or extension of the inflammation to the retina, and other textures behind the iris.

*Syphilitic iritis* is frequently, but not invariably, accompanied with effusions of fibrine, in the form of tubercles of a reddish or yellowish brown colour; it is also characterised by a reddish brown discolouration of the inner circle of the iris, the remarkable nocturnal exacerbations of pain*, the previous occurrence of syphilis, and, in most instances, the concomitant existence of other syphilitic symptoms. There is an angular disfigurement of the pupil, which, according to Beer, is usually drawn towards the root of the nose; but, according to Mr. Guthrie, not more frequently in this direction than others. The form and situation of the pupil seem to Mr. Lawrence to depend upon the effusions of fibrine. With regard to the opinion, that mercury is the cause of iritis, Mr. Lawrence's observations are strongly against its correctness; in nine cases, related in his "Treatise on Venereal Diseases of the Eye," iritis came on where no mercury had been

* See Lawrence's Treatise on the Diseases of the Eye, p. 317.

taken previously to its appearance. In some cases of syphilis, treated by Rose and Thompson, without mercury, iritis also occurred.

In *idiopathic iritis*, there is either no distinct deposit upon the iris, or it presents itself as a bright yellow elevation from the texture of the part, increasing to a certain size, and then breaking, so as to allow the escape of a yellow matter, which sinks to the bottom of the anterior chamber. Such yellow little abscesses are not observed in syphilitic iritis.

In *arthritic iritis*, or that connected with a gouty constitution, fibrine is effused from the margin of the pupil, but not deposited in a distinct form. and the adhesions are generally *white*. Both in the *idiopathic* and *arthritic* iritis, the pupil is contracted; but generally retains its circular figure and central position in the iris. In gouty and rheumatic iritis, a white zone is distinguishable between the red one and the margin of the cornea; but frequently it is incomplete, being only noticed on each side of the boundaries of the cornea.

In the *treatment of iritis*, there are three principal indications:—

1. That of putting a stop to the inflammation.

2. That of preventing the effusion of fibrine, and promoting its absorption, if it has been already poured out.

3. That of preventing the contraction of the pupil, and the formation of adhesions between the margin of the iris and the capsule of the lens.

The *first indication*, or that of arresting the inflammation, is accomplished by antiphlogistic measures; bleeding, saline aperients, and tartarised antimony. If the inflammation is not checked, it will soon extend to the choroid coat and retina, and sight be endangered. We should have recourse, therefore, to venesection, or cupping from the temple, or nape of the neck. Sometimes bleeding and the exhibition of sulphate of magnesia, and tartrate of antimony, with other antiphlogistic means, will accomplish the cure of iritis, if duly followed up; but more frequently additional plans are requisite. Antiphlogistic treatment relieves the congestion of the blood in the eye, lessens the redness, and diminishes the fever; but it does not always succeed in preventing the effusion of fibrine, or in bringing about the absorption of what has been poured out.

This makes it necessary to consider how the *second indication*, or that of preventing the effusion of fibrine, and promoting its absorption when deposited, is to be fulfilled. Experience proves that the grand remedy for this purpose is mercury, employed quickly and freely, so as to affect the system. It must be used immediately after bleeding and other means of depletion have been practised. The effect of it is so to change this action of the vessels of the iris, that they lose their disposition to effuse plastic substance; and that which has been already effused becomes absorbed: the natural colour of the iris is restored, the cornea becomes clear again, the red zone round it fades away, and the power of vision returns. All this improvement is rapidly effected when the system is expeditiously put under the influence of mercury; and here it is advisable to let that influence be stronger, than what is usually deemed necessary in other cases of ordinary disease. Two grains of calomel with one third of a grain of opium, are to be given every four or six hours. In cases of long standing, it is sometimes necessary to keep the patient under the influence of mercury several weeks.

The *third indication*, or *that of keeping the pupil dilated*, requires the application of belladonna. Other narcotics will produce the same effect,

particularly stramonium and hyoscyamus; but belladonna is most effectual. One scruple of the extract should be dissolved in ℥j. of distilled water, and filtrated. This preparation is to be dropped, once or twice a day, into the eye. But, if the inflammation be acute, it is better to smear the upper eyelid, forehead, and eyebrow with the extract itself, a little moistened. The other, however, is the most prompt method, if the inflamed state of the eye will bear it, which is not always the case. This use of belladonna is very important; not only as tending to prevent the closure of the pupil, but as keeping its edges away from the capsule of the lens, and even making the iris so withdraw itself from the lens that, if adhesions be already formed, and the fibrine soft, they will give way, and the pupil still recover its natural size and mobility. This beneficial change is materially promoted by the simultaneous use of mercury. While the iris is highly inflamed, and the disease not checked, belladonna will not dilate the pupil; yet, if applied only to the skin, and not to the eye itself, Mr. Lawrence is of opinion that it will do no harm, and perhaps may even prevent further contraction of that opening. Other local applications are of secondary importance; poppy fomentations generally give most relief, but cold applications may be used, if preferred. Blisters are not advisable until the disease becomes chronic; or, not until bleeding has been freely practised, and mercury exhibited.

When there is severe nocturnal pain about the orbit, the forehead and temple should be rubbed with mercurial ointment combined with opium, in the proportion of four grains of the latter to one scruple of the former.

In *arthritic*, or *gouty iritis*, mercury is less necessary than in the idiopathic and syphilitic forms of the complaint. Colchicum and magnesia, and, in the chronic stage, blisters, carbonate of iron, and quinine, are means on which some practitioners place their chief dependence. We should not imbibe the notion, that syphilitic iritis absolutely cannot be cured without mercury. Sometimes it may be cured by antiphlogistic treatment alone; and Mr. Hugh Carmichael, of Dublin, has published a series of well-marked examples of syphilitic iritis, which were cured by giving ℥j. doses of turpentine in the almond emulsion, three times a day. Yet he only resorted to this practice when mercury was inadmissible, in consequence of its injurious effect on the health.

### CHOROIDITIS AND RETINITIS.

The *internal inflammations of the eye* may sometimes arise in one texture, and, at other times, in another; in one case, the retina may be first affected; in another, the choroid coat; and, in a third, the iris. From these individual textures, the inflammation may afterwards extend to every part of the eye.

Retinitis is occasionally excited by long-continued immoderate exertion of the sight in the examination of minute microscopical objects, under a strong, and, perhaps, a reflected light. Such cases, however, are generally preceded by determination of blood to the head, or the eye. The same consequence may follow the effect of vivid flashes of lightning, or the sudden exposure of the eyes of persons to the light, who have long been confined in dark dungeons. *Chronic retinitis* is often regarded as weakness of sight, characterised by a morbid sensibility to light, and slight obscurity of vision, followed, after a time, by a gradual contraction of the pupil, immobility of the iris, and amaurosis.

The *treatment* of acute retinitis consists in keeping the eyes perfectly at rest, with the benefit of darkness, abstinence, and active depletion, followed by the quick introduction of mercury into the system, belladonna being also applied, as in iritis. The treatment, indeed, is essentially the same in both cases.

Having now finished the consideration of the principal inflammations of the eye, I proceed to notice some other affections which are consequences of an inflammatory process in that organ.

## GLAUCOMA

Is so called from the greenish colour reflected from the pupil, the iris becoming of a dull leaden or dirty green colour, the pupil dilated, the eye painful, its vessels distended, and vision generally destroyed. In the early stage, the green reflection seems as if it came from the very bottom of the eye; but, as the disease advances, the apparent opacity, which is always of a greenish colour, and often sea-green, looks as if it were situated in the centre of the vitreous humour, and at last appears to be immediately behind the lens. The opacity and green reflection are not the result of any change in the crystalline lens, but are more deeply seated. The change cannot be seen when the eye is inspected laterally, but only when we look directly towards the bottom of the eye.

Scarpa ascribes the glaucomatous state of the eye to inflammation and thickening of the retina; Beer to similar alterations of the vitreous humour; and other surgeons to morbid changes in both these textures. Dr. M'Kenzie, in dissecting some glaucomatous eyes, found the choroid coat, and especially the portion of it in contact with the retina, of a light brown colour, without any appearance of pigmentum nigrum. The vitreous humour was in a fluid state, perfectly colourless, or slightly yellow, without any trace of hyaloid membrane. The lens was of a yellow or amber colour, firm and transparent. In the retina, no trace of the foramen centrale and limbus luteus was distinguishable. No other change was noticed in the retina; for it was not thickened, nor changed in colour; neither was the vitreous humour thickened, or opaque, but perfectly fluid and transparent.

Glaucoma is always attended with a limited and sluggish motion of the pupil and other amaurotic symptoms. Ultimately, indeed, the pupil is greatly dilated, and the retina becomes insensible to light. The loss of sight, however, is generally gradual; and the want of pigmentum nigrum has been suspected to be capable of affording some explanation of the weakness of sight, which accompanies the early stages. This, however, may not seem satisfactory to every pathologist; nor are we sure, that a deficiency of pigmentum nigrum is an essential occurrence in every glaucoma.

Inflammation, leading to a destruction of the hyaloid membrane, may perhaps be set down as the proximate cause of glaucoma. The disease is much more common in old than young subjects, and is occasionally believed to come on chiefly in consequence of slow inflammation of the interior textures of the eye in gouty constitutions. Surgeons must be careful not to mistake glaucoma for cataract; the mere colour of the eye is sufficient to prove that, at all events, the case is not one of simple lenticular cataract, for opacity of the lens alone is never green. Also, when the pupil is dilated with belladonna, the green appearance seems to be further behind the pupil, and uniform, not streaked, nor spotted like a cataract.

When glaucoma has commenced in one eye, we generally find it take place also in the other, the disease being often seen in different stages in the two eyes.

Complete glaucoma may be set down as absolutely incurable, though it is possible that, in the early stage of the disorder, its progress may be arrested, and even vision improved. I should say, however, that the prognosis is always peculiarly unfavourable. Mild antiphlogistic treatment, with calomel and opium, may be tried, or iodine given; but the prospect of benefit is very slight indeed.

Instead of mercury, Dr. M'Kenzie, of Glasgow, suggests the trial of carbonate, or sesqui-oxide, of iron and sulphate of quinine, directly after depletion, but I know of no fact in support of the practice. Dilatation of the pupil with the aqueous solution of belladonna will sometimes temporarily improve the sight.

### ONYX, OR ABSCESS OF THE CORNEA,

Signifies a collection of matter between its lamellæ, and so called from its being of a semilunar shape, like the white mark at the root of one of the finger-nails. It is generally situated at the lower edge of the cornea, and, even when more extensive, may be readily distinguished from a collection of matter in the anterior chamber, called *hypopium*, by its form and situation remaining unchanged, whatever may be the position of the patient's head.

The treatment consists chiefly in the employment of remedies called for by the kind of ophthalmy, of which the onyx is an effect. As a general rule, it is the best practice not to open any collections of matter in the texture of the cornea, as we thus rather increase, than lessen, the risk of opacity of that membrane, and prolapsus of the iris. When, however, the onyx has a tendency to spread over the cornea without bursting, it becomes necessary to make an opening with a cataract knife.

### HYPOPIUM

Is a collection of matter in the chambers of the aqueous humour, especially the anterior. The matter is always first noticed at the bottom of that chamber; and it may increase gradually, till it not only covers the pupil, but fills the chamber, and even the pupil. Sometimes it shifts its position with every motion of the head; and, in other examples, its thick glutinous properties fix it in one place. If the case be neglected, the prominence of the cornea increases, and, at last, after most agonising pain, that membrane gives way: the suffering now ceases, and the iris falls forwards, protrudes, and becomes adherent to the cornea.

In the treatment, the principal indication is to lessen the inflammation, from which the hypopium has originated, whether of the cornea or the iris; for, if we succeed in doing this promptly, and then give mercury, absorption will often proceed so quickly in the anterior chamber, that the matter will soon be removed. The best general rule is to abstain from making an opening; for, in fact, the matter is a viscid kind of lymph, which will not flow out if a puncture be made.

If the eyeball were to suppurate extensively, things would be different, and then an opening for the discharge of the abscess would unquestionably be required.

*Ulcers of the cornea* are frequently the consequence of the rupture of an onyx or small abscess. In purulent ophthalmy, however, the ulcera-

tion generally begins externally, and penetrates more and more deeply, until it reaches into the anterior chamber. Sometimes ulcers of the cornea are produced by the irritation of extraneous substances on the eye, as quicklime, or pieces of glass. The ulcer is of a pale ash colour; its edges high and irregular; its margin surrounded by a slight halo of lymph, or a cloudy appearance of the cornea; it gives acute pain, discharges a thin lymph, and is disposed to spread. To the deposit of lymph around the sore, a fasciculus of vessels proceeds from the sclerotic conjunctiva.

When the ulceration extends superficially, the transparency of the cornea may be destroyed; and when it penetrates the anterior chamber, the aqueous humour escapes, and a prolapsus of the iris takes place. If the opening be large, even the vitreous humour and lens may be discharged, and the eye destroyed. Then, if less mischief occur, the cicatrix frequently produces indelible opacity of the cornea, and more or less injury of vision.

*Treatment.*— Our first endeavour should be to stop the ulcerative process by means calculated to lessen the inflammation, which is the cause of it. Local bleeding is proper, so long as there is an appearance of active inflammation, and much pain is felt in the eye. The bowels are to be kept open, and opium administered. In strumous cases, we may give the sulphate of quinine, and wash the eye with a collyrium containing iodine, according to the formula of Lugol. In the chronic superficial ulcer, we may prescribe calomel. In almost all cases, counter-irritation is useful. When the ulcer is kept from healing by the irritation of the motion of the eyelids, and it protracts the inflamed state of the eye, lunar caustic is the grand means of relief.

### OPACITIES AND SPECKS OF THE CORNEA

Receive different names according to their degree and mode of formation. The slightest degree of opacity is termed *nebula*, in which the cornea presents a diffused cloudiness, a hazy or milky appearance, that has no distinct boundary, but is gradually lost in the surrounding transparent portion of that membrane. It is often accompanied by an enlarged and reddened state of the vessels of the conjunctiva, some ramifications of which extend into the delicate layer of this membrane, spread over the cornea.

Opacities of a more circumscribed and complete kind are exemplified in *Albugo* and *Leucoma*, which consist of a deep extravasation of dense lymph in the substance of the cornea. They are of a clear white or pearl colour, and only differ in one respect; namely, that the albugo is the consequence of some description of ophthalmy, or of an abscess, or ulceration of the cornea, while the leucoma is the opaque speck or mark occasioned by a wound of that texture. For some time after the completion of the healing process, the opacity continues to diminish; but this improvement can only take place in a certain degree, and an indelible speck will yet remain, though considerably smaller than the original wound which was the cause of it.

Numerous red vessels are sometimes observed running into an albugo from the conjunctiva; and, when this is the case, the opacity is apt to spread, and is somewhat raised above the level of the cornea, the delicate layer of the conjunctiva spread over this membrane being much thickened. This variety of albugo is occasionally seen in scrofulous adults, and sometimes in children.

The remedies, calculated to do good to specks of the cornea, in their early stage, are those which have the effect of removing the inflammation that has given rise to them. At the same time, there are both general and local means peculiarly adapted for hastening the absorption of opaque deposits in the cornea; such are mercury and iodine. We have likewise various applications for quickening the action of the absorbents in the removal of specks, if employed at the proper time. If we commence their use too soon, that is, before the cause of the opacity is removed, we shall do more harm than good. For instance, if in an albugo, arising from scrofulous corneitis, and still attended by considerable vascularity, we were directly to attack the opacity of the cornea with stimulating powders and strong solutions of nitrate of silver, oxymuriate of mercury, or iodine, we should not only fail in accomplishing the object in view, but create a great risk of rendering the patient totally blind. But, if we begin with attacking the strumous inflammation, which still lingers in the eye, and that chiefly with constitutional remedies, we shall not only disperse the redness, but often find the cornea begin to get clearer from day to day, and the eyesight to be proportionally improved.

The best local means for dispersing opacities of the cornea are, a solution of the nitrate of silver, from two to five grains, in an ounce of distilled water; a solution of one or two grains of oxymuriate of mercury in an ounce of distilled water; the vinum opii; the ung. hydr. nitratis; or a finely levigated powder, consisting of ʒj. of red precipitate and one ounce of white sugar. The latter is generally blown on the speck through a quill. The useful effect of iodine collyria must also not be forgotten. The vascular forms of albugo sometimes require the trunks of the vessels distributed to them to be divided, and mercury or iodine to be exhibited.

### STAPHYLOMA

Is a term applied to various protrusions or projections on the front of the eye, in consequence of their fancied resemblance to a grape, *staphyle* being the Greek word for that fruit. Thus, a protrusion of a portion of the iris through an ulcer, or wound of the cornea, used to be called *staphyloma racemosum*, but now more properly *prolapsus of the iris*. At the present time, the term *staphyloma* is usually restricted to protuberances of the cornea and sclerotica. Staphylomatous affections of the sclerotica, however, are so rare, in comparison with those of the cornea, that it is only the latter which need detain us. When the cornea becomes staphylomatous, it looses its natural transparency, rises above its proper level, and even projects between the eyelids, in the form of a whitish, pearl-coloured, or bluish tumour, attended, when the whole cornea is affected, with loss of sight. To this grievance are added, in bad cases, all the evils which unavoidably result from the projection of the cornea: inability of closing the eyelids; exposure of the eyeball to the air and extraneous matter suspended in it; irritation and inflammation from this cause and the friction of the eyelashes; and soreness and excoriation of the lower eyelid and cheek from the constant stillicidium lachrymarum. Even the other eye is often sympathetically affected, becoming tender, and sometimes truly inflamed.

Staphyloma of the cornea is either *partial* or *total*. Although the most evident symptoms are opacity and projection of the cornea, a common effect of the disease is adhesion of the iris to the diseased cornea,

and consequently a diminution or total obliteration of the anterior chamber.

Where a partial staphyloma neither covers nor involves the pupil, the patient may be able to see objects placed above him or on a level with his eye; but he is generally affected with epiphora and painful sensibility of the organ. In more unfortunate cases, all the margin of the pupil is adherent to the opaque and projecting portion of the cornea; and it is only by the formation of a lateral artificial pupil, that any degree of vision can be recovered.

Partial staphyloma is sometimes confounded with leucoma; but it is to be recollected, that in general the iris is firmly adherent to the whole extent of a partial staphyloma, but either quite unconnected with a leucoma, or connected to it by a mere point. In partial staphyloma, the whole cornea inclines to a conical form, the apex of which is the centre of the staphyloma; whereas, in leucoma, the general spherical form of the cornea remains unaltered.

If either from closure of the pupil, or from the partial staphyloma being situated over it, no vision exists, we should try to lessen the staphyloma itself, and then consider whether, by an operation for artificial pupil, the eyesight can be restored.

Now, the safest plan of reducing a partial staphyloma is to apply to its apex the muriate of antimony with a camel-hair pencil, while the eyelids are kept widely separated. Then, before the eye is shut, the surface of the staphyloma should be washed with a large camel-hair pencil dipped in tepid water or milk. The caustic is not to be repeated till the slough has come away, and the inflammation, caused by the former application, subsided.

In one form of total staphyloma, the tumour is *spherical;* in the other, it has the shape of a *blunt cone.*

As there is no possibility of restoring sight to a patient afflicted with total staphyloma, even in cases where the lens, vitreous humour, and retina are sound, the only thing we can usefully do is to lessen the protuberance of the cornea, which is not only a great disfigurement, but a cause of the serious annoyances already specified. This is done by an operation, which consists, first, in the formation of a flap with the cataract knife: and, secondly, in completing the circular excision of the most prominent portion of the tumour with a pair of curved scissors. The lens and vitreous humour escape; the eye shrinks into the orbit; and, though the organ is destroyed, the patient is freed from a disease, which, besides being attended with total loss of sight, was a source of great misery and suffering.

## SYNECHIA

Is a term employed to signify a morbid adhesion of the iris. When the adhesion is to the cornea, the case is called *synechia anterior;* when to the capsule of the crystalline lens, *synechia posterior.* The former is often the consequence of a wound, or ulcer of the cornea, attended with escape of the aqueous humour; the latter is more frequently brought on by iritis.

Partial and recent adhesions of the iris to the capsule of the lens may sometimes be separated by the use of belladonna and mercury. In some instances of partial synechia anterior, and even of complete synechia posterior, which is mostly attended with closure of the pupil, vision may be restored by the formation of an artificial pupil.

The adhesion of the iris to the cornea produces a change in the size, position, and shape of the pupil; and when the result of inflammation, or of a prolapsus of the iris, the cornea mostly becomes opaque.

### PROLAPSUS OF THE IRIS,

Sometimes termed *staphyloma racemosum*, is a protusion of the iris through a wound or ulcerated opening in the cornea. It is necessarily of the same colour as the iris, brown or greyish, and its size varies from that of a pin's head to that of a small pea. As the cornea is rarely perforated at more than one point, the prolapsus is usually single, and its base is generally surrounded by an opaque circle of the cornea.

The inconveniences of a prolapsus of the iris are, pricking pain in the eye, inflammation of the organ, intolerance of light, a deviation of the pupil towards the seat of the prolapsus, and a lessening of its diameter. In cases of long standing, the protruded portion of the iris becomes less sensible, and the distress experienced less acute.

When the prolapsus is quite recent, and the consequence of a wound, no doubt can exist about the propriety of reducing the iris into its right situation again. In other examples this is impracticable, and then the inconveniences of the projection of the iris are to be relieved by touching the tumour repeatedly with the nitrate of silver, until it is sufficiently levelled and the ulcer healed; while the obstruction of vision itself, caused by the displacement and ulceration of the pupil, and the partial opacity of the cornea, may sometimes be removed by the formation of an artificial pupil. When the protruded piece of the iris is large, it may be necessary to snip off a part of it with scissors, before the nitrate of silver is applied.

### CLOSURE OF THE PUPIL, AND FORMATION OF AN ARTIFICIAL PUPIL.

A permanent contraction, or a closure of the pupil, is most frequently a consequence of inflammation of the iris; but sometimes it follows operations for the removal of cataracts, coming on slowly and insidiously at some indeterminate period afterwards, without any marked inflammation in the eye. The iris becomes motionless, assumes a radiated wrinkled appearance, and, when the lens is free from opacity, a small black point is seen in its centre. Under these circumstances, if the retina be sound, the patient may sometimes regain a considerable power of vision by the formation of an artificial pupil. The pupil may also be obstructed by the effusion and organisation of coagulating lymph from inflammation; or there may be such a displacement of the iris from prolapsus as causes an alteration in the shape and position of the pupil, attended with serious obstruction of vision.

The several varieties of operation for the formation of an artificial pupil may all be referred to three principal methods; the first is *a simple cut through the iris*, without the removal of any portion of it, termed *coretomia*. The second is an incision in the iris, and the removal of a part of it — *corectomia*. The third consists in separating some of its external margin from the corpus ciliare — *coredialysis*.

It is manifest that none of these operations can be performed with a reasonable prospect of success, except when the changes in the condition of the pupil are the only defect in the eye. Thus, unless the retina were sensible, it would be doing no good to make a new opening in the iris. The patient should always be capable of discerning the difference between

light and darkness; and, if he had not this power, the operation would hold out little prospect of success. This state, however, does not amount to an absolute prohibition of it, because sometimes the iris is so thickened, the posterior chamber so full of dense lymph, and the transparency of the lens so affected, that the power in question may be annihilated, yet the retina itself not be incapable of resuming its functions. The experiment, though unpromising, may be made.

An artificial pupil should never be formed in one eye, so long as the patient is able to see with the other. Nor ought the operation to be attempted if the eye be affected with inflammation, preternatural hardness, dropsy, or atrophy.

When a part of the cornea is opaque, the place for the artificial pupil must, of course, be determined by the situation of the transparent portion of that membrane; and if the operator has the choice of placing it behind either the nasal or the temporal edge of the cornea, the former situation is to be preferred, as affording a more useful degree of vision.

Whenever the lens and capsule are transparent, one chief caution in the operation is to leave those parts completely undisturbed.

As an artificial pupil possesses no power of contraction and dilatation, care must be taken to make it neither too large nor too small. Too small an opening would not be very serviceable; and if it were too ample, the quantity of light admitted into the eye would dazzle vision, and the new aperture be comparatively useless.

The limits of this work prevent me from describing all the modifications of operations, rendered necessary by the infinite variety of circumstances attending a closure of the pupil. The state of the pupil itself; its being filled or not by opaque fibrine; the condition of the cornea; the state of the lens; and the disease being complicated or not with prolapsus and adhesion of the iris, are several principal considerations materially influencing the particular mode of operating.

*Coretomia,* or the simple division of the iris, may be performed with an iris-knife, or couching-needle, that has a sharp edge only on one side; or else with a minute pair of scissors, one blade of which has a sharp point, the other an end, like that of a small probe. The iris-knife, which is but little larger than a common couching-needle, is introduced through the sclerotica, about a line and a half from the cornea; and, after perforating the iris on the side towards the temple, its point is conveyed across the anterior chamber nearly as far as the ciliary margin of the iris towards the nose. Then the sharp edge is to be turned backwards, and pressed against the iris as it is withdrawn, so as to make a transverse cut in the iris.

Another plan of dividing of the iris is performed by making an incision near the side of the cornea, and introducing small scissors, one of the blades of which has a sharp point, the other a probe point. The sharp point is then passed through the iris, near its ciliary margin; while the probe point is passed under the cornea, the requisite distance, when the blades are to be shut, and the necessary division of the iris executed.

These methods of operating are proper when the iris has a tense appearance, when the cornea is transparent, and there is no crystalline lens, or when the closure of the pupil has followed extraction of the cataract.

The *excision of a portion of the iris,* termed *corectomia,* is another method. It is performed in different ways. Thus, we may puncture the cornea, draw out a piece of the iris by means of a minute hook, made for the purpose, and snip it off. This was Professor Beer's way, which ap-

pears quite as good as that adopted by the late Mr. Gibson, who made an incision in the cornea, so as to let out the aqueous humour, after which he made a piece of the iris protrude by means of gentle pressure, and cut it off. The iris then receded into the eye with the new circular opening formed in it.

These last plans are proper when the centre of the cornea is densely opaque, but the whole, or a portion of its circumference, transparent, and the lens and its capsule sound.

The operation of separating a portion of the outer margin of the iris from the corpus ciliare, *coredialysis*, was first done by Scarpa, on the side towards the nose; but, as the opening did not continue to be permanent, this plan was abandoned in favour of Reisinger's method, which is executed by means of a very fine double-hook forceps, capable of being put into the form of a single hook by slight pressure. A small puncture is made in the cornea near its margin, the double-hook forceps introduced, and conveyed, with the points turned downwards, as far as the place where the iris is to be separated, but always as near as possible to the ciliary edge. The points are then to be slightly opened, and made to enter the iris. The blades are now to be shut, and the instrument slowly drawn outwards, by which means a sufficient piece of the iris will be detached, which, having been disengaged from the instrument, is to be left strangulated in the wound of the cornea. In fact, this operation is a combination of coredialysis with corectomia. In this country, coredialysis is not much in favour, surgeons generally preferring either *coretomia* or *corectomia*.

### HYDROPHTHALMIA, OR DROPSY OF THE EYE,

Seems to be generally a local disease, or, at all events, is never connected with, or dependent upon, ascites, anasarca, or other dropsical affections; and, if it depend upon constitutional causes, their nature has not yet been made out. There may be dropsy of the chambers of the eye, that is, an increase in the quantity of the aqueous humour; or there may be a preternatural accumulation of the vitreous humour; or, lastly, there may be a collection of serous fluid between the sclerotic and choroid tunics.

The symptoms of dropsy of the anterior and posterior chambers are a greater prominence of the cornea than natural, and an increase in its diameter, attended in the advanced stages with loss of its transparency. The iris is soon rendered motionless, and of a darker colour than usual. At first, the eye is far-sighted, but afterwards the power of seeing becomes considerably impaired, or lost. When this variety of hydrophthalmia follows injuries of the eye, it may be combined with a tremulous state of the iris, and partial amaurosis.

In the treatment, we may try blisters on the temple, or behind the ear; mercury, iodine, and purgatives. In inveterate cases, paracentesis oculi has sometimes been practised. If this plan be adopted, the best instrument is a grooved needle. I had a case in University College Hospital, in which I punctured the eye seven or eight times at intervals with such a needle, so as to discharge the fluid, and at length to diminish the size of the organ, and relieve the patient from the severe pain previously experienced.

If the existence of *subsclerotic dropsy* could be made out, the discharge of the fluid by puncture would be indicated.

*Dropsy of the vitreous humour* is attended with enlargement of the posterior part of the eyeball, a conical projection of the cornea forwards,

advance of the iris towards the cornea, deep blue colour of the sclerotica, and shortsightedness, followed by complete amaurosis, the eyeball becoming hard and motionless.

As the eyesight is totally lost, all that the surgeon can do is to relieve those inconveniences which arise from the distended state of the eye, and its pressure. If puncture with the needle were insufficient, a piece of the cornea might be cut off, and the humours discharged.

## AMAUROSIS, OR GUTTA SERENA,

Is an obscurity or loss of vision, arising from a more or less insensible state of the retina. Either the retina, the optic nerve, or the brain, may be the part first and principally affected. The expression *gutta serena* is only applied to cases of total blindness, plainly derived from the circumstance of the pupil having no opacity in it, and being apparently clear, though the patient is blind.

The symptoms of amaurosis are of two kinds: first, those which the *surgeon* notices in the form, colour, texture, consistence, vascularity, and motions of the different parts of the organ, or in the general condition of the patient; secondly, those which the *patient* himself experiences, as impaired or deranged vision, headach, vertigo, peculiar sensations in the eye, &c.

The first symptom, and one that never fails to be present, is the patient's want of a proper control over the eye affected, the pupils of the two eyes not being directed harmoniously to the objects looked at; and hence, there is a kind of staring and vacancy in the countenance. This symptom may exist at first only in a very slight degree; but, in some cases, it amounts to an actual squinting, or strabismus; while, in others, such is the want of control over the eye, that it is either affected with oscillation or stands quite motionless in the orbit. The motions of the eyelids, as well as those of the eyes, are likewise not unfrequently interrupted; sometimes the levator of the upper eyelid being palsied, and sometimes the orbicularis palpebrarum.

The eye may also form a greater prominence than the other, or be otherwise changed in its shape. Its colour is seldom that exhibited in the healthy state, the sclerotica being yellowish, bluish, or ash-coloured, and often streaked with varicose vessels; while no symptom of amaurosis is more to be depended upon, than an increase or diminution in the natural firmness of the eyeball.

Another usual symptom is a sluggish and limited motion of the iris, generally attended with dilatation of the pupil, but occasionally with contraction. The early and incomplete stages of amaurosis are, indeed, rarely accompanied by a widely dilated pupil; but, after the perception of light has become further weakened or extinct, the opening is commonly expanded and quite motionless. Yet, cases sometimes present themselves, in which the pupil of a completely amaurotic eye will move briskly, according to the degree of light acting upon the opposite or sound eye; though, if the amaurotic eye alone were exposed to its influence, the pupil of it would remain perfectly motionless and greatly dilated. Hence, it is a rule in surgery, always to close and cover the sound eye during the examination of the state of the iris and pupil of an eye suspected to be amaurotic. Other examples still more curious occur, in which, though the patient is totally blind, both pupils vary in diameter, according to the changing degrees of light, exactly as they do in the perfect state of the eyes.

Besides the motions of the iris, which must be examined in each eye separately, and with the opposite eye excluded from the light, the shape and situation of the pupil should be noticed, and the inclination of the iris considered; for sometimes the pupil is irregularly dilated, and sometimes moved towards a particular point of the circumference of the iris, while this membrane itself may either bulge out towards the cornea, or sink back, so as to present a concave appearance.

When amaurosis is an effect of hydrocephalus in a young subject, the pupil may exhibit its naturally black hue; but in elderly subjects, amaurosis is almost constantly accompanied either by some degree of glaucoma, or a dull glassy, or horny appearance in the pupil.

As for the symptoms or effects, of which the patient alone is conscious, there is, first, impaired vision, the progress and degree of which vary in different cases; for, in some instances, the patient becomes suddenly and permanently blind, while, in others, the sight diminishes in a very slow and gradual manner, without ever terminating in total blindness.

Hence, the distinctions of *complete* and *incomplete* amaurosis. Frequently, in the commencement of the disease, the failure of sight is only occasional, or for a short time, or periodical, assuming the form of *night blindness* or *day blindness*, or coming on after any great exertion of the eyes. A few lines of a printed book may perhaps be read, after which the letters appear completely confused. The failure of sight may extend to the whole field of vision, or only to a part of it. Thus more or less of the page of a book may not be visible (visus interruptus), or only the half of objects may be seen (hemiopia). Sometimes objects can be seen only when placed exactly in one particular direction (visus obliquus). To some amaurotic patients all objects seem disfigured, crooked, enlarged, diminished, or even inverted (visus defiguratus).

Then another common sign of amaurosis, which the patient perceives, is what are termed *ocular spectra*, as *sensations of flashes of light* in the eye (photopsia), or of insects or cobwebs flying about before the eye (muscæ volitantes); or of colours which are not before the eye. *Double vision* is also another frequent effect of the disease in its early stage. As the complaint advances, however, vision is obscured by one uniform cloud or network.

In the early periods, the patient has sometimes an unwonted sensibility to light, which even gives him pain; while, in other more usual cases, he always courts it from the very beginning. Pain in the eyes, head, and face, is another important symptom in amaurosis, denoting the probability of the existence of a slow inflammation of the retina, or of organic disease within the cranium itself. In fact, several of the incurable forms of amaurosis depend on causes, which act on the nervous structure of the eye from within the skull. Such are collections of fluid in the ventricles of the brain; disease or tumours of this organ, situated near that part of it where the optic nerve is connected with its base; while other swellings or diseases may affect the optic nerve in its course either within the cranium, or in the orbit.

Loss of sensibility in the retina, and a complete annihilation of its functions, may be the effect or accompaniment of other diseases of the eye; as, for instance, of the severe varieties of ophthalmy affecting the interior texture of the eye, glaucoma, hydrophthalmy, melanosis, and fungus hæmatodes. These examples, in which the retina suffers, in common with other textures, are named according to the primary disease, or to their most prominent symptoms; and when we use the term *amaurosis*,

we commonly understand a case, in which the retina, or nervous apparatus of sight, is the part of the eye first affected.

Immoderate exertion of the eye, more especially on small objects, and in persons either of plethoric constitution, or intemperate habits, producing a determination of blood to the head, may be set down as frequent causes of a slow inflammation of the retina, ending in an alteration of its texture, and in impairment or abolition of its functions. Hence printers, watchmakers, engravers, tailors, and other classes of workmen, whose eyes are employed on minute objects and needlework, are frequently afflicted with amaurosis.

Amaurosis is sometimes divided into *functional* and *organic*, the first implying the interruption of the functions of the retina, independently of any organic disease. Whether such case really occurs has sometimes been disputed; but if we admit that amaurosis may arise from sympathy of the eyes with disease or irritation in distant parts, we must, I believe, admit the doctrine of functional amaurosis. Thus amaurosis may arise from gastric disorder, the presence of worms in the bowels, the irritation of dentition, or that of a carious tooth. The disease may also be excited by a wound of the scalp, caries of the skull, disease of the antrum, abscesses about the face, the suppression of the menses, or the effect of particular aliments in persons of peculiar idiosyncrasies.

With respect to the prognosis, the functional amaurosis must leave a greater hope of cure than the organic. A suddenly formed amaurosis is generally less unfavourable, than one that has developed itself slowly. Complete inveterate amaurosis, attended with organic change of the retina, or optic nerve, may be deemed incurable. The distorted appearance of objects in the early stage is always a bad omen, because indicative of disease in the brain.

Amaurosis may be combined with glaucoma, or with cataract. The characteristic differences between the latter and amaurosis will be explained under the head of *Cataract.*

*Treatment.* — No doubt much of the difficulty of curing amaurosis arises from our being frequently ignorant of its causes; to their being in many instances various, complicated, and incapable of removal; or, if removable, to the impossibility of obviating their effects on the retina.

When amaurosis is attended by signs of determination of blood to the head, such as headach, vertigo, flushed countenance, and arterial throbbings of the temples; when the pulse is full, and the subject young and plethoric; general and local blood-letting, purgatives, and low diet, are indicated. If the case be altogether dependent upon vascular distension, these means, conjoined with rest of the organ, will probably effect a cure. If, along with vascular fulness, there be effusion, depletion will also be the most likely means of relief, and the best preparation of the patient for other remedies, more especially for the use of mercury.

When functional amaurosis depends upon disorder of the chylopoietic viscera, habitual costiveness, and an increased flow of blood to the head, purgatives, assisted by bleeding, are found to answer better in this country than nauseating doses of tartrate of antimony, so highly praised by Richter and Scarpa. We may give the blue pill at night, and a mild saline aperient mixture in the morning; and, after having continued this treatment for some time, tonics may be prescribed with advantage, as sulphuric acid, bark, and steel medicines.

Many examples of amaurosis depend upon the effects of chronic inflammation on the retina, or upon a slow and gradually-produced depo-

sition of lymph in various situations affecting the immediate organ of vision. Now, for the diminution and removal of such effects, we know of no medicine that is at all equal to mercury. I fully agree with Mr. Lawrence, that the right treatment of most cases of amaurosis turns upon two points, viz. — the employment of ordinary antiphlogistic means, and letting these be quickly conjoined with, or followed up by, the use of mercury. Here it acts in the same way as it does in iritis; and, in order to give it a fair trial, the system must be kept under its influence for a month or six weeks. The influence should also be such as is indicated by a moderate degree of salivation. Perhaps, I may say, with respect to nine out of every ten cases of amaurosis, that if they will not yield to a combination of antiphlogistic and mercurial treatment, they will yield to nothing that has yet been discovered.

We ought, indeed, to modify such treatment according to circumstances. Thus, if the patient were of weak frame, and apparently affected with more gastric than cerebal disorder, we should employ, perhaps, local bleeding, rather than venesection; and moderate doses of the blue pill, or compound calomel pill, with saline medicines, in preference to the active exhibition of calomel, or the free use of mercurial ointment.

In some cases, we may apply a blister, or seton, to the nape of the neck or temple.

The plan of treating amaurotic eyes with electricity, or stimulating applications, and tonics, is found to be generally unsuccessful. The idea of amaurosis being essentially connected with debility is erroneous. The only exception to this remark may be the amaurosis from suckling, and from profuse loss of blood. However, galvanism has now and then been applied to the frontal nerve with advantage. If a delicate female were to lose, first, her health, and then become amaurotic from suckling a hearty child, of course the best plan would be to wean it, and give her tonics and a light nutritious diet, with a small quantity of wine daily. In some instances, applying from half a grain to two grains of strychnia, to a blistered part of the skin behind the ear, or over the frontal nerve, has been productive of decided benefit.

### HEMERALOPIA, OR NIGHT BLINDNESS,

Is an incomplete and periodical amaurosis, exemplifying, according to my judgment, the reality of functional cases. The patient enjoys good vision all the day; but after twilight he becomes blind. No sooner, however, does the sun arise, than the affection of the optic nerve and retina goes off, and the patient then sees very well again. It is only in the tropics that hemeralopia is likely to be met with: in this climate, examples of it are rare, and, when they do occur, are generally relapses in persons who have been previously affected in hot countries. The disorder is easily cured by blistering the temples, and mild antiphlogistic treatment.

### NYCTALOPIA,

Signifying blindness during the day and vision by night, is described by writers, but is so rare, that few surgeons have ever seen an example of it. Larrey records a case of it in an old man, one of the galley-slaves at Brest, who had been shut up in a dark subterraneous dungeon for thirty-three years. When released, he could only see in the shade of night, and was completely blind during the day. Ramazzini also mentions an epidemic day blindness, which, in his time, attacked boys in Italy, about ten

years of age. But, though we do not meet with nyctalopia in England as an original disease, we know that great intolerance of daylight is one of the common effects of scrofulous ophthalmy. The *photophobia*, or aversion to light, exemplified in the *albino*, is familiarly known. Day-blindness is also noticed as a symptom of *mydriasis*, or a simple preternatural dilatation of the pupil. Patients, who have incipient cataracts, see very little in the brightness of day, but much better in the evening, when the light is diminished and the pupil expanded.

## CATARACT

Is usually defined to be a weakness or interruption of sight, produced by opacity either of the crystalline lens, its capsule, or the fluid of Morgagni. Occasionally, however, the term is used in a more comprehensive sense, implying every perceptible obstacle to vision, situated between the vitreous humour and the uvea and pupil.

When the disease is seated in the lens, its capsule, or the fluid of Morgagni, it is called a *true cataract;* but, when it consists of opaque matter deposited in front of the lens, it is denominated a *false cataract.* The terms, *lenticular*, *capsular*, and *capsulo-lenticular cataracts*, express some of the distinctions referred to. The Morgagnian may be dismissed from present consideration, its separate existence not being generally credited.

Cataracts are also distinguished into *idiopathic*, or such as arise from internal, but generally unknown causes, — and into *accidental*, which originate from external violence, or active inflammation. In general, the idiopathic, sooner or later, affect both eyes; but an accidental cataract is frequently restricted to one eye.

The symptoms of a cataract are of the following description: — 1st. All objects, especially white ones, seem to the patient as if covered with a mist, a circumstance that generally precedes any visible opacity behind the pupil. 2d. The decline of vision bears an exact proportion to the degree of opacity. 3d. The opacity is almost always first noticed in the centre of the pupil, the examples, in which it first presents itself at the circumference, being much less frequent. 4th. When the iris is light-coloured, the more opaque the cataract is, the more plainly a blackish ring is seen at the edge of the pupil; and such a ring is particularly conspicuous when the cataract is soft and large, as it then propels the margin of the uvea forwards. 5th. As a cataract generally begins at the central point behind the pupil, objects placed directly in front of the eye are most difficultly seen, even in the early stage of the disease; but those, which are on one side, may yet be discerned, particularly if the light be not strong, which would make the pupil too diminutive to let the rays pass through the thinner transparent edge of the lens. 6th. What I have just observed likewise explains why patients, having an opacity in the centre of the lens, are sometimes completely blind in a strong light, though they may enjoy a useful degree of vision in the shade, or in moderately dark places. 7th. The eyesight of patients, affected with incipient cataract, may be materially assisted with convex glasses, because objects are magnified by them. 8th. To patients in this state, the flame of a candle seems to be obscured in a white misty halo, which always becomes broader the further the patient is from the light. When the cataract is more advanced, the flame cannot be discerned, but merely the place of the light. 9th. The action of the iris is not affected.

In amaurosis, the horn-like or glaucomatous appearance is more deeply seated in the eye than the opacity of a cataract, and is somewhat concave. It is frequently of a greenish colour, while the opacity of cataract is usually greyish, white, or amber-coloured. The decline of vision, also, is not in a ratio to the opacity, and the patient may be entirely blind, with little appearance of defect in the eye. The pupil is likewise generally dilated and motionless, with its pupillary margin somewhat irregular. The temporary increase or decrease of blindness, a circumstance so common in patients with incomplete amaurosis, depends upon circumstances which depress or excite the system, and not, as in cases of cataract, upon the degree of light, and the corresponding alterations in the size of the pupil.

The misty halo, seen by amaurotic patients round the flame of a candle, is not like a whitish cloud, as in cases of cataract, but exhibits all the colours of the rainbow. To amaurotic patients spectacles are of no service; and objects situated on one side are not better seen by such persons, than those which are directly in front of the eye. Neither is there any temporary increase of the power of vision obtained by the use of belladonna, as in cataract.

Whiteness denotes either a dissolved lens or a capsular cataract; a grey colour, a lenticular cataract; an amber colour or dark grey, a firm lens; and light grey, a soft one. If the whole extent of the pupil is uniformly opaque, the cataract is probably one of the lens; if the opacity is streaked or speckled, it is likely to be one of the capsule. If the opaque streaks radiate from a centre, the posterior layer of the capsule is probably affected. If the form of the opacity is convex, either the anterior capsule or the lens is the seat of it; if concave, the posterior part of the capsule. With the light concentrated on the pupil by means of a double convex glass, all these particulars may be ascertained. I believe, that the size of a cataract is a better criterion of its consistence than its colour is; and, at all events, that the smaller the lens is, and the darker its colour, the more solid its substance will generally be; while the larger and more protuberant it is against the iris, the greater is the probability of its being soft.

A cataract of the lens itself, as I have already explained, is termed a *lenticular cataract*, which may vary much in its consistence. Thus, such a cataract may be *hard*, as it is often found to be in elderly persons, with an amber colour, the tint being deeper in proportion as the cataract is firmer.

A lenticular cataract may be *soft*, that is to say, of a cheesy, gelatinous, or even milky consistence. Soft cataracts are more bulky than hard ones, so that they project nearly into the pupil. Hence, sight is more considerably interrupted than when the cataract is hard, and the power of distinguishing colours frequently quite abolished. The capsular cataract has a smooth and glistening surface, with streaks upon it, and it lies close to the edge of the pupil.

When the lens is present, a capsular cataract is rarely unaccompanied by a lenticular one; but an opaque lens may be removed or taken away by absorption, and a capsular cataract may be left. In this case, as the opacity is merely a thin layer of the capsule, the cataract makes no projection against the iris, and the anterior chamber is not lessened by the advance of the iris towards the cornea.

In children, cataracts are never hard: but in adults, we meet with both hard and soft ones.

Cataracts may occur in any period of life, and are sometimes *congenital*. They are most frequent in elderly persons, and mostly arise without any manifest cause, or any thing wrong in the rest of the eye, or the constitution at large. The capsulo-lenticular cataract is alleged to form very commonly under circumstances denoting a determination of blood to the head and the eye, accompanied by uneasy sensations in those parts; but generally we cannot refer the origin of a cataract to any particular causes. There is an exception, with respect to cataracts following a wound of the lens, or its capsule. Experience proves that the slightest prick of these parts will lead to their opacity, or rather, I should say, that the capsule inflames, and becomes opaque, and the lens itself is afterwards absorbed; so that the result is, in fact, a capsular cataract.

A cataract is termed *simple* when accompanied by no other disease of the eye likely to impair its functions, or with no particular constitutional disease; *complicated*, when joined with other diseases of the eye, as adhesion of the crystalline capsule to the iris, amaurosis, glaucoma, or a gouty, rheumatic, or syphilitic state of the system. The circumstances denoting glaucoma have already been explained. If, in addition to a sluggish or immoveable iris, the patient is totally incapable of distinguishing the least glimpse of light, the cataract is combined with amaurosis.

When a cataract is free from every complication; when it is not attended with frequent headach, nor pains in the eye; when the pupil retains its regular circular shape; when the iris possesses its natural power of motion in the different degrees of light; and when the patient can readily discern the difference between light and darkness, and even perceive bright colours, and the outlines of objects, in shady places where the pupil naturally expands — the prognosis is favourable.

There are no medicines, nor applications, capable of dispersing an opacity of the lens, or its capsule. The cases, injudiciously blended with the subject of cataract, under the name of *false cataracts*, which are only obstructions of the pupil with fibrine, effused in consequence of inflammation, may indeed sometimes be benefited, or even cured, by the means recommended for the cure of iritis; but no real analogy exists between such cases and opacity of the lens and its capsule. In all examples of true cataract, it is only by an operation that sight can be restored.

Whether an operation should be performed when the cataract is single, and the other eye in the enjoyment of good vision, is a question on which some difference of opinion is entertained. Diversity in the refracting powers of the eyes after the removal of the lens from one of them, and the apprehension of confused vision, as the result, are the reasons usually urged against the practice, which has, however, to a certain extent, proved successful; while the continuance of a cataract in one eye not only gives a disposition to the origin of the same kind of opacity in the other, but permanently impairs the sensibility of the retina itself for want of exercise.

It is a general rule, and I believe an excellent one, never to operate upon both eyes at the same time. In particular, when extraction is to be done, this maxim universally prevails. It is also a maxim to let the patient have the benefit of preparatory treatment before he undergoes the operation. His diet should be lowered and his bowels emptied.

In cases of congenital cataract, ought the operation to be delayed till the patient has attained the age of docility and reason? Or ought it to

be practised in early infancy? Every consideration seems, I think, to be in favour of an early performance of it. If it be postponed, the eyes, having no distinct perception of external objects, acquire such an inveterate habit of rolling, that for a long time after the pupil has been cleared by an operation no voluntary effort can control this irregular motion. The retina, too, by a law common to all structures of an animal body, for want of being exercised, becomes more or less deprived of power. From the age of eighteen months to that of two years is deemed an advantageous period for operating on congenital cataracts.

Persons blind from congenital and other cataracts of long duration, and habituated to live with four senses, are generally confused and perplexed on the restoration of vision. They have a difficulty in combining the action of the eye with that of the other senses. Hence Dupuytren has often found it necessary to deprive them, for a time, of the use of one or two of the other senses, in order to enable them to use the organ of vision. He has applied this principle to infants, by closing their ears, as it was noticed that they suffered themselves to be guided by sound, and by impressions received by the hands, which they thrust out before their bodies like tentacula.

There are three kinds of operation for cataract. 1st. The method formerly termed *couching*, and which is simply the removal of the cataract out of the axis of the vision, leaving it still in the eye. It is now frequently called *displacement;* and has two varieties, *depression* and *reclination*. 2d. Surgeons practice *extraction of the cataract;* that is, they take the opaque lens completely out of the eye. 3d. Another method often adopted consists in the *division of the cataract into fragments*, which, being exposed to the aqueous humour, become absorbed.

By *depression* and *reclination*, we change the situation of the cataract. In *depression*, the lens is pushed directly below the level of the pupil. In *reclination*, the lens is made to turn over into the middle, and towards the bottom of the vitreous humour; so that the surface of the lens, which was previously directed forwards, is now placed upwards, and what was the upper edge is turned backwards. Over the lens, displaced in this manner, the vitreous humour will close much more completely than over the simply depressed lens, so that its ascent behind the pupil again will be less likely to happen. Nor will the retina be so liable to be pressed upon by the cataract as after depression; yet, reclination unavoidably does more extensive injury to the hyaloid membrane of the vitreous humour.

*Extraction* is the complete removal of the cataract out of the eye through an opening made in the cornea. The incision for this purpose must form the segment of a regular circle, be smooth, and, at the same time, of sufficient size to permit the easy passage of the cataract through it. Both in this first period of the operation, and in the subsequent one of opening the capsule, the iris should remain entirely free from injury.

One of the chief dangers of extraction is that of loss of the vitreous humour, which, if due care be not taken, is apt to be suddenly forced out of the eye along with the cataract.

Another risk is that of the iris being wounded. Sometimes the operation is followed by a prolapsus of this organ, and occasionally by a closure of the pupil from the inflammation excited in the iris by injury of its texture.

The *division*, or breaking of a cataract piecemeal, may be done with a needle, either through the sclerotica or the cornea. It has the recommendation of being the most easy, but sometimes needs repetition.

Opaque portions of the capsule, however, frequently resist absorption, and must, after all, either be extracted or displaced. The division of a cataract, when performed by passing the needle through the cornea and pupil, is termed *keratonyxis.*

No method of operating for the cure of cataract should be exclusively preferred; each having its advantages in particular cases.

*Depression and Reclination through the Sclerotica.* — Each of these operations has three stages: —

In the *first,* the needle is introduced through the coats of the eye into the vitreous humour.

In the *second,* the instrument enters the posterior chamber, and is applied to the cataract.

In the *third,* the displacement is effected.

It is only in the third stage that reclination differs from depression.

The patient is generally seated on a low stool, with his head supported on the breast of an assistant, who stands behind him; and, if the operation be about to be done on the left eye, he puts his right hand under the patient's chin, while with the index and middle fingers of the left hand, applied to the margin of the upper eyelid, he keeps it raised against the superciliary ridge of the frontal bone, without making any pressure upon the eyeball itself. In all operations on the eye, performed with the needle, the pupil should be first dilated with belladonna, because the more expanded this opening is, the better the surgeon can see what he is doing. The pupil should also generally be kept dilated for some time after the operation, in order to let the aqueous humour have free access to the lens, and to prevent the pupillary margin of the iris from contracting adhesions.

The operator sits in front of the patient, on a seat of such height that the patient's head is opposite to his breast. If it be the left eye which is to be operated upon, he takes the needle in his right hand, while, with the left fore-finger, he depresses the lower eyelid, and at the same time puts the end of the middle finger just below the caruncula lachrymalis, so as to prevent the eye from rolling inwards.

*First Stage.* — With the little finger resting on the patient's cheek, the surgeon introduces the needle one eighth of an inch behind the temporal edge of the cornea, so as to avoid the ciliary processes, and one line below the transverse diameter of the pupil, so as to avoid wounding the long ciliary artery. For the purpose of avoiding the lens and ciliary processes more surely, the needle should be directed towards the centre of the vitreous homour, but only to the depth of one fifth of an inch, as it would be wrong to injure the vitreous humour to an unnecessary extent.

*Second Stage.* — One flat surface of the needle is now to be turned forwards, the other backwards, and its handle inclined towards the temple, so as to bring its point between the ciliary processes and the circumference of the lens.

The instrument is next to be carefully introduced between these parts into the posterior chamber, across which its point is to be conveyed, till it arrives behind the nasal portion of the iris.

*Third Stage.* — When depression is the method chosen, the flat side of the end of the needle is now to be placed upon the upper part of the lens, the handle gradually elevated, and the point carried downwards, and a little outwards and backwards, the proper direction in which the lens should be depressed, but no further than is necessary to remove it from the axis of vision. The needle should be kept for a minute or two

on the lens, and, before it is withdrawn, we should observe whether the cataract rises again.

Some operators turn the point towards the pupil, and move it freely in it, in order to be sure that the capsule, if left behind, will be so lacerated that it will give no further trouble.

When *reclination* is preferred, the surgeon alters the plan of proceeding in the third stage; and then, instead of placing the end of the needle on the vertex of the cataract, he applies the instrument to its front surface, a little above its centre, and makes pressure on it downwards and a little outwards, by which manœuvre it is made to fall backwards, as it were, into the vitreous humour.

If displacement be attempted on a soft fluid cataract, no sooner is the capsule opened with the needle, than its contents mix with the aqueous humour. In a day or two, however, this fluid will become clear again; but, unless we break the anterior portion of the capsule, before we withdraw the needle, vision will still be interrupted by the capsular part of the cataract.

After the operation, the eyes are to be shaded by means of a slight compress, pinned to the nightcap. The room is to be kept moderately dark, and a low diet and quietude strictly enjoined. After three or four days, a green shade may be put on; but the eyes are not to be used at least for a fortnight.

*Extraction* of the cataract through an incision in the cornea is divided into three stages: —

In the *first*, the cornea is opened with a knife;

In the *second*, the anterior layer of the capsule is divided;

In the *third*, the cataract is taken out of the eye, or extracted.

The eye is to be fixed, as already explained; unless the surgeon choose to place the patient in the recumbent position, with the intention of dividing the upper segment of the cornea, while he fixes the upper eyelid himself; a plan which has its advantages, and the merit of first practising which belongs, I believe, to Mr. Alexander.

*First Stage.* — 1. The point of the knife is to enter the cornea very near the sclerotica, and a little above the horizontal diameter of the cornea.

2. It is first to be directed rather towards the iris, until it reaches the aqueous humour, so that there may be no risk of its gliding between the layers of the cornea, and not entering the anterior chamber at all.

3. As soon as the point is in the anterior chamber, the handle is to be inclined backward, and the point directed towards the place at which it is intended to make it pierce the cornea on the side towards the nose.

This place should be rather above than below the horizontal middle diameter of the pupil, and very near the edge of the cornea.

4. Having performed the *punctuation* and *counter-punctuation* of the cornea, as they are termed, the eye is completely under our control. At this particular period all pressure is to be removed, and therefore the finger, placed on the caruncula lachrymalis, shifted to the lower eyelid. Just before the section is finished, the upper eyelid is to be allowed to fall, the room rather darkened, and nothing more done till the patient has had a short time given him to become composed again.

*Second Stage.* — For opening and lacerating the anterior layer of the crystalline capsule, a lance-shaped, sharp, double-edged needle, is the best instrument. The assistant is cautiously to raise the upper eyelid, without touching the eye in the least. The operator draws down the

lower eyelid, and presses it very gently against the eyeball, so as to make the cataract advance a little, and the pupil expand, but not so forcibly as to burst the hyaloid membrane. The needle is then to be introduced under the flap of the cornea, and through the pupil to the anterior layer of the capsule, which is to be freely cut and torn in various directions; then the needle is to be withdrawn, and the eye again closed.

*Third Stage.*—If the pressure made on the lower part of the eyeball in the second stage were continued, the lens would come out of the eye on withdrawing the needle; and many surgeons allow this to happen. Others let the pressure cease for a minute or two, and close the eye again after having divided the capsule. They then take the curette in the hand which held the needle; and having opened the eye, and renewed the pressure, they see the whole lens pass into the anterior chamber, and then through the incision in the cornea. The curette is only used, if necessary, to facilitate its passage through the wound.

The patient is now to close his eye again, and the operator, having received the lens on his finger nail, examines whether it is entire.

After having once more opened the eyelid, and ascertained that the sides of the incision in the cornea are accurately in contact, and the pupil clear and circular, the eyes are to be shut, and a light fold of linen is to hang down from the cap, to which it is to be pinned.

The patient should afterwards be kept perfectly quiet, in a room somewhat darkened, with a nurse to watch him, so that he may not rub the eye with his hand during sleep. The incision may be looked at on the third day, and on the fourth the patient may be allowed to sit up. On the fifth a shade may be put on; but the eye should not be used for at least ten days, and then only on large objects. The bowels are not to be disturbed for a day or two after the operation, but the patient should be restricted to low diet for eight or ten days. If pain and inflammation follow the operation, we are to bleed the patient freely, and give calomel. Many surgeons always bleed the patient before and after the operation.

The kind of operation to be preferred must depend upon the species of cataract, and the sort of eye which is to be dealt with. I put out of present consideration the difference of skill in different operators. No doubt, extraction is the right method, when the cataract is hard, and the practice not contra-indicated by the cornea being remarkably flat, the iris too convex, the eyeball small, and sunk in the orbit, or the space between the eyelids very narrow. When there are adhesions between the cornea and iris, or between the iris and the crystalline capsule, extraction should not be attempted. A very small pupil, not admitting of being much dilated even with belladonna, would be another reason against extraction.

The operation of division is most applicable to caseous or fluid cataracts, and especially to such as occur in children. If the cataract were hard, but not proper for extraction, owing to the general form or state of the eye, depression should be practised.

The loss of the crystalline lens necessarily produces a considerable diminution in the refracting power of the eye, and in its faculty of adapting itself to the different distances of objects. These defects are palliated by the use of convex glasses of different foci. Their use, however, must not commence too soon after the operation, and never while vision continues to be improving without them.

### MALIGNANT DISEASES OF THE EYE

Are three; namely, *Cancer*, *Melanosis*, and *Fungus Hæmatodes* or *Medullary Cancer*.

Cancer frequently begins in the conjunctiva, whence it afterwards extends to the eyelids, caruncula lachrymalis, and the eye itself. The lachrymal gland, I believe, is not so often implicated as was once supposed; though it is prudent to remove it with the rest of the contents of the orbit, when the eye is extirpated on account of cancer.

As cancer commences on the external parts of the eye, and, therefore, in its early stage, may admit of effectual removal, it is a less formidable disease than *fungus hæmatodes*, which first attacks the optic nerve and retina, the pupil becoming dilated, of a dark amber or greenish hue, the iris motionless, and the sight seriously impaired or destroyed from the very first. In an early stage of the disease, a white shining substance, compared to burnished iron, may be seen through the pupil, at the back part of the eye. As the disease advances, this substance is found gradually to extend more and more forwards, and to be of a solid nature. It is, indeed, a medullary mass, occupying the whole of the interior of the eye behind the iris, and presenting an amber or brown appearance. Next, the form of the eyeball begins to deviate from what is natural; the sclerotica becomes of a dark blue or livid colour; and the medullary mass gets into the anterior chamber. Lastly, the cornea or the sclerotica ulcerates; so that, in the former event, the medullary substance protrudes; and, in the latter, it forms a tumour covered by the conjunctiva. It is generally rapid in its growth, often attains a considerable size, is of a dark red or purple colour, and is frequently attended with hæmorrhage and sloughing of its most prominent part. The absorbent glands about the parotid and under the jaw are also frequently involved. The disease, which begins in the optic nerve and retina, and corresponds in its ungovernable and fatal nature to fungus hæmatodes, or medullary cancer in other situations, is very much restricted to children.

With few exceptions, the operation of extirpating the eye for this disease has been of no avail.

With respect to *melanosis*, or the deposition into the eye of a peculiar black substance, attended with total disorganisation of it, if it be confined to the eyeball, and the optic nerve is not implicated, the eye may, perhaps, be removed with some little more prospect of success, than for medullary cancer. The prognosis, however, would be bad.

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## DISEASES OF THE EAR.

What is called *earache* frequently proceeds from inflammation of the meatus auditorius, or the tympanum itself. The pain is often remarkably severe; a circumstance observed to attend inflammation of all textures, whose nature and situation prevent them from readily yielding to the swelling, which is commonly the result of that affection. Inflammation within the ear may proceed to suppuration, the abscess make its way out through the meatus auditorius externus, the Eustachian tube, or the membrana tympani, or even behind the ear, with or without having pervaded the cells of the mastoid process, and occasioned caries of the bone. According to my experience, the worst suppurations of the ear occur in

scrofulous children, in whom they are frequently accompanied by partial destruction of the membrana tympani, and disease of the bony parts of the organ, followed in some instances by necrosis and separation of the ossicula. But inflammation and suppuration, within the ear, may not only cause these consequences, and more or less complete deafness, but extend their effects to the dura mater, and destroy the patient. When exfoliations occur, they most commonly consist of the meatus externus, or of the outer laminæ of the mastoid process.

Acute inflammation of the ear demands rigorous antiphlogistic treatment. In adults, copious venesection should be resorted to; and, in children, leeches. With these means, fomentations and purgatives are proper, which should be followed up by blisters.

If, after the reduction of the inflammation, the discharge of matter should continue, and the patient appear to be scrofulous, alterative medicines, as iodine internally and iodine lotions, or an injection of a weak solution of the nitrate of silver, may be employed. When diseased bone is present, of course the discharge will not cease till exfoliation is completed.

The *meatus auditorius is frequently blocked up*, and the external side of the membrana tympani covered *with hard dry masses of cerumen*, so as to render the patient entirely deaf. Such hardened pellets of wax, if neglected, may ultimately cause a great deal of irritation, followed by inflammation and ulceration of the membrana tympani and lining of the passage, and they always give rise to a sensation of false confused sounds in the ear, which are truly distressing.

The cure consists in washing out the meatus auditorius by means of a syringe, capable of holding at least four or six ounces of warm water. This should be thrown into the passage, so as to make it regurgitate with considerable rapidity. We generally have to do this several times, before the pellets are loose enough to be washed out.

The meatus auditorius is occasionally the seat of *polypi* and *other excrescences*. When situated near the orifice, they may be taken hold of with a hook, and cut away; but, in other cases, it is best to extract them with forceps, and apply the nitrate of silver, or tinctura ferri muriatis, to the part to which they were attached.

*Extraneous Substances in the Meatus Auditorius Externus.* — When insects get into the ear, if they can be seen, the best plan is to take them out at once with a pair of forceps. If not, we employ a piece of lint, dipped in honey or oil, and put on the end of a probe; these, on account of their adhesiveness, will entangle any small insect, and bring it out. Then the passage is to be washed out with a syringe. Syringing the ear I deem the best method of all, not only for insects, but for the removal of peas, small pebbles, &c. The regurgitation quickly brings them out, when all other means fail. One day, when I was visiting the Fleet Prison Infirmary, a child was brought to me with a pebble in each of its ears, that had been there a twelvemonth, and had now excited violent pain and inflammation, attended with total deafness. Various surgeons had failed in their attempts to get these foreign bodies out. I immediately tried what could be done with a large syringe, and had the satisfaction of soon bringing the pebbles so near the external orifice, that they admitted of being hooked out with a bent probe. In some instances, it has been judged necessary to divide the soft parts of the meatus; but a real necessity for this proceeding must rarely occur.

Almond or sweet oil, dropped into the ear, soon destroys any insect lodged in it.

*Deafness from more internal causes* than those which I have specified, forms too long and complicated a subject for consideration in a work like the present. It may arise from obstruction of the Eustachian tube by mucus, as happens in severe catarrh; by the pressure of a tumour, as is sometimes exemplified in cases of polypi, or swelled tonsils, or in the effects of syphilitic ulceration, or sloughing sore throats.

For the removal of deafness, caused by permanent obstruction of the Eustachian tube, Sir Astley Cooper suggested the practice of making a small puncture in the anterior and inferior part of the membrana tympani; a method that has been attended with a degree of success, but which should not be undertaken without mature consideration, and a proper discrimination of the cases, to which alone it is applicable.

*Diseases of the labyrinth*, or of the complicated apparatus composing the internal ear, are the cases which, generally speaking, completely baffle the art and science of surgery. We scarcely ever have any clue to their cause, or even to the precise parts affected, so that no surprise ought to be entertained at the little success with which such kinds of deafness are treated.

Amongst the varieties of disease to which the labyrinth is liable, I may mention, —

1. Disease of the fenestra ovalis and fenestra rotunda, as ulceration and thickening.
2. Malformation of these apertures.
3. Inflammation of the nervous membrane lining the labyrinth.
4. Malformation of the labyrinth, especially of the semicircular canals. In two cases, examined by Mr. Cocks, the extremities of the semicircular canals, opening into the vestibule, were perfect, but the central portions were impervious, or rather did not exist at all. See Med. Chir. Trans. vol. xix.
5. Alteration or deficiency of the liquor of Cotunni.
6. Affections of the nerve of hearing, analogous to amaurotic diseases of the eye.

When one eye is diseased, the other is disposed to fall into the same condition; but a similar fact does not prevail with respect to the ears. Numerous persons are more or less deaf on one side, but the other ear usually continues its functions very well, and even as long as if the other ear had no defect.

Every kind of deafness from malformation of the labyrinth is incurable.

Nervous deafness ought perhaps to be treated on principles analogous to those adopted for the cure of amaurosis. Inveterate cases of long standing must, of course, be hopeless.

## DISEASES ABOUT THE FACE.

### LUPUS, OR NOLI ME TANGERE,

Begins with a tubercular induration in the tissue of the true skin, or mucous membrane, or, perhaps, in the subcutaneous, or submucous cellular tissue. A single tubercle may be formed, or several appear together. While the tubercular induration is making slow progress to the surface, the skin assumes a livid colour, which extends itself in proportion as the tubercular affection spreads, and is almost always followed by ulceration. After a time, the cuticle cracks, and a coarse laminated scab is produced,

from beneath which ichorous matter exudes. The scab, which is very closely adherent to the tubercle, continues to enlarge, occasionally falling off, and exposing a very foul inveterate ulceration, which is found to be larger at each successive detachment of the crust, the limits of which it even sometimes exceeds. Dr. Houghton, who has drawn up an excellent description of lupus, chiefly founded on the observations of M. Biett*, notices three varieties: 1. Lupus, in which the ulcerative process destroys principally in depth. 2. That in which the destruction and cicatrisation do not produce any open ulceration, but are accompanied by hypertrophy of the skin. 3. Lupus, which spreads chiefly superficially. The first, or the *deep erosive lupus*, is more particularly that of the nose. In many cases, the ulceration is accompanied by a constant discharge of thin fetid matter from the nostril of the side affected. The disease sometimes, indeed, commences in the mucous membrane, though more commonly upon one of the alæ, or the tip of the nose. It may even cause a great deal of internal mischief, without the skin itself being implicated; but, as it extends itself from within outwards, at length it approaches the skin, which then assumes a livid colour. But, whether it be in the cutaneous or mucous tissue that the disease begins, its progress after a short time is the same. The subjacent cellular tissue and the muscles are destroyed by ulceration; the cartilages, in their turn, share the same fate; and frequently also the bones. The destruction is generally complete in one of the alæ, or the point of the nose, before it spreads further on its surface; but, sooner or later, the disease extends so as to embrace both sides; and wherever it advances, it is by the same kind of tubercular deposit with which it began. Sometimes, after having destroyed the tip of the nose, or one of the alæ, it forms a puckered cicatrix, and seems to be nearly healed up; but it rarely stops in this manner, and more generally, after a time, new tubercles are developed in the midst of the cicatrix itself, which ulcerate and destroy with all their original virulence. In general, while the mischief is spreading externally, the internal parts are not spared, the inner surface of the alæ, and especially the septum narium, being attacked. In such cases, the discharge is constant, and the crusts which collect on the septum and turbinated bones nearly block up the nostrils. In the end, if the disease be not checked, all the soft parts of the nose are destroyed, and the septum broken up, leaving only a square aperture in place of the nose, partially divided by a partition. Nor is this all the possible mischief; for it is not uncommon for the ossa nasi to suffer, and, in some instances, the superior maxillary bones.

All the varieties of lupus are rare after the age of forty. The disease is more common between the ages of six and sixteen than at earlier or later periods. The female sex is more subject to it than the male. The superficial lupus is frequently considered as a scrofulous disease.

In the treatment, general as well as local means are, for the most part, proper. If the patient be manifestly scrofulous, and the lupus superficial, the medicines and regimen in repute for this state of the system should be employed. In such cases, the use of iodine lotions, made in the manner directed by Lugol, were found by Dr. Houghton to produce striking amendment. The proto-ioduret of iodine, in the dose of one quarter of a grain twice a day, is one of the best preparations for internal use.

* Abrégé Pratique des Maladies de la Peau, d'après les Auteurs les plus estimés, et surtout d'après les Documens pris dans la Clinique, de M. le Dr. Biett, par MM. Cazenave et Schedel.

Iodine, however, is only useful in the superficial variety of lupus. The chloride of barytes, which was believed by Bateman to have influence in dispersing the tubercular formation, is not at present so frequently prescribed as the chloride of lime, which agrees better with the stomach.

The tinctura ferri sesqui-chloridi, and the sesqui-oxide of iron were formerly praised as useful medicines in cases of lupus; but I am not aware of their possessing any specific power over this disease.

Arsenic has considerable influence in checking the progress of the tubercles, and altering the character of the ulcerated surface. Small doses of the liq. arsenicalis may be prescribed, beginning with not more than two or three drops thrice a day; but gradually increasing the dose to ten, if no deleterious effects are produced.

Another medicine in repute is the bichloride of mercury, prescribed in minute doses, so as gently to affect the gums.

*External applications* constitute the most important means of cure. Sometimes the progress of the lupoid tubercle may be arrested, and ulceration prevented by the application of leeches to the inflamed skin round its base, followed by evaporating lotions, and alterative doses of calomel. Thus the disease may often be reduced to a chronic state, in which friction with ointment of the ioduret of zinc, or mercury, may be employed to promote its absorption. Biett uses the ioduret of sulphur, made into an ointment, in the proportion of fifteen grains to an ounce of simple ointment. In the hypertrophic lupus, these resolvent ointments are particularly indicated. When the tubercles are once ulcerated, the ung. hydrarg. nitratis, or the liquor arsenicalis, is often used; but generally escharotics now become necessary, and arsenic is the substance frequently preferred. Sir Astley Cooper uses an ointment composed of ʒ j. of spermaceti cerate, ʒ j. of sulphur, and ʒ j. of white arsenic. When the action of arsenic is impeded by the thickness of the cuticle over indolent tubercles, a small blister is sometimes first put on the part, or the following ointment applied: ℞ ung. cetacei ʒss., oxydi arsenici ʒ j., empl. cantharidis ʒiij.; M. ft. ung. Sometimes an arsenical paste is applied. That of Frère Côme is made by moistening arsenic, cinnabar, and burnt leather. Being a very powerful application, this paste demands particular caution not to let it act on more than a small area, lest the patient be poisoned by it. Indeed, no arsenical dressing should be allowed to come in contact with a surface of greater extent than a shilling. The above paste is apt to bring on erysipelas of the face. A milder, safer, and better arsenical paste, is that recommended by Dupuytren, composed of calomel and oxyde of arsenic, moistened with mucilage in the proportion of from six to twelve parts of arsenic in every 100. The same eminent surgeon also used an arsenical powder, made of ninety-six parts of calomel and four of arsenic. These applications, however, he applied but to a small surface at a time. The nitrate of silver, sulphate of copper, and muriate of antimony, are likewise escharotics in great repute; and so is the concentrated nitric acid for cases where the ulceration invades the deep layers of the skin and the cellular tissue. At the Hôpital St. Louis, a solution of ʒ j. of the protonitrate of mercury in an ounce of nitric acid is employed with great success, by Richerand and Cloquet.

I have known lupus cured by excision of the diseased part of the skin.

When the nose has been destroyed, a new one has often been successfully formed from the skin of the forehead.*

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* See Dr. Houghton's article on "Noli me Tangere," in the Cyclopædia of Practical Medicine.

### LIPOMA OF THE NOSE.

The integuments of the apex and alæ of the nose are sometimes enormously thickened by interstitial deposit, so that a true hypertrophy of them is occasioned, forming, as Mr. Liston correctly states, a lobulated reddish-blue mass, intersected by fissures.* The sebaceous follicles are so expanded, that they will admit the point of a quill. The ramifications of many turgid superficial veins are seen on the part. The disease, besides being productive of vast deformity, may attain such magnitude that vision, the passage of air through the nostrils, and the introduction of food into the mouth, are more or less obstructed.

The only mode of relief is that of removing the hypertrophied skin. If both sides of the nose are affected, the nostrils may be distended with lint, and then a perpendicular incision made through the morbid skin, in the mesial line of the nose. The edge of the divided integument may then be taken hold of with a pair of forceps, and the diseased structure carefully cut away. The bleeding is generally copious: some of the vessels will require ligature; the others will cease to bleed on pressure being applied.

### POLYPI OF THE NOSE

Are swellings arising from the mucous membrane of the nose, and generally consisting of a soft substance easily torn, streaked with a few vessels, and of a light yellowish or grey colour, and not endued with much sensibility. The disease is most common in persons between forty and fifty, though occasionally met with in younger subjects. The polypi, which have the character now enumerated, are not of a malignant nature; and whatever inconvenience may be produced by them is caused by their obstructing the nostril, and by their pressure on the adjacent parts. They are commonly of a pyriform shape, though, if they are large, their figure is in a great measure determined by that of the cavity in which they grow; but whatever may be their shape, they are invariably connected to the mucous membrane by a narrow stalk or pedicle, sometimes termed their *root*. They rarely or never grow from the septum nasi, but usually from a point at or near the upper os spongiosum.

The polypi, whose texture corresponds to what I have mentioned, are those mostly met with, and often named *soft* or *gelatinous polypi;* or occasionally *mucous polypi*, from their structure bearing a considerable resemblance to the mucous membrane from which they originate; or *benign polypi*, in consequence of their having no disposition to assume a dangerous morbid action. Sometimes they are of a firmer consistence and fibrous texture, when they are termed *fleshy polypi;* but these are more frequently noticed in the uterus than in the cavity of the nose, and grow not from the lining of the uterus, but under it, in, or connected with, the substance of the womb itself. Another kind of disease is improperly called the *malignant polypus*, because it is not truly a polypous excrescence at all, but a tumour, partaking in every respect of the nature of medullary cancer.

In many cases, several polypi of different sizes occur in one or both nostrils. Sometimes we meet with only one; and, in particular examples, the nostrils are filled with a peculiar kind of polypi, consisting of cysts or vesicles, filled with a colourless fluid: these are *vesicular* or *hydatid polypi*,

* Elements of Surgery, part ii. p. 179.

as they are termed, and are not uncommon in children and very young persons.

Truly cancerous polypi are said, occasionally, to take place in elderly persons; but the malignant polypi, which I have seen, were evidently specimens of medullary sarcoma.

The common pendulous *soft benign kind of polypus* generally grows from the external side of the cavity of the nose, and, in many examples, from the mucous membrane covering the ossa spongiosa. The growth of a polypus from the septum narium, if it ever occur at all, is so uncommon, that some surgeons of the most extensive practice have never seen an instance of it. The commencement of the disease is attended with a feeling of obstruction in the nose, like what is usually felt in an ordinary catarrh, the obstruction being more considerable in wet, than dry weather. These polypi, when under a certain size, may be made to advance or recede by the force of the breath in inspiration and expiration. The sound of the voice is nasal, and there is generally some uneasiness felt about the frontal sinuses.

Sometimes, when a polypus becomes large, it passes towards the velum pendulum palati, over which a part of it hangs towards the pharynx; or if it originate towards the back of the nares, it may take the same direction, instead of towards the nostril. In certain examples, polypi project in both directions.

Common polypi cannot be cured by local applications; caustic only acts upon their surface, and cannot get to their root. They grow indeed faster than any caustic can destroy them.

*Extraction*, *excision*, and the *ligature* are the three means of curing nasal polypi. Extraction is the method usually preferred in this country, and is accomplished with forceps made for the purpose, and of different shapes and sizes. Some are slightly curved, and formed with oval excavations on the inside of the ends of the blades, and also with an aperture in each of them. Others are straight, and the inner surfaces of the blades furnished with projections, or teeth. Some are constructed with serrated blades, which, when shut, meet in the manner of a suture of the cranium.

The patient being seated opposite a strong light, the surgeon first examines the extent and situation of the polypus with a probe, endeavouring in particular to make out the point of its attachment and the place of the pedicle. This cannot always be done; but we know that the os spongiosum superius, and the outer and upper side of the nostril, are the common situations for the attachment of the polypus. We therefore convey the forceps in that direction, and endeavour to seize the pedicle. If we succeed thus far, the best plan is not to pull it directly outwards by a jerk, but to twist the tumour from its connection. The hæmorrhage from soft benign polypi is never dangerous, though it may be copious. Sometimes, a layer of bone comes away with the polypus, a circumstance often regarded as favourable, inasmuch as the root of the tumour will then have been taken away. After the operation, the nostril and nares should be washed occasionally with an astringent lotion, containing alum, or the muriate of ammonia.

When a polypus projects backward, towards the throat, it is sometimes taken hold of with a pair of curved forceps, introduced from the mouth, and extracted. But frequently another part extends forwards, which we may begin with. In this manner, the pedicle is sometimes broken, and both portions may then be readily extracted. Much of the operation is

necessarily performed, as it were, in the dark; for, after the bleeding begins, nothing can be seen. Supposing only a fragment of the polypus to be at first taken out, we should not stop, but try to extract the rest, either piecemeal or in one mass, just as may be practicable.

*Excision* is a plan occasionally applied to large polypi extending back towards the throat, and having a pedicle, the situation of which can be felt and reached with a pair of long probe-pointed scissors. The bleeding need not be feared; but, so far as my experience goes, we seldom know the precise situation of the pedicle, or can reach it sufficiently well with scissors to make this method advisable.

The *ligature* has also been applied to similar polypi extending towards the throat. The noose of a ligature, or piece of wire, is introduced through the nostril to the back of the throat, where it is put over the tumour with the aid of a pair of forceps. The ends of the ligature, or wire, hanging out of the nostril, are then passed through a double cannula and twisted. It is a practice rarely adopted in this country. The best instruments for this operation are those of Graefe, which may be procured of Weiss.

*Vesicular* or *hydatid* polypi generally grow again. We may clear the nostril from them, but they return. One plan, to which they will sometimes yield, is that of applying strong astringent lotions to them. They should first be removed, and the lotion then applied by means of lint.

With respect to the malignant kinds of polypi, they are out of the power of surgery; all that can be done is to lessen the patient's sufferings by narcotic medicines, opium, hyoscyamus, or hemlock, and to diminish the fœtor of the discharge by means of lotions, containing the chloride of soda, or lime, or a proportion of creosote.

## SALIVARY FISTULA.

An opening in the cheek, from which the saliva escapes, arising from a wound, ulceration, or phagedenic disease, involving the parotid gland or duct, is called a *salivary fistula*. The duct has also been burst by violent blows. We sometimes meet with cases, in which the parotid duct becomes obstructed by a calculous formation within it, just in the same way as the salivary ducts under the tongue become occasionally blocked up with calculous matter. Calculi in the parotid duct, if not removed, may, of course, enlarge, and excite inflammation and an abscess in the cheek. This bursts, and the flow of saliva from the opening immediately draws the surgeon's attention to the state of the parotid duct; a probe is introduced, and the calculus felt. Here the first indication is to extract the extraneous substance, and then endeavour to heal the ulcerated opening in the cheek.

If the parotid duct is recently wounded, the sides of the wound should be brought together, and pressure applied. Thus a salivary fistula may often be prevented altogether: either the divided ends of the duct re-uniting, and the saliva resuming its original course, or, what is more probable, the wound in the face healing at every part, with the exception of a small fistulous track, which serves as a continuation of the duct into the cavity of the mouth. This is supposing the wound to have extended quite through the cheek.

When a salivary fistula is already formed, it may be cured by passing a seton from the fistulous opening into the mouth, keeping it there a certain time, and, after withdrawing it, applying the nitrate of silver to heal the outer opening. The caustic alone will frequently succeed. Another in-

genious plan is that of Béclard, who passed a leaden style into the orifice of the portion of parotid duct connected with the gland, and then united the outer wound with the twisted suture. This is a quicker mode of cure than the seton, and more sure than simply closing a recent wound and applying pressure.

### DISEASES OF THE ANTRUM.

The antrum, or rather its mucous lining, is subject to *inflammation* and *suppuration*. A darting pain is felt in the side of the face, usually supposed to be the toothach, and, indeed, mostly connected with a carious state of the neighbouring teeth. If an abscess form, and the matter be prevented from passing into the nose by accidental obstruction, it may produce an expansion and attenuation of the sides of the antrum; and at length discharge itself either through the cheek, or, what is more common, into the mouth.

The indications are, to lessen inflammation and pain by antiphlogistic soothing means; to provide a speedy outlet for the matter, when an abscess forms; to check the discharge, and maintain cleanliness by the use of tepid slightly astringent injections; and, if there should be any dead bone or carious teeth present, to remove them as soon as circumstances will allow; the teeth as soon as the inflammation has somewhat abated, and the dead bone when exfoliation is sufficiently advanced.

When there is a carious tooth below the antrum, its extraction, and the perforation of the socket, are sometimes considered the best mode of making an outlet for the matter. In other cases, the third or fourth grinder may be drawn and the socket perforated. Another method is that of detaching the cheek from the front surface of the antrum, and applying a small trephine, or other perforating instrument, to the bone. The cheek is to be raised up so as to expose the membrane covering the gum on the side of the face, and a transverse incision made down to the bone. The instrument, preferred by Sir Benjamin Brodie for the perforation of the bone, is a pair of sharp-pointed strong scissors. This plan is applicable to cases in which the socket is filled up with bone.

In one case of inflammation of the antrum, recorded by Sir Benjamin Brodie, where the severity of the symptoms made him suspect the presence of matter in that cavity, he made a perforation, but no pus was met with. Two grains of calomel and half a grain of opium were then given three times a day, and, on the gums becoming sore, a cure speedily ensued.

### COLLECTION OF MUCUS IN THE ANTRUM

Is more rare than one of puriform fluid. The cause of such an accumulation is probably an accidental obstruction of the natural communication of the antrum with the nostril, between the two turbinated bones. The manifest indication is, to make an outlet for the confined fluid, which is producing the swelling and pain of this part of the face. In one interesting case, related by Sir B. Brodie, he made an opening with a knife in the swelling above the gum, which opening continued ten years afterwards, the patient wearing a plug in it.

### MEDULLARY DISEASE OF THE ANTRUM

Produces a gradual expansion of it, and then such pressure on other parts as leads to an immense degree of suffering, and often fatal consequences. Thus, the pressure may render the eye amaurotic, or even displace it from the socket; it may force out all the neighbouring teeth; make its

way through the palate and alveolary process into the mouth; fill up the nostril; protrude through the integuments of the face in a frightful form; or through the cribriform plate of the ethmoid bone, or the orbital process of the frontal bone into the cranium itself, when the patient soon dies in a comatose state. I have seen one case, however, in which the patient did not die, or even become senseless, till the mass of the tumour in the cranium had attained the size of an orange.

When the character of the disease is known beforehand, and especially when the soft parts are implicated, an operation is not likely to be of any service, the disease almost always returning. However, if the new growth were entirely restricted to the antrum, and the patient, after a candid explanation of the nature of the disease, and the bad chance of benefit from an operation, were anxious to take that chance, the surgeon would be justified in performing the excision of the upper jaw. This is to be preferred to the plan of opening the antrum, and attacking the disease in that situation, as Desault appears sometimes to have done. I do not, at the present time, recollect how far the cases published by Desault amount to a satisfactory proof of the permanency of the cures; but, in one example recorded by Dr. Anderson of Glasgow, no recurrence of disease in the antrum had taken place five years and a half after the operation, as was ascertained by a *post mortem* examination. The actual cautery had been employed after the knife had done its duty; a measure very essential for the prevention of a relapse. However, I should be sorry to advocate the removal of medullary tumours from the antrum. No doubt, the disease in this situation presents little chance of benefit from such or any other proceeding; but fibrous tumours hold forth more prospect of permanent success.

## HARE-LIP

Is for the most part a congenital malformation; but it is now and then produced by accidental wounds. It is mostly met with in the upper lip, and very seldom in the lower. Sometimes there is only one fissure; on other occasions two, the hare-lip being then termed a double one. In some cases, the fissure only extends partly towards the nostril; in others, it reaches into that aperture, which is then much expanded. The fissure is of course to one side of the mesial line; and its edges, which are covered by a continuation of the prolabium, are rounded off below. Besides the fissure in the lip, there is frequently so large a cleft in the upper jaw and palate bones, as to convert the mouth and nose, as it were, into one cavity. A double hare-lip is particularly often accompanied by a fissure in the bones of the palate. Sometimes, but not usually, there is a fissure in the soft palate. In certain examples the jaw-bone, or teeth, project forward into the cleft of the lip.

A hare-lip, besides being a great deformity, is attended with a defect in the speech; and when the fissure extends through the palate, there is more or less impediment to sucking and swallowing.

In ordinary cases, the cure is easy; the surgeon pares off the margin of the fissure, brings the fresh cut surfaces into contact, and keeps them in this position until they have grown together.

As infants are very subject to convulsions after operations, many surgeons think it best to defer the cure of a hare-lip till the child is about two years of age, or even rather older. The youngest subject on which I ever operated, was only five months old, but the case was perfectly successful.

In the operation, the wound should be as clean and regular a cut as possible, in order that it may the more certainly unite by adhesion, and of such a shape that the cicatrix may form one narrow line. The margins of the fissure, therefore, ought not to be cut off with common scissors, which always produce some degree of contusion; though what are called knife-scissors, which are employed by some operators, are said to answer well.

Sometimes a bit of pasteboard is placed under the lip; and while this is supported and fixed upon it, the edge of the fissure is cut off with a sharp bistoury. Or the lip may be held with a pair of hare-lip forceps, in such a manner that as much of the edge of the fissure, as is to be removed, is situated at the side of the upper blade of the forceps, so that it can be cut off with one sweep of the knife, which will be guided along the instrument, as along a ruler. This is to be done on each side of the cleft, the two incisions meeting at an angle above, thus A, in order that the whole of the wound may admit of being brought together, and united by the first intention. Particular care should be taken to remove completely the rounded corners at the lower part of the fissure; for if this be not done, an unseemly notch is left in the prolabium. Mr. Liston's mode of operating I commonly prefer to any other, as being the neatest, quickest, and most easily accomplished: it consists in passing a straight bistoury from without inwards, so as to penetrate the membrane of the mouth, above the angle of the fissure. The part is stretched by the fingers of an assistant, whilst the instrument is carried downwards, so as to detach the edge and rounded corner of the fissure. A similar proceeding is then adopted on the other side. Hemorrhage is prevented by the assistant making gentle pressure whilst the surgeon stitches the lip.

As the lips are exceedingly moveable, and it is essential to heal the wound by adhesion, the twisted suture is generally employed for keeping its surfaces in contact. Two steel pins, or silver pins made with steel points, are introduced through its edges, and a piece of thread is then repeatedly twisted round the edge of the pins, from one side of the division to the other, first transversely, then obliquely, from the right or left end of one pin above, to the end of the lower on the opposite side, &c. Thus the thread, being made to cross as many points of the wound as possible, maintains the edges in contact. If silver pins are used, the points, which are made to slide on or off the instruments, are now removed; or if steel pins are employed, the points are taken off with a small pair of cutting forceps. A great deal of exactness is requisite in the introduction of the pins, in order that the edges of the incision may afterwards meet correctly: and, as it is of great consequence to make the red parts of the lip correspond precisely, this object is secured by introducing the lower pin first. The pins ought never to extend more deeply than about two-thirds through the substance of the lip; and they should be removed in three or four days, the support of sticking plaster being then sufficient.

When the case is a *double hare-lip*, and the intervening portion of skin is sufficiently broad and long, it should be preserved in the operation; but if narrow and short, it should be cut away. In the latter event, the rest of the operation is the same as for the single hare-lip. But, when the middle piece of skin is to be saved, a union between it and the lip on one side is first to be accomplished by an operation like that for the single hare-lip, and then, in a few weeks, a second operation of the same description is to be performed on the opposite side.

Hare-lips are frequently complicated with a fissure in the roof of the mouth. When it is confined to the upper maxillary bones, it generally closes, by slow degrees, after the operation; but when it reaches along the palate bones and velum pendulum palati, its entire closure rarely or never takes place. Sometimes one upper maxillary bone exceeds the level of the other. When the hare-lip is double, a distinct part of the jaw may push forward the middle portion of skin. In certain cases, one of the maxillary bones inclines backwards, and its alveolary process juts out. In other examples, an impediment to the union of the hare-lip arises from the projection of a tooth, which must then be extracted.

When the jaw itself projects, the common preliminary step to the operation for the hare-lip consists in cutting away the bony prominence. But, according to Desault, this measure is seldom proper; for when the original congenital deformity is removed, a disfigurement of the face yet follows, from the upper lip having no proper support. The diameter of the upper jaw is also liable to diminish so considerably, in proportion as the two maxillary bones coalesce, that the upper and lower jaws no longer correspond, and the same kind of inconvenient mastication is produced, which is often noticed in old people. Hence, Desault preferred reducing the projection of the jaw, by means of the pressure of a tight bandage; for, as there is a fissure in the roof of the mouth, the bony prominence has little support, and readily yields. In one instance, I made the necessary pressure with a small spring truss, which in a few weeks reduced the bony projection sufficiently to let the operation be undertaken. In another instance lately brought to me from the country, I advised the same plan to be tried.

### CANCER OF THE LIPS.

The lips are frequently the seat of troublesome and obstinate ulcerations, sometimes connected with disorder of the general health, but more commonly prevented from healing by the constant motion and friction to which they are subjected.

Some ulcers of the lip having a foul, and even a malignant appearance, will yield to liquor arsenicalis, iodine, the iodide of potassium, the extract of hemlock, the compound decoct. sarsap., or the compound calomel pill, with occasional purgatives. The most eligible dressings are generally the ointment of the nitrate of mercury, or that of the nitrate of silver, 10 grs. to an ounce. In one case in University College Hospital, I tried both the carbonate of iron and Dupuytren's arsenical powder, and found the latter answer better than the former.

When cancer takes place, it is almost always in the lower lip; and it is not an uncommon opinion, that the pressure and irritation of tobacco pipes give a disposition to the disease, which usually commences as a small tumour in the cellular tissue between the mucous membrane and the skin. The swelling and induration make the disease obvious before the villous surface of the lip cracks transversely, and a thin fluid oozes out. The part then ulcerates and scabs by turns, and the disease ultimately penetrates more deeply, and throws out a fungus. The patient is generally a male subject, above the middle age, and, as I have said, accustomed to smoking. The skin, mucous membrane, and labial glands now form a close compact mass, and the submaxillary lymphatic glands become affected.

Whenever any malignant disease of the lip resists alterative plans, it should be extirpated with the knife, before its effects extend to the

lymphatic glands. The disease may be removed by an operation resembling that for the cure of hare-lip, or by a semi-lunar incision through the lower lip, as practised by Dupuytren, by which a freer removal of the part may be made than can be effected in the other way. The commissures of the lips, however, should always be spared. A moderate breadth of the lip may thus be taken away with much less deformity than might be apprehended.

### DISEASES OF PARTS IN THE MOUTH.

*Wounds of the tongue* are generally transverse, and caused by the violent and spasmodic closure of the teeth, while the tongue is out of the mouth, as sometimes happens in epilepsy, and falls on the chin. Wounds of the tongue, thus produced, may give rise to profuse hemorrhage; such as would prove fatal if not soon suppressed. As for taking up one of the lingual arteries for this purpose, it would not generally answer, because the wound almost always affects the branches of both. Sometimes, in order to stop the hemorrhage, the surgeon has been compelled to apply the actual cautery, or even to pass a double ligature through the centre of the tongue, behind the wound, and then tie each side of that organ. With the aid of a tenaculum forceps, however, the tongue may be kept steady, and drawn sufficiently forwards to facilitate the application of a ligature to any bleeding vessel. This plan is always the most eligible, when practicable.

### INFLAMMATION AND PRODIGIOUS SWELLING OF THE TONGUE.

The tongue, when in the state of inflammation, may swell so enormously as entirely to fill the cavity of the mouth, protrude between the teeth, and obstruct deglutition and respiration in a most dangerous degree. I remember a soldier's wife at Brussels, whose life was in urgent danger from such an affection of the tongue, brought on by the use of mercury.

Common antiphlogistic treatment will not afford sufficiently prompt relief. The right practice consists in making two or three longitudinal incisions in the dorsum of the tongue. The copious bleeding, which ensues, soon reduces the swelling. In bad cases, all medicines and food ought to be given through an elastic gum tube, introduced down the pharynx from the nostril.

### ULCERS AND INDURATIONS OF THE TONGUE.

Putting out of consideration the effect of mercury, the irritation of carious teeth, with points and inequalities, is one of the most frequent causes of ulceration of the tongue. Here, it is clear enough, that the right treatment consists in extracting such teeth, or filing away their sharp projections.

Hard tubercles sometimes grow on the dorsum of the tongue, having a narrow pedicle, and a broad mushroom-like head. These may be snipped off with a pair of scissors, or tied, and the parts afterwards touched with the nitrate of silver.

I have seen the whole surface of the tongue covered with hard tubercles, some of them in a state of ulceration. On this form of disease, I find that mercury has considerable effect. Some inveterate ulcerations of the tongue may be cured by the same alterative plans, as I have advised for similar sores on the lips. Venereal ones I have noticed with the subject of syphilis.

### CANCER OF THE TONGUE

Commonly begins as an irregular, rugged, unyielding knob, generally situated in the anterior third of this organ, midway between its raphe and its edge, the mucous surface being puckered and rigid, and the patient experiencing severe pains in the part, which shoot towards the ear. Sometimes the knob acquires considerable size before ulceration commences. Persons, about the age of forty, are most subject to cancerous disease of the tongue. The glands of the neck after a time become swollen and indurated, and profuse bleedings are disposed to take place from time to time, whereby the patient becomes extremely weakened and reduced.

There are two methods of extirpating cancerous portions of the tongue: one by the knife; the other by a double ligature passed through the centre of the part by means of a sharp-pointed curved needle fixed in a handle, one portion of the ligature being firmly tied over one side of the organ, and the other portion over the other side. In this operation, some surgeons first take hold of the tongue with a pair of hook forceps, so as to fix it. The objection to the knife is the hemorrhage, which, if profuse, and not capable of being stopped by the methods noticed in the remarks on wounds of the tongue, would require some extraordinary means for its suppression, such as the application of the actual cautery, or even securing the lingual artery as it passes over the cornu of the os hyoides. When the extirpation of a cancerous induration can be accomplished by removing a piece of this organ in the shape of the letter V, the best mode of stopping the bleeding is to bring the sides of the wound closely together with a suture. The tongue may also be removed by an incision, made under the jaw, between its symphysis and the hyoid bone. If the portion to be removed be drawn out through the wound, and the rest held with a tenaculum, the requisite incision may be performed, and the arteries tied. In this way, also, the extirpation with a ligature may be performed further back, than in the common mode.*

Relapses are frequent after operations on cancerous tongues; a fact that should make us cautious in the judgment we give, respecting the chances of a cure.

### OF DIVIDING THE FRÆNUM OF THE TONGUE.

Children are not so frequently tongue-tied as nurses and mothers imagine; and we may be sure, that when once an infant has been able to suck properly, whatever may be its present inability to do so, it does not proceed from the confinement of the tongue by the frænum, but probably from the large size of the nipple, excoriation of the lips, or other causes, which should be investigated.

When the frænum really ties the tongue too closely to the bottom of the mouth, the surgeon will find, that he cannot raise the tongue to the palate with his fingers. Sometimes, however, the frænum is really so short that it interferes with the requisite movements of that organ in sucking, deglutition, and the articulation of words. The surgeon is then called upon to divide it, which may be done with a pair of blunt-pointed scissors, care being taken to direct the incision downwards, so as not to injure the raninal vessels.

An immoderate cut gives rise to two dangers: one is, that of hemorrhage; the other, that of the tongue being left so unfixed, that it may

* Arnott, Med. Chir. Trans. vol. xxii. p. 20.

be thrown back into the pharynx in the act of deglutition, and cause suffocation. A similar danger has been exemplified after the operation of removing the lower jaw.

With respect to hemorrhage, children are constantly disposed to suck and swallow whatever comes into their mouths, and hence they sometimes die with their stomachs full of blood, even when only the branches of the raninal artery are wounded, and not the trunk itself. Nay, it is alleged, that the veins have sometimes yielded a dangerous quantity of blood, which has been swallowed.

### RANULA

Is a tumour situated under the tongue, and commonly believed to arise from a dilatation of the duct of the submaxillary salivary gland. The swelling is usually situated on one side of the frænum, and, when large, extends forwards, under the apex of the tongue. Its contents are generally a glairy fluid, resembling white of egg; but if the tumour has been of long standing, their consistence may be much thicker, and even blended with calcareous matter. Neglected ranulæ may attain a considerable size, and not only obstruct the movement of the tongue, but even produce serious annoyance and mischief to the teeth and lower jawbone by their pressure. In general, however, when they have become as large as a walnut, they burst; the opening heals up; and then they fill and burst again.

Some ranulæ arise from obstruction of the duct, the orifice of which, therefore, should be examined; and if a piece of calculus can be felt with a probe, it should be removed: this alone would lead to a cure. In ordinary cases, the disease may be cured by opening the swelling and snipping off a portion of the sac, so as to prevent the part from closing again. Merely opening the cyst, without the excision of a portion of it, will not always suffice. It is also a good plan to apply a bit of lint, dipped in a weak solution of lunar caustic, to its inner surface. I lately attended a young lady for a ranula, that would not yield to any ordinary modes of treatment. I opened it, and removed a considerable piece of the cyst, filling the cavity with lint; but this plan failed. I then cut away a second piece of the cyst, and dressed the cavity with lint dipped in a solution of nitrate of silver: this also was followed by a relapse. I then passed a seton through the ranula, and kept it applied for two or three weeks in vain. Lastly, I made a small opening, and put into it a little silver tube, which was worn about five or six weeks, and the disease never returned. The latter treatment of ranula by puncturing it, and placing in the opening a small tube not quite half an inch long, and made with a rim, by which it is retained in the part, was frequently adopted by Dupuytren.

### DISEASES OF THE TONSILS.

When the tonsils are so considerably swollen from an attack of acute inflammation that deglutition and respiration are seriously obstructed, they should be freely scarified; after which, the bleeding from them, assisted by venesection, leeches, and other antiphlogistic means, will in general quickly bring down the enlargement.

If the same inconvenience should arise from the formation of matter, the abscess should be opened with the long narrow sharp-pointed bistoury, the blade of which may be partly covered with lint to keep the edge from wounding the tongue.

The tonsils are also liable to chronic enlargement, more especially in scrofulous subjects. It is a mere hypertrophy, without any tendency to

cancerous or malignant action. The tonsils may, indeed, swell to such a magnitude as to close the aperture between the mouth and pharynx, and create a total impediment to swallowing, and much difficulty of breathing.

If these enlargements resist the internal use of iodine, or small doses of the bichloride of mercury, with tinct. rhei, or tinct. cinchon, and the application of lunar caustic, or nitric acid, the tonsils, or rather the redundant portion of them, should be extirpated by means of a ligature or cutting instrument. Cheselden's plan of passing a ligature through a diseased tonsil, by means of a crooked needle fixed in a handle, and with an eye near its point, is not a bad method. Graefe has also invented a most ingenious instrument for the purpose. Excision of part of the tonsil, however, is a better practice, and may be safely performed with a hook and straight probe-pointed bistoury, for the hemorrhage will never be serious, if the knife be directed downwards and inwards away from the carotid artery.

### ELONGATION OF THE UVULA.

The uvula is sometimes thickened and considerably elongated, producing great uneasiness about the throat, and irritation of the epiglottis. If the disease cannot be remedied by astringent gargles, or touching the uvula with the tincture of the sesquichloride of iron, the best plan is to snip off the superfluous length of the part with a pair of long blunt-pointed scissors. I once attended a gentleman with a phagedenic venereal sore throat, whose uvula was so deeply attacked at its root with the same kind of ulceration, that it remained attached only by a few fibres, so as to hang down, and irritate the epiglottis in a most distressing manner. Under these circumstances, as it could not be saved, I immediately cut it off, to the great relief of the patient.

### DISEASES OF THE GUMS.

The gums in the natural and healthy state are not very sensible: they may be divided with a lancet without much pain; and the pressure of hard substances against them in mastication is not productive of any injury. When, however, they become inflamed, in consequence of decayed teeth, a cold, or any other cause, they cannot be touched or pressed upon, in the slightest degree, without the patient being put to a great deal of suffering. Some diseases of the gums originate from those of the teeth; while others have no connection with this cause.

### THE GUM-BOIL, OR PARULIS,

Is merely an abscess of the gums, generally arising from the irritation of a diseased tooth, though sometimes from disease of the alveolary process, or from splinters of this part left after the extraction of a decayed tooth. These abscesses are to be treated on common principles, and opened with a lancet as soon as matter is formed: afterwards, when the part has become quiet, the decayed tooth, if there be one, should be taken out.

If the gum-boil become fistulous, it must be freely laid open, and a solution of lunar caustic applied.

### EPULIS, OR EXCRESCENCE FROM THE GUMS.

The fibro-vascular texture of the gums is much disposed to produce fungous and other excrescences. Any kind of irritation, as that of bad teeth, or a severe blow, will sometimes lead to the growth of considerable tumours from the gums; and occasionally they arise without any manifest exciting cause.

The texture of an epulis is generally soft, spongy, and vascular; but sometimes hard, fibrous, incompressible; and not endued with much vascularity.

A soft vascular epulis mostly originates from the gum itself; while that which has a fibrous or fibro-cartilaginous structure frequently grows from the alveolary process. When the excrescence first makes its appearance between sound teeth, which it afterwards loosens and forces out, it may be concluded, that the disease originates from the periosteum and interior of the socket.

As tumours of the epulis kind have no disposition to recede, and, when they originate from the periosteum or bone, are disposed to assume a malignant character, I cannot too strongly insist upon the necessity of an early operation for their complete removal. The knife is the best means for the purpose. Any teeth in the way should be first extracted; the whole substance of the swelling removed; the bone and periosteum scraped; and even a portion of the jaw (if diseased) removed with Hey's saw, or a pair of cutting forceps. After the removal of a cancerous epulis, many foreign surgeons apply the cautery.

The manner of removing the diseased portion of alveolary process is, to make a perpendicular cut through the bone on each side of the tumour with a fine saw, after which its separation may be completed with a strong pair of forceps. The bleeding is profuse, but may be stopped by pressing into the wound a dossil of lint dipped in the tincture of sesquichloride of iron; the application of which, or of a solution of lunar caustic, may be repeated, if necessary, at each succeeding dressing.

## WOUNDS OF THE THROAT

Are cases of frequent occurrence in persons who attempt to commit suicide. Some merely penetrate the integuments, and are not of any particular importance. Others extend more deeply, and divide some of the primary branches of the external carotid, especially the lingual, and superior thyroid arteries. Others make an opening into the mouth by separating the os hyoides and tongue from the thyroid cartilage; while others are situated lower down, so as to penetrate the thyroid cartilage, or betwixt that cartilage and the cricoid, and sometimes through these into the œsophagus. Surgeons meet with more wounds of these parts, than of the trachea itself; for persons, who aim at suicide, generally make the wound high up in the neck, and, unless they cut with great determination and violence, they do not reach the carotid, or internal jugular vein, because they hold their heads back at the time, and thus render the larynx and trachea prominent. Some individuals, however, in a desperate state, reach these vessels, even high up in the neck, dividing nearly every thing down to the vertebræ. Under these circumstances, they are, of course, immediately destroyed by hemorrhage.

A simple incised wound of the trachea, unaccompanied by injury of other important parts, provided all hemorrhage has ceased, or can be controlled, is generally much less dangerous than a wound of the larynx —especially one that penetrates the thyroid cartilage, so as to approach the vocal cords and edges of the glottis, which may be involved to such a degree in the subsequent inflammation, as to put a stop to respiration.

Mr. Ryland, whose work contains the best observations on the present subject with which I am acquainted, divides wounds of the larynx and

trachea, 1st, into those which interest that part of the larynx which is situated above the attachment of the vocal cords to the thyroid cartilage; and 2d, into others, which penetrate the cavity of the larynx or trachea. Wounds in the former situation are comparatively free from danger, because, unless very deep, they do not reach the track through which the air passes in respiration, and therefore the risk of hemorrhage into the trachea is absent. The effusion of blood into the air-tubes is generally the immediate source of danger in wounds of the larynx, or trachea, and life is more frequently lost by this occurrence than by external bleeding.*

In ordinary cases, when there is much bleeding, it is from the lingual, or superior thyroid artery. Then also the patient, if not promptly assisted, may die from loss of blood, but more frequently he faints, and this is followed by a temporary stoppage of the hemorrhage; and time is thus afforded for a surgeon to be sent for.

I have known a patient die in about twenty minutes after cutting his throat, though no artery of any size was wounded, and the hemorrhage on the whole was very trifling. Thus, a prisoner in the Queen's Bench cut his throat, dividing the trachea and the external jugular vein. As he did this when he was alone in his room, the occurrence was not known to any other person for nearly twenty minutes after it had taken place, and when the gentleman who assists me in the duty arrived, the patient was at his last gasp. On examination after death, it was found that no large artery had been cut, but the stream of blood from the external jugular vein had passed into the trachea, and caused suffocation. Bleeding even from some of the numerous veins in front of the trachea, below the thyroid gland, might have the same fatal consequence.

I had another patient in the same place, who, after the nurse had retired to rest, took out his razor and cut his throat. A girl accidentally entered the infirmary directly afterwards, and seeing the stream of blood which went as far as the middle of the room, she gave the alarm, and a surgeon in the prison immediately secured the superior thyroid artery that had been divided. In all cases of this kind, the bleeding vessels are to be secured by ligature; and the edges of the wound are not to be immediately brought together, because, as Mr. Ryland justly remarks, "when the immediate danger from bleeding into the windpipe has past away, secondary hemorrhage may occur, either on the establishment of reaction, or from the effects of ulceration; and this is more likely to be attended with fatal results, when the edges of the wound have been brought together, and no outlet is left for the escape of the blood."

Wounds between the hyoid bone and the thyroid cartilage may injure the epiglottis, the anterior wall of the pharynx, or the lips of the glottis, and the arytenoid cartilages. The epiglottis may be severed from the tongue and hyoid bone by a division of the hyo-thyroid membrane, and by then falling over the rima glottidis cause danger of immediate suffocation. Such a case is recorded by Dr. Houston, who extricated the patient from this first danger by raising up the epiglottis, bringing it over the edge of the thyroid cartilage, and fixing it there with a single stitch.† Loose portions of the mucous membrane, I have known cause similar distress.

Certain cases recorded by Larrey prove, that the destruction of the epiglottis seriously injures the voice; that immediately after its occurrence, the power of swallowing is lost; but that, in time, the lips of the

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* Frederick Ryland on Diseases and Injuries of the Larynx and Trachea. 8vo. Lond. 1837. p. 234. A work of great merit.

† Dublin Hospital Reports, vol. v. p. 315.

glottis are able to prevent solid food from penetrating into the larynx, though liquids will still produce much inconvenience.

Wounds between the hyoid bone and thyroid cartilage may prove fatal by exciting inflammation of the glottis, and consequently serous infiltration of the submucous cellular tissue of the epiglottis and superior aperture of the larynx.

When the knife or razor penetrates deeply into the hyo-thyroid space, the anterior wall of the pharynx will be opened; an occurrence soon manifested by the passage of liquids, taken by the mouth, through the external wound. If the opening in the pharynx be large, so as to be followed by a frequent escape of the alimentary matters through the wound; or if deglutition be attended with difficulty, an elastic gum tube should be introduced into the œsophagus from the nostril, or mouth, and food injected through it into the stomach.

I have seen cases, in which the epiglottis, and also the arytenoid cartilages and vocal chords, were injured. In one example, recorded by Sir Charles Bell, the divided arytenoid cartilage, suspended merely by a membranous connection, slipped into the rima glottidis, and caused suffocation.* A man who commited suicide, and died in University College Hospital, made an oblique incision in the thyroid cartilage, extending upwards with such force, that the os hyoides was cut in half.

Wounds penetrating the air-tube cannot be attended with obstructed respiration so long as the external wound remains open; but in others only interesting parts above the rima glottidis, death may be occasioned by this circumstance in a few hours. At the same time, as Mr. Ryland explains, there can be no doubt, that wounds which penetrate either the larynx or the trachea are attended with much greater risk to life, than those which merely injure the epiglottis, the anterior wall of the pharynx, or the hyo-thyroid membrane. In the former cases, death may ensue from hemorrhage into the trachea; from suffocation, caused by excessive granulations; or from a chronic thickening of the mucous membrane, as happened some weeks after the accident in one of my patients in University College Hospital, when the outer wound and that in the air-tube had been perfectly healed; or from extension of the inflammation around the wound to the lungs and pleura.

With respect to wounds of the trachea or larynx, complicated with a wound of the pharynx or œsophagus, it is remarked, that, upon the whole, the pharynx is less frequently wounded than the œsophagus, because it is so protected by the larynx, that it cannot be reached unless the thyroid or cricoid cartilage be cut through. When the trachea is completely cut across, the œsophagus is generally injured.

Certain cases, quoted by Mr. Ryland, show that the escape of fluids taken by the mouth, through a wound in the trachea or larynx, is not an absolute proof that the pharynx or œsophagus is injured. He conceives that the circumstance is to be ascribed to some defective action in the epiglottis from the injury.

In the *treatment*, the first indication is to stop the bleeding by tying the divided vessels, if large enough to require it, whether arteries or veins.

Until this has been done, no wound communicating with the trachea or larynx is to be closed; because, if the hemorrhage continue, the blood, not being able to pass outwards, will flow into those tubes, and death be likely to be produced by suffocation.

As soon, however, as all risk from bleeding is over, the wound may be

* Surgical Obs. vol. i. p. 44.

closed by position, sutures, plaster, or bandage. The edges of wounds in the hyo-thyroid space may generally be brought together by means of position alone. The patient is to lie on his back, and the chin is to be approximated to the sternum with a bandage, the upper ends of which are to be fastened to each side of the back part of a night-cap, while the lower are attached to a band placed round the chest. High pillows are also to be placed under the head. Adhesive plaster, or water dressing, may be applied to the external wound.

In wounds of the hyo-thyroid space, penetrating the pharynx, the patient is to lie upon his back, in order to lessen the flow of saliva and mucus towards the wound, and an elastic gum tube should be passed from the mouth or nostril, for the injection of nourishment and medicines into the stomach.

If urgent difficulty of respiration should come on within a few days after the infliction of a wound in the hyo-thyroid space, and this apparently from extension of the inflammation of the injured parts to the lips of the glottis, bleeding and calomel should be immediately resorted to, and if not promptly effectual, bronchotomy should be practised.

Wounds of the larynx require very similar treatment to that recommended for those of the hyo-thyroid space. I have rarely employed sutures, though Mr. Ryland considers them necessary, if the thyroid cartilage be cut in more places than one, and the pieces separated.

When the wound is made in the space between the thyroid and cricoid cartilages, the pharynx is more likely to be reached, than when the knife first meets with the thyroid cartilage. Here the use of an œsophageal tube is required. With respect to sutures, if, in this case, the gaping of the wound in the larynx be considerable, one or two stitches will be advantageous, on condition that they be taken out immediately any obstruction of respiration occurs. In wounds of the trachea, if the whole of its circumference be not divided, no sutures are necessary; the head is to be kept forwards; and adhesive plaster, or the water dressing, applied. When the division of the trachea is complete, position may not suffice to bring the separated parts together, and then one or two sutures will be indispensable.

If the œsophagus be wounded, the œsophageal tube should be introduced.

The danger of closing the external wound before the oozing of blood has entirely ceased, and the risk of its passing into the trachea is over, has been already insisted upon. So has the necessity of having quick recourse to bleeding, and calomel, when difficulty of breathing follows a wound of the air-tube, and depends upon obstruction of the rima glottidis from inflammation and thickening, or œdema, of the lining of the larynx; quickly followed up, if relief be not speedily obtained, by the performance of tracheotomy.

All patients with wounds of the throat, inflicted for the purpose of suicide, should be closely watched, lest they repeat the attempt. They should be kept perfectly quiet, and their minds soothed by good advice. In many instances, we find great depression of the system, especially where the loss of blood has been considerable, or the individual is under the influence of some deplorable domestic calamity. On this account, and also that air of too low a temperature may not pass direct into the trachea through the wound, the chamber should be kept at a moderate temperature. In other instances, where much reaction supervenes, bleeding and other antiphlogistic means may be called for.

During my service in the army, I had opportunities of seeing many ex-

traordinary wounds of the throat and neck. Thus, after the battle of Waterloo, one man was brought into the military hospital, who had received the thrust of a lance in the throat, by which the mouth was laid open, the tongue dreadfully lacerated, and several of the primary branches of the external carotid were wounded; consequently it became necessary to tie the common carotid artery. This operation, performed by Mr. Collier, suppressed the bleeding, and the patient recovered. After the attack on Bergen-op-Zoom, I saw a soldier, the whole of whose lower jaw, with the soft parts attached to it, had been carried away by a grape-shot. This poor fellow recovered, and was much indebted for this favourable result to the aid derived from elastic gum catheters. In another example, a musket ball had injured the carotid, in the lower part of the neck, which gave way about ten minutes after the soldier had been placed in the hospital. No blood escaped outwardly, but the man died of the pressure of the effused blood on the trachea, so suddenly, that there was no time to make any attempt to save him.

### FOREIGN BODIES IN THE ŒSOPHAGUS,

Requiring extraction, are such as might create bad symptoms, if pushed down into the stomach, in consequence of their hardness, indissolubility, pointed shape, or other hurtful qualities. On the other hand, those which are not likely to produce harm, and are capable of being digested, may be at once pushed down into the stomach. They most frequently lodge about the upper or lower orifice of the œsophagus; seldom in its middle portion. When low down, the surgeon is often compelled to force them into the stomach, though their quality is such as would render their extraction desirable. In many instances, they are situated in the pharynx. Hence, it is an important rule, always to press down the tongue, and examine the back of the throat, before any thing else is attempted. Thus, they may frequently be discovered, and extracted with the fingers or forceps, when, from the patient's account, one would conjecture that they had descended much further.

When a foreign body is situated about the upper orifice of the œsophagus, it may often be felt with the surgeon's finger, and if incapable of being removed with it, it may sometimes be easily extracted with a pair of forceps, provided the patient extend his head as far back as possible, so as to bring the mouth and pharynx nearly into the same line. In this position, with a pair of long-bladed forceps, like those invented by Dr. Bond of the United States, foreign bodies, nearly down to the cardiac orifice of the stomach, may be taken hold of, and extracted. A common instrument for the removal of foreign bodies from the œsophagus is a kind of hook, constructed of flexible wire, doubled and twisted together, and the bent end forming a noose. In general, small bodies, like needles, fish-bones, &c., are more easily extracted with a piece of sponge, introduced beyond them. The art of employing compressed sponge in the most advantageous manner, consists in taking a piece about the size of a chestnut, and introducing a strong ligature through it. The ends of the ligature are then to be passed through a flexible catheter, and fastened to that end of it which the surgeon holds. The sponge is then to be introduced down the œsophagus beyond the foreign body, and water is to be injected down the tube, in order to wet the sponge and make it expand. The ligature is then to be firmly drawn, for the purpose of pressing the sponge against the extremity of the tube, and making it spread itself out in a still greater degree. The tube is now to be withdrawn, together with

the sponge, the instrument being twisted to the right and left in thi part of the operation.

When the foreign substance cannot be extracted with this instrument, a probang may be tried, to the end of which a bunch of thread is fastened, doubled so as to make an immense number of nooses. In this way, fish-bones, and other substances, frequently admit of being entangled, and extracted, after other modes have failed.

Some practitioners are in the habit of giving emetics; but this method must be improper when the foreign body is pointed, and is seldom of much use in any case, as patients usually make efforts to vomit of their own accord.

When foreign bodies produce urgent symptoms, and cannot be extracted, it becomes necessary to push them into the stomach, whatever may be their nature or quality; and here it should be mentioned, that substances which one would imagine likely to produce alarming symptoms by being put into the stomach, frequently occasion, after they are in that organ, no dangerous symptoms, and even not the smallest inconvenience. A whalebone probang is the instrument for this purpose.

When foreign bodies can neither be extracted, nor pushed down, the consequences are not invariably dangerous. When the extraneous substance is small and pointed, it frequently excites suppuration, becomes loose, and is either carried into the stomach, or ejected from the mouth. Sometimes it makes its way to the surface of the neck, occasioning there an abscess, out of which it is extracted.

In some instances, foreign bodies, especially needles and pins, after making their way through the œsophagus, travel a great way about the body, and, at length, arrive under the skin of remote parts, behind the ears, at the shoulders, feet, &c., where they produce an abscess, that leads to their discovery and extraction. Surgical authors mention a variety of examples, in which pins and needles, after being swallowed, continued in the body many years. In one instance, recorded by M. Hevin, in the Memoirs of the French Academy of Surgery, a needle that had been swallowed, remained in the body eighteen years before it made its appearance under the skin, during all which time not the slightest inconvenience was experienced.

When the foreign body is large, impedes deglutition, dangerously obstructs respiration, and can neither be pushed down into the stomach nor extracted by the mouth, the only means of saving the patient's life is œsophagotomy, which is directed by Lisfranc to be done as follows: the patient's head having been inclined backwards, an incision is to be commenced at the inner edge of the left sterno-mastoid muscle, opposite the superior edge of the thyroid cartilage, and continued down to the lower edge of the cricoid. An assistant is now to draw the carotid sheath towards the outer side of the wound, while the operator cautiously dissects through the cellular tissue close to the trachea, until the œsophagus is exposed, where it inclines to the left side of the windpipe. A long, slightly-curved cannula, with a grooved stilet, is now to be introduced from the mouth down the œsophagus, and its point, being inclined to the left, may readily be felt in the wound. The stilet is then to be pushed forwards through the œsophagus; the operator ascertains, by passing his finger along the concave end of the instrument, that no arterial branch lies over it, and then puts a bistoury into the groove, under the guidance of which the œsophagus is opened. The foreign

body, lodged in this canal, is now to be extracted with a pair of forceps. The only example of œsophagotomy in this country, within my recollection, was performed by Mr. Arnott. The operation was perfectly well executed, but did not ultimately save the patient, who was a child of tender age.

### WRY-NECK. CAPUT OBSTIPUM.

In this complaint, the head is drawn towards one of the shoulders. In general, the face is turned towards the opposite side; but, occasionally, towards that to which the head inclines. The affection, when in a high degree, renders the head quite immoveable, so that neither the patient, nor any other person, can place it in its proper position. Hence, when the patient wishes to look in any direction, except immediately before him, he is necessitated to turn his whole body. Sometimes the head can be moved, but not brought into a straight posture. In other instances, the patient, with exertion, can manage to keep his head straight for a short time; but it soon becomes inclined again towards the shoulder. The disorder mostly arises from irregular action in the muscles of the neck, especially the sterno-cleido-mastoideus, or else from the contraction of a cicatrix, or from deformity of the cervical vertebræ.

When the cause is irregular action of the sterno-cleido-mastoideus, this muscle, on the side to which the head is drawn, has a hard, tense, unyielding feel; every attempt to bring the head into its right position exciting the muscle to make greater resistance, and to assume a more stretched appearance. Frequently the sterno-cleido-mastoid muscle of one side is paralytic, and the wry-neck is then occasioned by the healthy ordinary action of its antagonist. It may be inferred, that the cause of the deformity lies in an alteration of the vertebræ, when the muscles are free from the above-mentioned appearances, the patient is scrofulous and ricketty, and the head more moveable than in the preceding case.

The *prognosis* depends on the cause and duration of the deformity. In young subjects, if the cause lie in the muscles, the prognosis is favourable. When, however, the case has existed a long while, and particularly when it began in early childhood, and continued during growth, the cervical vertebræ are sometimes distorted, altered in shape, and even anchylosed; in which circumstances, the disease is incurable. This participation of the vertebræ in the disorder does not constantly exist, at all events in an irremediable degree, even though the disorder may have begun at an early period of life, and prevailed a considerable time. Richter and Chelius refer to several instances in which wry-necks of the most unpromising description were cured; cases, in which the head had been quite immoveable, the disease of twelve and sixteen years' duration, and its origin had taken place in infancy.*

When the deformity follows the contraction of a cicatrix, the cure is by no means easy. A transverse incision is made through the integuments, and the head is afterwards kept in a straight posture by some mechanical contrivance, until a certain period after the wound is perfectly healed. The apparatus being left off, the distorted position of the head is generally disposed to return. It was on this account, that Mr. Earle proposed the removal of the whole of the cicatrix, and having

* Ansfangr. de Wundarzn. b. iv. p. 276. M. J. Chelius, Handbuch der Chirurgie, b. i. p. 796, 8vo. Leipzig. 1826.

recourse to treatment already noticed in the observations on burns. In some instances, however, where the chin was nearly in contact with the breast, in consequence of the effect of severe burns, I have known considerable amendment follow the division of the longitudinal folds in the cicatrized parts, and the long continued use of mechanical means for preserving the head in an even position.

In common examples, depending chiefly upon a loss of equilibrium between the muscles of the opposite sides of the neck, and especially upon a rigid contraction of one of the sterno-cleido-mastoidei, the means of relief, usually tried, are camphorated mercurial frictions over the rigid muscle, even till salivation occurs; the application of the nitrate of silver to the skin; the internal exhibition of opium, together with mercurial frictions; electricity; stimulating embrocations; the shower-bath; blisters; issues, &c. These remedies should be assisted with mechanical contrivances, for gradually bringing the head into a straight position. The best apparatus which I know of for this purpose, is that invented by Professor Jörg.* It consists of a pair of leather stays, and of a band or fillet, which goes round the head. On the centre of the forepart of the stays is a kind of pulley, or grooved wheel, which can be turned round with a key in one direction, but not in the other, as it becomes fixed by means of a spring. From this pulley, or wheel, a band proceeds up the neck to the fillet on the patient's head, to which it is fastened directly behind the ear, close to the mastoid process. The band lies in the same direction as the lengthened sterno-cleido-mastoideus muscle, and, when drawn towards the breast by means of the wheel, it produces the same effect as would arise from an increase in the action of that muscle. In short, it pulls the mastoid process downwards and forwards towards the sternum, counteracts the opposite muscle of the same name, and rectifies the position of the head. The apparatus is to be constantly worn.

When, by perseverance in the use of this simple invention, and other means, the position of the neck has been improved, the head is generally found to have a disposition to incline too much forwards; an effect which the contracted sterno-cleido-mastoideus, and its antagonist, the band, both tend to promote. In order to hinder this, Professor Jörg removes the end of the band from the breast, carries it under the arm, and through a ring at the side of the corsets, or stays, and thence to the fillet on the head, where it is fastened close to the mastoid process. The ring hinders the band from chafing the axilla, and following the motions of the shoulder.

If, when the disease originates from irregular action of one of the sterno-cleido-mastoidei, Sharp's operation of dividing the muscle be determined upon, it will generally be prudent at first only to cut through the clavicular portion of it. A transverse incision having been made over this part of the muscle, the operation is completed by passing a director, and blunt-pointed curved bistoury, under the place where the division is intended to be made. In one example, Dupuytren passed a bistoury behind the muscle, and divided it by cutting forwards, leaving the skin uncut, in order that the patient, who was a female, might not have the disfigurement of a scar in the neck. The position of the head was then regulated by a bandage; and the result was successful.

When a wry-neck depends upon paralysis, or weakness of one sterno-cleido-mastoideus, while the other retains its natural power, electricity,

* Ueber die Verkrümmungen des Menschlichen Körpers. 4to. Leipzig. 1816.

the application of a grain or two of strychnia to the skin which has been blistered, setons, blisters, liniments, the cold bath, and tonics, are indicated. The state of the bowels and digestive organs should also be carefully regulated. During the trial of these remedies, the head should be kept in a straight position, as paralytic muscles are more likely to recover their tone in a tense, than a relaxed state. When such treatment fails, a partial division of the healthy sterno-cleido-mastoideus has been suggested, as a means of restoring the equilibrium of the head. At the present day, we rarely hear of operations of this kind.

### BRONCHOCELE,

Signifies an indolent enlargement of the thyroid gland; the tumour, when not accidentally inflamed, is free from pain; and in its incipient state, has a soft, elastic consistence. When it has existed some time, the gland loses its natural figure, assumes a firm fleshy feel, being firmer, however, in some places, than in others, spreading towards the sides of the neck, and sometimes attaining a prodigious magnitude. When the adjacent cellular tissue, and lymphatic glands, participate in the disease, the base of the swelling may extend from one side of the neck to the other. In a few instances, only one lobe is affected.

Bronchocele is endemic in several mountainous countries; as, for instance, Switzerland, Savoy, the Tyrol, Derbyshire, &c.; and is most frequent in young females. The disease is sometimes a mere hypertrophy of the thyroid gland; sometimes an excessively indurated, or even a partly ossified condition of it; and, in other instances, the swelling consists of many cysts of different sizes, filled with transparent viscid fluid, or matter of various kinds. The tumour sometimes creates no particular inconvenience, and is merely a deformity. When large, however, it is frequently attended with considerable obstruction of the speech, respiration, and deglutition. It has little tendency to become malignant, that is to say, cancerous, and is not very liable to inflammation and its consequences, though these changes sometimes happen. In Mr. Langstaff's museum is a fine specimen of fungus hæmatodes of the thyroid gland, which had been mistaken for bronchocele.

The causes of bronchocele are involved in great obscurity. At one time, it was conjectured, that drinking water, obtained from melted ice or snow, frequently gave rise to the disorder. The disease, however, is frequent in Sumatra, where ice and snow are never seen; while it is entirely unknown in Thibet, where the rivers are exclusively supplied by the melting of the mountain's snow. Bronchocele has been regarded as a scrofulous complaint; but this doctrine is denied by Prosser*, who argues, that the disease is often seen in persons entirely free from every mark of scrofula; and that, while boys are as subject to scrofulous diseases as girls, bronchocele seldom occurs, except in young females.

Formerly, the medicine commonly given for the cure of bronchocele, was burnt sponge, in the dose of a scruple, two or three times a day, either made into an electuary with syrup, or prescribed in the form of a lozenge, the efficacy of which was thought to be greatest when it was placed under the tongue, and allowed gradually to dissolve there. A mercurial purgative was usually given about once a fortnight. The good effects of burnt sponge are now well known to depend upon the iodine which it

* An Account and Method of Cure of the Bronchocele, or Derby-neck, 3 edit. p. 5. 4to. Lond. 1782.

contains, and, consequently, at the present day, iodine itself is commonly prescribed. Its efficacy is promoted by the previous application of leeches to the swelling, and a low regimen.

With such treatment, external means are to be combined; as repeated frictions of the swelling with strong camphorated or ammonia liniment, or, what is still better, the ointment of the iodide of potassium, with or without a proportion of mercurial ointment blended with it.

From the foregoing description of the very different conditions of the thyroid gland in different instances, it is manifest, however, that iodine will not cure every form of it.

Accident has sometimes furnished useful suggestions in the practice of surgery: bronchoceles have occasionally festered, or ulcerated, and the result sometimes been the dispersion of most of the swelling. Hence, the plans of forming issues and setons, as a mode of cure. Valuable information, respecting the effects of setons, may be collected from a paper by Dr. Somerville, describing the practice of Quadri at Naples, and inserted in the Med. Chir. Trans. vol. 10.; and from another paper in the eleventh volume, drawn up by Mr. Copland Hutchison. The seton was often employed by Dupuytren. It should never be made, except when iodine has decidedly failed, and the complaint is beginning to be very oppressive. If a seton be passed through the thyroid gland, the hemorrhage is always profuse, and might prove dangerous, were it not checked by cold applications, and pressure. In general, the seton must be kept in several months, before the swelling is completely reduced. It will not cure the hardest forms of bronchocele; but it will cure hypertrophy, cysts, and hydatid formations, which iodine and other specifics frequently fail to disperse.

If this latter measure, or the formation of an issue, should not be deemed advisable, and the patient's life be rendered miserable, or seriously endangered by the pressure of the swelling on the trachea, œsophagus, and veins returning the blood from the head, it will be for the practitioner to consider, whether he will imitate Blizard, Walther, Wedemyer, Graefe, Coates, Brodie, &c. in tying one or both of the superior thyroid arteries, or follow the example set by Gooch, Desault, Theden, Vogel, and Hedenus, who ventured to extirpate the enlarged thyroid gland. The latter surgeon has performed this bold operation, at least six times, with complete success. The most essential rule in the operation would be to secure every large artery directly it was cut, so that the patient might not be lost by hæmorrhage, ere the complete detachment of the swelling had been effected. The ligature of the superior thyroid arteries is generally followed by some diminution of the tumour, but this amendment has not always been permanent. In some of the cases on record, the patients died either of inflammation and its consequences, or of secondary hemorrhage.

In one example that occurred in University College Hospital, Mr. Liston exposed a large prominent portion of the tumour, and after carrying the dissection as far as he deemed safe, passed a double ligature through its base, and thus effected its destruction.

## WOUNDS OF THE CHEST

Are divided into *surperficial*, and *penetrating*. The former do not materially differ from common wounds of the skin and muscles in other situations, and therefore do not here require particular notice.

When we consider the important organs contained in the chest, we should hardly suppose it possible for a bullet or a sword to pass across it without inflicting a mortal wound. Yet, recoveries from such injuries are frequent, and this notwithstanding they may be complicated with a wound of the lungs. Nay, facts are recorded, which leave no doubt, that even wounds of the heart itself are not always fatal, balls having been found encysted in its substance, after death from other causes, long after the receipt of the wound.

When, in respiration, the air passes alternately into and out of a wound in the parietes of the chest, we know that the weapon must have penetrated beyond the pleura costalis. In the expansion of the thorax by the muscles of inspiration, the air enters the wound; in its contraction by the muscles of expiration, the air is pressed out in a more or less forcible current. When the communication between the cavity of the pleura and the atmospheric air is free and ample, the lung generally collapses, unless prevented by adhesions; and the knowledge of this circumstance led to the belief, that if direct openings were made simultaneously into both cavities of the pleura, the patient would inevitably die of asphyxia produced by the collapse of both lungs. Experience proves, however, that this is not the fact, and that recoveries may follow wounds penetrating the two sides of the chest, even where the admission of air to the cavities of the pleura is free and direct. Three chief sources of danger present themselves in all penetrating wounds of the chest.

1. The risk of profuse internal hemorrhage, by which the patient is sometimes destroyed at once; or by which he is more slowly cut off, generally in consequence of the extravasation in the pleura producing too much pressure on the lungs, or becoming combined with inflammation of those organs.

2. Other patients fall victims to inflammation within the chest, without any effusion of blood, though sometimes the inflammation is followed by abscess, or, as it is here called, *empyema*.

3. Another cause of danger, when the lungs are wounded, is *emphysema*, or the inflation of the cellular tissue, sometimes of the greater part of it throughout the body.

The symptoms of *a wound of the lungs* are, bloody expectoration *immediately* after the receipt of the injury, frequent coughing, great difficulty of breathing, a feeling of suffocation, and a sudden alteration of the countenance, which exhibits paleness and marks of great anxiety. Here the immediate danger is either from the quantity of blood withdrawn from the circulation by internal hemorrhage; or from the passage of that fluid into the bronchi and air-cells of the lungs; or into the cavity of the pleura, so as to cause suffocation. Hence wounds of the root or upper part of the lungs, where the vessels are large, are always the most dangerous.

With regard to the *treatment*, it is a general rule to close all such wounds without delay. We ought, however, to extract any splinters of a broken rib, a ball, a portion of the clothes, or any other extraneous substances which lie near the surface, and can be easily reached without too much irritation. With respect to *a wounded intercostal artery*, all the best modern practitioners disapprove of the introduction of various in-

struments and contrivances into the wound or chest for the suppression of the bleeding. Dr. Hennen had heard of examples, in which the intercostal artery was taken up with a tenaculum. But supposing this were not practicable, I believe, that less danger would arise from closing the wound and applying a compress over it, than from the introduction of extraneous substances round or within the rib. I attended, with Mr. Frogley of Hounslow and Mr. Broxholm of Sunbury, a young gentleman, one of whose intercostal arteries was wounded by a small knife. The result was a prodigious effusion of blood under the muscles of the back, followed by large collections of matter, and very urgent danger; but, in the end, the patient recovered. No attempt was made to secure the vessel. About eight ounces of blood flowed out of the orifice of the wound directly after the accident; the outward hemorrhage then ceased; but the blood accumulated in the cellular tissue; great swelling ensued, and, in about eight days, such a quantity of matter and putrid blood was suddenly discharged from the external wound, that the patient lay in a kind of pond, extending from his feet to his neck. Incisions were occasionally practised to facilitate the exit of the matter. It was some months before the discharge ceased, and the wound closed. In the early inflammatory stage, leeches and venesection were freely employed.

In all penetrating wounds of the chest, and especially those extending into the lungs, the free use of the lancet is the only thing that can be depended upon in the beginning. It is by this means that internal hemorrhage is to be checked; and inflammation of the lungs prevented or subdued. Here, as in certain injuries of the head, moderate bleeding will not suffice. We may perhaps be required to bleed the patient more than once a day for six or eight days in succession. The first bleeding should be copious; and, if the patient faints, we should not give him cordials, but allow him to revive gradually without them.

When the oppression of breathing returns, and the pulse rises, accompanied by pain in the chest, and spitting of blood, venesection should be performed again; and thus the lancet is to be used as often as the state of the circulation, the pain, and oppression of breathing, or other circumstances call for it. If we neglect this rule, we are certain of losing the patient.

When the paroxysms of pain, the sense of suffocation, and the internal hemorrhage are lessened, but the cough is severe, we may prescribe digitalis or hyoscyamus, with small doses of the acetate or muriate of morphia, and saline medicines.

When much cough and pain in the chest continue, after bleeding has been carried as far as practicable, a blister may often be applied to the chest with great benefit; and, sometimes, leeches or cupping may yet be ventured upon, though venesection itself is not any longer admissible.

When matter forms in the cavity of the pleura, after a wound of the chest, constituting *empyema*, or when the extravasation of blood in the chest causes urgent danger by its pressure, the indication is to make an outlet for the discharge of such fluids; but, if the wound should not be closed, we ought to avail ourselves of the opening already existing for this purpose; and, with this view, direct the patient to lie in a posture that will render the wound depending.

In former days, when *blood* was *extravasated in the chest*, surgeons used to make themselves particularly officious about its evacuation, sometimes using tubes and syringes for the purpose. But, at present, we never hear of such schemes being put in execution. This part of surgery, however, is sometimes attended with a great deal of perplexity; for we have two

dangers to contend against,— one is that of letting the patient die of suffocation from the pressure of the blood on the lungs and diaphragm, if no opening be made for its discharge; the other is that of seeing him fall a victim to continued hemorrhage if such opening be made. I believe, however, that the experience of army surgeons, who are the best and most experienced judges of this subject, will justify me in saying, that we shall generally act with most prudence if we do not hastily adopt schemes and contrivances for discharging blood from the chest, but rely upon rigorous antiphlogistic treatment. The diagnosis also is rarely so clear, with regard to an extravasation of blood, as to justify the performance of an operation for its evacuation. At all events, we should not be in too great a hurry to make an opening in the chest; but give nature an opportunity of doing her best, under the assistance of the treatment which I have advised.

Sometimes wounds of the chest are complicated with protrusion of a portion of the lungs: one such case was brought to me at Brussels after the battle of Waterloo. The protruded piece of lung was of a long, narrow, tongue-like form, and severely contused. The wound had been made with a lance. I thought at first of cutting the protrusion off, but the bleeding made the inclusion of it in a ligature necessary. The patient, I believe, did not ultimately recover.

### EMPHYSEMA,

Or the inflation of the general cellular tissue, is frequent in cases of fractured ribs with wounded lungs, because the air has no outlet, the skin being entire. It seldom occurs as a complication of a free and direct wound, but chiefly of those, whose orifices are narrow, and whose direction is oblique, as is the case with punctured wounds in general. It is not uncommon in cases of gunshot wounds of the chest, their orifices being blocked up by the swelling around the wound, and the sloughs within it. Emphysema is not confined to examples of penetrating wounds of the chest, or of broken ribs, but may take place in any situation in the vicinity of the organs and apparatus of respiration. Hence, emphysema of the eyelids from fractures of the os ethmoides, os unguis, or frontal sinus, or from a laceration of the mucous membrane of the nose.*

The symptoms of emphysema are, great oppression of the breathing, inability to lie down, or a preference to an upright or sitting posture; a colourless, elastic, crackling tumour, beginning near the wound or fractured rib, and often extending with great rapidity, so as to cause sometimes an enormous distension of the cellular tissue of every part and region. The chief cause of danger, however, is not this diffusion of air in the subcutaneous cellular tissue, but its insinuation into the interlobular cellular tissue of the lungs, and its accumulation in the cavity of the pleura, — two circumstances causing a perilous obstruction of the function of respiration. Emphysema is also frequently combined with the danger depending upon inflammation, effusion of blood, or lodgment of foreign bodies in the chest.

Experience proves, that when emphysema is restricted to a moderate space, and only a few cubic inches of air are within that space, it is readily absorbed again. But circumstances are different, when it has passed, not only into the whole of the cellular tissue under the skin, and between the muscles, but into that of the viscera of the thorax, and even of the

* See Dupuytren, Leçons Orales, t. i. p. 123. A footman, in the service of the Duke of Sussex, was lately under my care in University College Hospital, with a fracture near the inner side of the right orbit, accompanied by emphysema.

abdomen ; and likewise into the great cavities lined by serous membranes. The mechanism, by which the air is impelled into the cellular tissue, is an interesting part of the subject. When, in consequence of previous inflammation of the chest, there exist organised adhesions between the two pleuræ, and a continuity of tissues is thus formed between the surface of the lung and the parietes of the chest, emphysema is very easy of comprehension. The air then passes from the interior of the lungs into the interstices of the new organisation, and afterwards, gradually making its way through the parietes of the chest, gets into the submuscular and subcutaneous cellular tissue. Here we are supposing the weapon, or point of a fractured rib, to have pierced the lung precisely in the seat of such adhesions. But, when there are no adhesions, the air, which is inspired, partly escapes from the breach in the surface of the lung, and passes at first into the surrounding tissues and cavity of the pleura. Thence it is next forced by the influence of the contraction of the chest in respiration. The expansion, or act of inspiration, draws the air first from the breach in the lung into the cavity of the pleura, and thence it is propelled into the cellular tissue adjoining the wound in the side, by the diminution in the capacity of the chest in each expiration. In other words, each inspiration draws it out of the rent in the lung into the cavity of the pleura, and each expiration pumps or compresses it out of that cavity into the cellular tissue, for it cannot return into the air-cells, on account of their being already full of air themselves. Its progress over the body is also, no doubt, facilitated by its own elasticity. The quantity of it, thus diffused, is sometimes enormous, filling not only the parietes of the thorax and abdomen, the upper and lower extremities, the loose cellular texture of the scrotum, the neck and head, but also the pleuræ, the mediastina, the pericardium, and even the interlobular cellular tissue of the lungs.

The *treatment* varies according to the degree of emphysema, and the urgency of the symptoms arising from it. In cases of only moderate extent, attended with broken ribs, a compress may be applied over the swelling, and then a bandage round the chest, followed up by venesection and opening medicines. The object of the bandage is to suspend the action of the intercostal muscles, and to make the patient breathe entirely by the diaphragm, so as to promote, on the one hand, the union of the fractured rib, and, on the other, to resist, as much as possible, the causes of emphysema. In emphysema of great extent, as I have explained, one principal risk proceeds from the accumulation of air in the cavity of the pleura, — a state indicated by a metallic tinkling sound, compared to the dropping of shot into a porcelain basin ; and, therefore, when scarifications do not give relief, and there is reason to believe, that air is confined in the chest, we should make a deeper and freer incision over the broken part of the rib, or enlarge the original wound, and puncture the pleura costalis.

Slight scarifications and a bandage round the chest will tend to prevent the increase of emphysema in the common cellular tissue : and may, indeed, be of important utility in hindering its extension into this texture so far as to reach the interlobular cellular substance of the lungs. Yet, in more aggravated cases, I believe with Baron Dupuytren, that they are inefficient means, and also that the pressure of the bandage would really make the state of the breathing worse. In urgent or rapidly increasing cases, therefore, perhaps, the most prudent plan is to make an incision, and then cautiously puncture the pleura costalis. However, nothing will answer, if the cellular tissue of internal organs is already much inflated.

The place for the incision and puncture is determined by the fracture, or original wound, where the air first escapes from the chest; but, when the intention is to let out blood, water, or purulent matter, we are to divide the integuments over the space between the sixth and seventh ribs, where the indigitations of the serratus magnus meet those of the obliquus externus, and, having cut through the intercostal muscles, cautiously puncture the pleura.

The incision through the intercostal muscles should be made away from the lower edge of the rib, where the chief branch of the intercostal artery runs.

## DISEASES OF THE BREAST.

The classification of diseases of the breast, adopted by Sir Astley Cooper, is,

First, into diseases, *the result of common inflammation*, whether *acute*, or *chronic*.

Secondly, into diseases *accompanied by peculiar* or *specific action*, but which are *not malignant*, and *do not contaminate other structures*.

Thirdly, into others, which not only *consist in local, malignant, and specific actions*, but *are connected with a peculiar and unhealthy state of the constitution*, and affect with similar disease, besides the part originally attacked, others in the neighbourhood, and even sometimes remote parts.

The first class of diseases comprehends: 1. *Acute inflammation* of the breast, and the *milk abscess*. 2. *Chronic inflammation*, terminating at length in *suppuration*. 3. The *lacteal tumour*, so called by Sir Astley Cooper, on account of its arising from obstruction of one of the lactiferous tubes, as an effect of chronic inflammation. To this arrangement I shall confine myself, after noticing a few diseases of the nipple.

### DEFICIENCY OF THE NIPPLES, OR THEIR NUMBER GREATER THAN USUAL.

Sometimes there is *congenital absence of the nipple;* sometimes, it is *accidentally obliterated* by wounds, pressure, a burn, venereal, or other forms of ulceration. Under any of these circumstances, there is an impediment to the excretion of the milk, which can only be determined from the breast, as much as possible, by the action of purgatives.

The *nipples may exceed their usual number;* for instance, there may be two on each breast, or even as many as five.* The removal of the superfluous nipples is evidently the proper measure; but, as there is a risk of mistaking the natural nipple itself for the abnormal ones, Boyer may be right in advising the operation to be deferred until after the birth of the first child, when the true nipple will be ascertained.

Sometimes the *nipple is imperforate* from birth. This condition may not become known until after the subject of it has been delivered of her first child. Such a case is generally incurable.

### EXCORIATIONS.

The greater number of women who suckle for the first time, experience, more or less, tenderness of the nipple. But, frequently, in conse-

* Acta Havniens, vol. iii. Obs. 98.

quence of being incessantly irritated by the child's mouth and the lodgment of milk upon it, it inflames, and becomes *excoriated.*

Various plans of relief are adopted for *excoriations of the nipple.* One consists in not letting the infant suck only at longish intervals, and keeping the part covered with a piece of fine soft linen. If this should not answer, the nipple may be bathed several times a day with the lotio plumbi acetatis, or the linimentum calcis. Sir Astley Cooper prefers an application, composed of ʒj. of borax, ʒss. of alcohol, and ʒj. of water. M. Velpeau, if simple ointments fail, employs a weak solution of the nitrate of silver, or sulphate of zinc, or an ointment containing white precipitate.

But it is always to be recollected, that the child's suction is the exciting cause of the complaint, and that several of the applications above specified, would be productive of inconveniences, if allowed to remain on the nipple when the infant sucks. Hence, under such circumstances, an artificial nipple, made to fit accurately, is sometimes deemed one of the best means of relief. With the aid of this, and cleanliness, and some of the applications enumerated, a cure is generally accomplished in a few days.* In some cases, the child should take milk chiefly from the opposite breast.

### ULCERATED FISSURES, OR CRACKS IN THE NIPPLE,

Which arise from the same causes as excoriations, may occur on different points of the areola, or on the nipple itself. In consequence of being stretched and irritated whenever the infant sucks, they extend more and more deeply, and cause acute suffering. Sometimes they become so large and deep, that, whenever disturbed by the child, they bleed profusely; and, occasionally, they penetrate the base of the nipple so far, that the latter part is in danger of being completely detached. Hence, from the severity of the inflammation the secretion of milk and suckling are sometimes quite interfered with.†

The treatment should be like that of excoriations; artificial nipples being here even more necessary. The applications in common use are the calomel and lime water lotion; zinc ointment; or the nitrate of silver; with which all the surface of the fissures should be carefully rubbed at intervals. I concur with M. Velpeau in thinking lotions of the bichloride of mercury improper, as likely to poison the infant.

In women, who have long ceased to suckle, the nipple is sometimes attacked with a combination of *chronic eczema* and *psoriasis.* In two cases, recorded by M. Velpeau, the disease had continued for several years, attended with itching, and thick greenish, or yellow scabs, but no inflammation. He ascribes its commencement to the friction of the corsets against the breast. One patient was cured by the use of an ointment, containing white precipitate; the other submitted to the excision of the diseased nipple.

### THE LACTEAL SWELLING

Is confined to the nipple, and consists of a large collection of milk, partly fluid, and partly coagulated, often mixed with pus, in one of the lactiferous tubes, the aperture of which has been stopped up by chronic inflammation. It is a disease analogous to ranula. The swelling presents a distinct fluctuation; the cutaneous veins are large; but the colour of the

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* See Velpeau, Mal. du Sein. p. 4. 8vo. Paris. 1838.

† See Velpeau, Op. cit. p. 6.

skin is not changed. If a slight puncture be made, it soon heals, and another accumulation takes place; or, if a small ulcerated opening form, a little way from the nipple, it continues during the period of suckling, and the milk, instead of passing into the child's mouth, is lost.

The origin of the lacteal tumour is referred by M. Velpeau to sudden exposure of the breast to cold; too abundant a secretion of milk; and too long retention of it. Rough suction of the nipple, and the free use of cordials, will also promote its occurrence.

A puncture of moderate size will suffice, if the child is weaned; if not, a larger opening must be made, so as to let the milk escape while the child is sucking, until the secretion of milk ceases, or the child is weaned This is the advice given by Sir Astley Cooper.

If a small *lacteal fistula* were to be left after the puncture, or to follow an abscess communicating with one of the lactiferous ducts, M. Velpeau is in favour of touching it at intervals with the nitrate of silver, and applying astringents. This practice he finds almost always successful. If it should not be so, he recommends injecting, twice a day, a weak solution of nitrate of silver, or alum, or lotions containing tincture of iodine, or red wine. Were this plan not to succeed, he would dilate the orifice in the skin, and apply the nitrate of silver freely to the inside of fistula. By one or the other of these methods, M. Velpeau has never met with a lacteal fistula that was not cured. If the patient were not obliged to suckle, these means would cure the fistula still more quickly. Compression, and internal medicines might also be employed.* Dupuytren gives an account of cysts filled with a *milky* or *buttery matter*, which he had found in the breast† ; and which contained a milky substance either in a liquid, half-liquid, or imperfectly curdled state; but M. Velpeau is not aware that solid tumours, really formed by the milk have been hitherto described. Certain irritations of the texture of the breast, he conceives, may lead to infiltration of the milk out of the lobules or excretory ducts of the mammary gland, so as to form abnormal collections of it, just as blood is extravasated from its vessels as a consequence of blows. M.Velpeau, in 1838, attended a woman, whose breast was transformed into a spongy, highly-sensible mass; an exploratory puncture was made in it, and a quantity of milky fluid was discharged, which manifestly issued from the cellular tissue. But he is of opinion that the actual escape of milk from its proper vessels is not essential to the production of true accumulations of it. The lactiferous tubes may be dilated, and transformed into cysts of considerable size. M. Velpeau believes, that milk effused in the breast may, like extravasated blood, remain a long while, and be the cause of much pain; or, that it may be decomposed, and lead to the formation of a cyst filled with serum, if the curd is first absorbed, or filled with semi-fluid matter, if the serum is first taken away. In other cases, the effusion of milk may cause inflammation and milk abscess; or, again, in others, being once coagulated in the lactiferous tubes, or interlobular tissues, it may become blended with the fibro-cellular element, concrete, and harden more and more, and thus produce what M. Velpeau terms a *buttery* or *caseous tumour* of the breast. It is less necessary for us to adopt the foregoing theoretical explanation, than to remember the fact, that the breast is liable to tumours of this nature, which sometimes attain a large size. It is curious to learn also, that, in the case recited by M. Velpeau, tumours of the same kind were developed secondarily, as medullary masses in the axilla, and

* Op. cit. p. 48.

† Poillard, Journ. Hébdom. 1829.

under the clavicle. The tumour of the breast itself, after being completely removed, was reproduced.* These latter particulars lead me to suppose that, whatever might have been the first state, or cause of the formation of this tumour, it was afterwards of the nature of medullary cancer; a disease, which, in some of its varieties, we know is as liquid as cream or milk; though in others of the encephaloid consistence or even much firmer, as exemplified in Abernethy's mammary sarcoma.† The great size which the swelling of the axillary glands attained, viz., that of a child's head, and its lobulated shape, tend to confirm the view to which I incline. However, caseous matter is described as issuing from ulcerated parts of the tumour; and M. Donné, who, in one instance, examined the substance compared to cheese, or butter somewhat altered, found in it numerous globules, which, in the microscope, resembled those of milk, and, like them, were found also to be soluble in ether, and alcohol, and insoluble in ammonia. They were likewise blended with mucous globules, and the minute granular bodies, characteristic of colostrum.

In the *treatment* of solid milk tumours of the breast in the early stage, and where the milk appears to be diffused in the breast by infiltration, M. Velpeau recommends leeches, or even venesection, and active purgatives, followed by liniments of camphor or ammonia. But, if distinct lobulated prominences present themselves, quite concrete, and the disease is of long standing, he deems the extirpation of the tumour the only chance of saving the patient. I apprehend, however, notwithstanding some particulars calculated to support his view, that my friendly correspondent, M. Velpeau, may have mistaken a variety of medullary cancer for a tumour composed at first of effused, and afterwards of curded, milk.

### ACUTE INFLAMMATION AND MILK ABSCESS.

Inflammation and abscesses of the breast admit very well of the division adopted by M. Velpeau, into the *subcutaneous*, the *deep*, or *submammary*, and *those of the mammary gland itself.*

Women, during the period of suckling, are particularly liable to inflammation and suppuration of the breast: hence, the term *milk abscess.* The inflammation is of the phlegmonous kind, exhibiting all it usual characters; but, on account of the sensitive nature of the part, and the envelopment of it in a dense cellular or fascial covering, not readily yielding to inflammatory swelling, the suffering is uncommonly severe. A solid swelling is produced, succeeded by a blush of inflammation on its surface, and at length a prominence and smoothness in one particular situation, where the fluctuation of matter may be felt.

The most frequent cause of *milk abscess* is the great determination of blood to the breast each time the child is about to suck, by nurses called the *draught*, combined with the mechanical irritation, to which the part is continually subjected. The origin of such abscesses is sometimes promoted by the child not being put to the breast soon enough after birth; consequently the breast becomes too full; and this state, influenced by the stimulating diet often pressed upon mothers by nurses, soon ends in acute inflammation.

In the early stage, we may sometimes bring about resolution by employing cold evaporating lotions, leeches, and purgative medicines. All action

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* Velpeau, Op. cit. p. 83.

† See Carswell's Elementary Forms of Disease.

of the great pectoral muscle should be prevented by keeping the arm in a sling; and the patient, when in bed, should lie on the opposite side. If the breast be very large, some practitioners keep it supported with a bandage; a method, which I do not usually follow. Amongst the causes of this complaint, I have mentioned the mechanical irritation and disturbance of the breast in suckling. Hence, I always advise the mother not to allow the child to suck the inflamed breast; and, if it be necessary to draw the milk from it, recommend the use of a glass tube made for the purpose.

When an abscess cannot be prevented from forming, cold applications are to be discontinued, and emollient poultices and poppy head fomentations substituted for them.

With respect to the question of opening the abscess, I may observe, that if the collection of matter be superficial, not attended with extreme pain, and quick in its progress to the surface, it is not of great consequence, whether the abscess be opened, or allowed to burst of itself; but when the abscess is deep, its progress tedious, and the pain severe, and accompanied by fever, the matter should be let out. But, even with regard to the most superficial abscesses, some practitioners prefer opening them at once, so as to obviate all risk of the skin becoming undermined by them. I see no objection to the practice, for otherwise sinuses may form, and the cure be rendered more difficult and tedious. "Abscesses in cellular and fatty texture of the breast," says M. Velpeau, "should be opened, and this very freely as soon as a fluctuation can be plainly felt. I will add, that making a puncture in the centre of such abscesses, even before they are completely mature, appears to me to check their progress, and promote their dispersion." The puncture should be made in a depending situation, and if the skin be extensively thinned, or sinuses exist, incisions should be made at different points.*

Some cases are exceedingly obstinate, in consequence of several abscesses following one another in succession. Here the administration of opium and the sulphate of quinine will be found beneficial; and when a deep-seated abscess, in consequence of not being opened freely or soon enough, leads to the formation of sinuses in various directions, which continue to discharge matter for a long time, if they cannot be healed by pressure, we may follow Sir Astley Cooper's plan, which is, to inject into them a lotion of rose water, with every ounce of which two or three drops of concentrated sulphuric acid are blended, and apply the same lotion to the surface, and sometimes a bandage. Mr. Hey, of Leeds, was an advocate for laying open all sinuses of this kind; and M. Velpeau strongly insists upon the advantages of such practice, with the condition, that it be restricted to cases, where the fistulæ have existed several weeks or months, and ordinary incisions and other means have failed. While M. Velpeau gives his testimony in favour of opening *superficial*, *subcutaneous*, and *submammary* abscesses of the breast early, he recommends not opening those of the mammary gland itself, until a fluctuation is very distinct. In the latter cases, also, he finds, with M. Donné, that the milk secreted contains numerous globules of pus; and hence, he objects to the child being put to the breast in this state.†

*Chronic abscesses of the breast* occur chiefly in scrofulous constitutions, and are much less frequent than acute or milk abscesses. The matter ought to be let out, and an attempt made to improve the general health,

* Op. cit. p. 26. † Id. p. 39.

by some of the plans mentioned in the general observations upon scrofula. The state of the uterine functions, in particular, should always be inquired into; for they are often disordered, and then aloëtic and steel medicines are indicated.

With regard to diseases of the breast, arising from peculiar or specific action, but not malignant, I will first notice

### HYPERTROPHY OF THE BREAST,

Especially that, which M. Velpeau names *glandular*, is more frequently met with in the Indies, America, England, and Germany, than France. The principal cause of hypertrophy of the breast is ascribed by Sir Astley Cooper to celibacy; and, according to his observations, it occurs principally between the ages of thirty and thirty-five. He mentions a girl, only fifteen years old, whose breast, of a pyriform shape, and extending over the abdomen, was twenty-three inches and a half in circumference. One case is also recorded, in which the breast descended to the knees, and weighed thirty pounds. Others deem the age of puberty that in which this hypertrophy is chiefly noticed. As the swelling is not at first attended with pain, nor with any serious functional disturbance, its commencement does not excite much attention. The menses, however, are lessened in quantity, or are irregular, or even suppressed. The voice is also affected, and patients seem hoarse.

As the state of the mammæ is intimately dependent upon that of the womb, M. Velpeau regards marriage and pregnancy as the most likely mode of checking hypertrophy of the breast. The internal exhibition of iodine is also recommended, with iodine baths, and then rubbing the breast with an ointment, containing either the ioduret of lead, the iodide of potassium, or mercury. A vegetable diet is preferable to animal food, and a suspensory and compression are not to be neglected.

### HYDATID TUMOURS

Were so named by Sir Astley Cooper, who has described several forms of them. Since the expression *hydatid* would lead us to suppose, that the disease always consisted, not of adherent cysts, but of detached globular ones, endued with separate vitality, independent of the texture in which they are formed, many surgeons prefer the term *cysts of the breast.*

The tumour is characterised by a tendency to increase to a considerable size; but it is not prone to malignant change; nor does it occasion any inconvenience, except what proceeds from its bulk. At first, it feels entirely solid, but after a time a fluctuation can be distinguished at certain points. The tumour is very moveable and pendulous. Sometimes the cysts ulcerate, discharge a serous fluid, and then heal, or even become obliterated. No local applications are of any service. If there be only one large cyst, and it be punctured, sometimes it will not fill again. The only reason for removing this kind of disease, when it becomes large, is to relieve the patient from the annoyance produced by its bulk. All the swollen and indurated parts must be taken away, for if any small cysts remain behind, the disease will recur. The glands in the axilla are either free from disease, or only enlarged from irritation. M. Velpeau doubts whether the extirpation of a serous cyst of the breast is ever indispensably necessary. He would prefer making a puncture with a small trocar, emptying the cyst, and then injecting a lotion consisting of ʒij. of the

tincture of iodine in each ounce of water. He has tried the plan, however, only in one case, but with complete success.*

As for *swellings of the breast consisting of globular hydatids*, an incision should be made in them, and the bag extracted, after which the part will heal. The disease is characterised by a central fluctuation,a solid circumference, and freedom from tenderness on pressure. The disease is of an innocent nature. Dr. Warren describes one case, in which the tumour weighed twelve or thirteen pounds.†

### CHRONIC MAMMARY TUMOUR.

The substance of the female breast is liable to a slow kind of induration, —a swelling that grows from its surface rather than from its interior, and therefore seems to be superficial, except when it grows from the posterior surface of the breast. It is exceedingly moveable; not buried in the mammary gland, but only connected to its surface; not generally painful, nor tender when touched; its growth is slow; and its weight seldom more than from one to four ounces. It is not malignant, and often remains stationary for years, and then disperses. The disease seldom occurs in persons after the age of thirty.

The tumour, when taken out and examined, is lobulated, and at first view something like the mammary gland itself: it is contained in a cyst. The cause of the chronic mammary tumour is generally sympathy of the breast with the uterus, producing great determination of blood to the part; but blows and the pressure of stays may likewise excite it.

When the digestive functions are deranged, we may try the compound calomel pill at night, with the infusion of calumba and rhubarb and carbonate of soda twice a day. When the uterine functions are disordered, we may prescribe small doses of the blue pill, with extract of colocynth and steel medicines.

Sometimes the tumour yields to the internal and external use of iodine. The emplastrum ammoniaci cum hydrargyro is a common application. The disease does not require to be extirpated, nor, as Sir Astley Cooper observes, is it any impediment to matrimony; for, in fact, pregnancy and suckling rarely fail to make it disappear.

### SCROFULOUS SWELLINGS OF THE BREAST

Are occasionally seen in young women, who have enlarged lymphatic glands under the jaw. In general, there is only one tumour, and it is exceedingly indolent. There is no disposition to malignancy, and, of course, it would be improper to have recourse to extirpation. The treatment is like that of scrofulous diseases in general.

### IRRITABLE TUMOUR OF THE BREAST.

The breast is sometimes the seat of severe pain, without any distinct or perceptible swelling. Such an affection might be called *neuralgia* of the breast; but occasionally, besides excessive pain in the part, there is also a tumour, composed of a structure unlike that of the gland itself, and which therefore appears to be a specific growth. When the glandular structure is the seat of it, one or more of its lobes become exquisitely tender; and, if handled, the pain will sometimes continue for several hours, extending to the shoulder, axilla, down the arm, and even to the

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* Op. cit. p. 70.

† Warren on Tumours, p. 206.

side of the body. When the pain is most severe, which is often the case prior to menstruation, the stomach frequently sympathises, and the patient is troubled with vomiting. The *irritable* tumour is most common between the ages of 16 and 30.

Sometimes a distinct circumscribed tumour is noticed, highly sensitive to the touch, acutely painful at intervals, more especially just before menstruation, very moveable, often not larger than a pea, and rarely exceeding the size of a marble. Although the disease may continue for years, it varies but little in size, hardly ever suppurating, but occasionally disappearing of itself. In the general account of tumours, I have already noticed this disease, under the name of *painful tubercle*, as affecting other parts. The tumour, when taken out and examined, is found to be composed of a solid semi-transparent substance, with fibres interwoven with it; but, according to Sir A. Cooper, no large filaments of a nerve can be traced into it.

Equal parts of soap cerate and extract of belladonna may be applied; or a bread poultice made with a solution of the same extract. Or the part may be protected with a piece of oil-skin or hare-skin. Leeches are proper during the violence of the pain.

As internal remedies, we may try calomel with opium, and hemlock with purgatives. If the menstrual secretion be interrupted, the mistura ferri comp., combined with aloes, may be prescribed.

The breast is also liable to the greater number, if not all the varieties, of *tumours* noticed in our first section.

### THE ECCHYMOSE DISCOLOURATION OF THE BREAST

Is a morbid change, sometimes occurring in young women at the time of menstruation, preceded by severe pain in the breast and arm. Velpeau notices its occurrence also sometimes in women arrived at the critical age. The extravasation of blood makes its appearance as a large spot, with smaller and less conspicuous ones in other places. In general, it gradually disappears after menstruation. According to Sir Astley Cooper's views, the indications are, 1st, to render the menstrual discharge more regular, by means of steel medicines; and, 2d, to support the strength by means of sulphate of quinine, given with infus. rosæ comp. The best local application is the liq. ammon. acet. with spirit of wine, five ounces of the former to one of the latter. M. Velpeau does not consider any active treatment usually requisite, as the discolouration and pain almost always subside of themselves in a fortnight or month; but, if a contrary case presented itself, he would try one general bleeding, leeches to the breast, a discutient lotion, and purgatives and emmenagogues.

With respect to the *third class of diseases* of the breast, or the *malignant*, it comprises scirrhous and medullary cancer, the nature of which has been treated of in the first section of this work.

## WOUNDS OF THE BELLY

Are divided into two principal classes: in one, the solution of continuity is confined to the integuments, muscles, &c. exterior to the peritoneum; in the other, this membrane is penetrated, and frequently some of the viscera. Wounds, which do not extend through the peritoneum, are not materially different from those of ordinary textures, and are to be treated

on principles applicable to wounds in general. However, if the injury penetrate more deeply than the integuments, the parietes of the abdomen generally remain weakened at the part; and, firm as the cicatrix may appear, if it be not supported with a bandage, it is liable to become the seat of a hernial protrusion.* Severe contusions of the skin and muscles of the belly are also sometimes followed by such an incapacity of resistance in them, that they yield to the pressure of the contained parts, and a particular kind of hernial tumour is the consequence.

A spent ball, striking the belly, may rupture the rectus muscle and aponeuroses of the abdominal muscles, so as to produce at once a protrusion of the viscera; while the integuments, on account of their greater elasticity, continue unbroken.† In other examples, the ball, in its rotation over the circumference of the abdomen, not coming against any hard projecting part, depresses the parietes of the belly, and produces deeper mischief amongst the viscera, succeeded by inflammation, a copious effusion of bloody serum in the cavity of the peritoneum, and other fatal effects.‡ In a case that had a favourable issue, a cannon ball carried away the integuments, a piece of the left os ilium, and the attachments of the broad muscles of the belly, exposing a part of the sigmoid flexure of the colon.§

Sometimes, in consequence of punctured wounds, or violent blows, matter forms in the tendinous sheath of the rectus muscle; and when the abscess bursts, or is opened, several pints of pus are unexpectedly discharged. The nature of this case should be remembered, as there is frequently no change of appearance in the integuments, denoting either the suppuration, or its extent. Such an abscess ought always to be opened early, and in a depending situation. The same practice is advisable, when purulent matter collects between the layers of abdominal muscles, or between these muscles and the fascia transversalis, and the peritoneum.

Except when a wound of the belly is free and direct, attended with protrusion of the bowels, or the escape of feces, chyle, fetid air, bile, &c., the fact of its having penetrated the cavity of the abdomen is generally somewhat obscure. Authors do, indeed, advise us to compare the direction of the stab with the ordinary thickness of the abdominal parietes at the wounded part, and the breadth of the wound with that of the weapon with which the injury has been inflicted. When the instrument has entered perpendicularly at a place where the parietes are thin, and when, notwithstanding the narrowness of the end of the weapon, the division is rather broad, it is inferred that the wound is of the penetrating kind. This mode of judging, however, must generally be fallacious, on account of the frequent impossibility of learning the exact direction of the thrust, or of obtaining a sight of the instrument. Also when a probe will pass perpendicularly into the wound for a certain distance, it is concluded, that the injury extends into the abdominal cavity. But it must not be positively inferred, that the wound does not penetrate because a probe

* Richerand, Nosographie Chir. t. iii. p. 322. ed. 2. Schmucker relates a case, which followed puncturing an abscess of the abdomen with a lancet, Vermischte Chirurgische Schriften, band. i. p. 197. See also a case by Wardrop, in Sir A. Cooper's work on Crural and Umbilical Hernia, p. 60.

† Larrey, Mém. de Chir. Mil. t. iii. p. 332.

‡ Op. et vol. cit. p. 334.

§ See in Hennen's Mil. Surgery, p. 452., a case, in which nearly all the anterior parietes of the belly were torn away, leaving the lacerated peritoneum exposed. The injury was not immediately fatal.

cannot be thus introduced; for its passage may be stopped by the several layers of muscles not having exactly the same situation with respect to each other which they had at the moment of the injury. In short, unless the wound be straight, a probe can hardly be made to follow its course. The local symptoms, then, of a simple penetrating wound are frequently not to be depended upon, and the employment of probes and injections for ascertaining the point is more likely to do serious harm than real good. Nor can certain information always be deduced from a consideration of what may be called the *general* symptoms; a small, feeble, contracted pulse; pallid countenance; cold extremities; great and sudden debility; hiccough; vomiting; and spasms. Several of these effects frequently take place in irritable, timid, nervous subjects, without any parts being injured in addition to the skin and muscles; and they are frequently absent when the weapon has actually entered the peritoneum. I am far from meaning to say, however, that such indisposition is to be disregarded; on the contrary, it seems to me, that particular attention ought to be paid to the symptoms in question; because, if they do not soon subside, there are then strong grounds for suspecting something more than the effects of a common superficial wound on an irritable, timid subject. But, in the beginning, unless the wound be large, or a protrusion of the viscera, or a discharge of bile, chyle, or feces, take place, there is generally a degree of uncertainty with respect to the depth of the injury. At the same time, it is not to be concluded that the wound does not penetrate because no protrusion nor extravasation happens; for a narrow stab may extend into the abdomen, even amongst the viscera, without giving rise to either of these accidents.

There is in these cases a class of symptoms which Richter * and other writers denominate *particular*, from their evincing what bowels are wounded; as, for instance, bloody urine, when the kidneys and urinary bladder are injured; vomiting of blood, when the stomach is pierced; discharge of blood with the feces, when the large intestines are wounded. Symptoms like these must of course throw considerable light on the nature of the accident.

With regard to our not being always able to pronounce whether a wound penetrates the cavity of the belly or not, the want of precise information on this point is of little practical importance; for, if the case be not complicated with any urgent symptoms, the treatment should obviously resemble that of a simple wound.

The principal dangers of penetrating wounds of the belly partly arise from internal hæmorrhage, or extravasation of the contents of the viscera; but, in a still greater degree, from the strong disposition of the peritoneum to inflammation. With the exception of persons who die instantly, or in a few hours, from internal bleeding, &c., nine tenths of those who die from penetrating wounds of the belly, are cut off by peritonitis. They who perish with extravasation of the contents of the bowels, also die in fact from peritonitis, which is generally excited partly by the injury, and partly by the irritation of the effused matter. Many authors represent the danger of a penetrating wound of the belly, as principally arising from the entrance of air into the cavity of the peritoneum. But, according to my ideas, it is the wound itself that excites the peritonitis, by which the patient is destroyed; and the same fatal inflammation would come on with equal frequency, were the wound entirely excluded

* Anfangsgr. der Wundarzn. b. v. p. 7.

from the air. The cavity of the belly is always so completely occupied by the viscera, that the whole inner surface of the peritoneum is constantly in close contact with them, and, therefore, the air cannot so easily enter within that membrane as some writers seem disposed to believe.

### WOUNDS IN WHICH THE VISCERA PROTRUDE, BUT ARE UNINJURED.

When a portion of intestine or omentum protrudes, the sooner it is returned, the more effectually will the irritation, arising from its exposure and constriction be prevented. Fomenting the protruded bowels, as is sometimes recommended, would be absurd; for what application can be so congenial to them, as the natural warmth and moisture of that cavity into which they ought to be immediately reduced? And is it possible to suppose, that the efficacy of any artificial fomentation will make amends for the harm, resulting from continuance of the bowels in a state of exposure and constriction? In order to promote the reduction, the muscles of the abdomen should be relaxed; but, whether we ought to waste any time in giving clysters to empty the large intestines, previously to attempting to return the parts, is a question, on which I entertain the same sentiments as those delivered on the subject of fomentations. The mesentery is always to be returned before the intestine; and the intestine before the omentum; but the last protruded portion of each of these parts ought to be first reduced. In the reduction, care must be taken that the bowels are completely returned into the abdomen, and are not pressed between the layers of the abdominal muscles, or into the sheath of the rectus muscle.

When the distension of the protruded intestine with air or feces creates a difficulty of reduction, its contents may frequently be gradually pressed into that portion of the intestinal canal which is within the abdomen, and the gut may then be returned. But, if this plan were attended with difficulty, I should prefer dilating the wound to much handling of the bowel.

When the protruded bowel is distended with air, Paré and others recommended making small punctures in it with a needle, so that the air may escape, and the intestine collapse. This proposal is justly rejected from modern surgery, both on the grounds of danger and inefficacy. The small apertures made with a round needle will not discharge the air; for they are closed by the mucous coat*, and the making of larger punctures, as suggested by Desault†, would be far more dangerous than dilating the wound. When it is absolutely necessary to enlarge the wound, the dilatation should be made in a direction which will not endanger the epigastric artery; and, if possible, parallel to the muscular fibres.

When the protruded intestine is already inflamed, its immediate reduction is, beyond all dispute, the right practice. Even when the inflammation is severe, the reduction of the part without delay, and the employment of antiphlogistic means, will often prevent gangrene. The dull, brown, dark-red colour of the protruded intestine, may induce the practitioner to suppose, either that it is already gangrenous, or that gangrene is inevitable, and, consequently, he may delay returning it into its natural situation. But, notwithstanding this suspicious colour of the intestine, its firmness will evince that it is not in the state of gangrene,

* See Travers on Injuries of Intestines, &c. p. 176.
† Traité des Maladies Chirurg. tom. ii. p. 135.

and, therefore, its immediate reduction ought to be put in practice. The recovery of a portion of intestine, so circumstanced, is always a matter of uncertainty; but the propriety of speedily replacing it in its natural situation is a thing most certain. In case it should mortify, after being reduced, all hopes of the preservation of life are not to be abandoned.

When the omentum protrudes, and is strangulated by the narrowness of the opening, it soon contracts adhesions. Richerand has recommended us to cut off all this membrane which exceeds the level of the integuments, and not to trouble ourselves about the remainder, which, he asserts, will act like a stopper, and hinder a future hernia. If adhesions had already been formed, this practice would, perhaps, be the best, but under other circumstances, if the omentum were sound and free from constriction, it should unquestionably be reduced without delay. In cases where this membrane, besides protruding, is in a gangrenous state, certain writers authorise the excision of the dead part, and the reduction of the rest, each of the bleeding vessels having been first tied with a small silk ligature. It will be found, however, that whenever the omentum has been out so long as to slough, adhesions within the wound have had time to form; an event which would embarrass the operator, and constitute a decided prohibition to the attempt. The reduction having been effected, the patient is to be laid upon his back, with the thighs somewhat raised or bent, and he must strictly avoid making any exertion, lest he bring on another protrusion. The wound is then to be closed with adhesive plaster, the uniting bandage, or a suture. Sewing up wounds of the belly made a long subject, in all the old works on surgery, under the appellation of *gastroraphe*, which was nothing more than a quill-suture, practised by introducing the needle through both lips of the wound from within outwards, in order to avoid all risk of pricking the bowels. In Pibrac's* dissertation on the abuse of sutures, cases are related which satisfactorily prove, that the majority of penetrating wounds of the belly may be healed very well without it; and if we wish for still more decisive proofs of the fact, we may find them in accounts of the Cæsarean operation, the extensive wound of which has frequently been healed by common means. But, though sutures are not necessary for all wounds of the belly, they may be useful under particular circumstances: for instance, were the wound of a certain size, they might be indispensable to prevent the protrusion or exposure of the bowels.

### CASES WITH INJURY AND PROTRUSION OF THE VISCERA.

Penetrating wounds, attended with protrusion of the intestines or omentum, are always to be regarded as dangerous cases; but the danger is much more serious, when a portion of the intestine not only protrudes, but is wounded. Under such circumstances, we have the authority of numerous writers on surgery, as a sanction of the practice of sewing together the edges of the wound in the bowel; the true utility of which practice, however, is now a disputed point. Even the advocates of sutures here differ exceedingly, both as to the precise object in view, and the way of making the stitches. Some advise only one stitch to be made (frequently only through the mesentery); and they employ the ligature

* See Mém. de l'Acad. de Chir. tom. iii. 4to. Other cases of similar success may be perused in numerous works; Journal de Médecine, tom. lxxi.; Duncan's Medical Commentaries, vol. x.; Philosophical Transactions, vol. xvi. &c.

chiefly with the view of confining the injured bowel near the external wound, so that, in the event of any effusion, the matter may readily find its way outward. Other writers wish to remove the possibility of extravasation by applying numerous stitches, and attach little importance to the plan of using the ligature principally for the purpose of keeping the intestine near the external wound.

When the wound of a bowel is so small, that it is closed by the protrusion of the villous coat, the application of a suture must evidently be needless. Supposing the breach in the intestine, however, to be somewhat larger, so as to be capable of letting the feces escape, what practice ought we to follow? — As Sir Astley Cooper was operating upon a strangulated hernia, an aperture, giving issue to the intestinal contents, was discovered in a portion of sound bowel, just when the part was about to be reduced. The operator, including the aperture in his forceps, caused a fine silk ligature to be carried beneath the point of the instrument, firmly tied upon the gut, and the ends cut off close to the intestine. The part was then replaced, and the patient recovered. Mr. Travers, who has related this fact, approves of the plan of cutting away the extremities of the ligature, instead of leaving them hanging out of the external wound; for the remnant always finds its way into the intestine, and is discharged by stool, without the slightest inconvenience.*

We are next to consider the case, in which the protruded bowel is still more extensively, or even totally, divided. Here the admirers of the needle have found ample scope for their ingenuity; and since very few of them have met with cases exactly of this description in the human subject, they have made a variety of experiments on animals, in order to determine the right mode of treatment. Some of these reports are favourable to the practice of sewing up the wounded bowel. Ramdhor is stated to have actually cut off a large part of a mortified intestine in the human subject, and to have joined the sound ends together, by inserting the upper within the lower one, and fixing them in this position with a suture; the ligature being also employed to keep them near the external wound. The patient recovered, and the feces afterwards passed entirely the natural way.† About a year after the operation the patient died, when the anatomical preparation of the parts was sent to Heister. They were preserved in spirit of wine, and exhibited, according to this last author, a union of the two ends of the bowel, and their consolidation with a part of the abdomen. Now, it has been reasonably questioned, whether the union here spoken of ever really happened. When the upper end of the bowel is introduced into the lower, the external surface of the former is put in contact with the inner one of the latter; a serous membrane is placed in contact with a mucous one. These heterogeneous structures are not disposed to unite. The mucous membrane, when inflamed, more readily secretes a kind of mucus, which must be an invincible obstacle to adhesion. In the case related by Heister, the invagination was probably maintained by the union of the intestine with the corresponding part of the abdominal parietes. Several experiments on living animals tend to prove, that the mucous membrane will not unite with the external peritoneal coat. If this be a fact, it is of course a

* Inquiry into the Process of Nature in repairing Injuries of the Intestines, &c pp. 112, 113.

† Haller, Disput. Anat. vol. vi.; Obs. Med. Miscell. 18.

strong argument against repeating Ramdhor's practice. Another objection is, that the upper end of the bowel cannot be put into the lower one, unless it be separated from a part of the mesentery, and a division of the mesenteric arteries would cause a dangerous bleeding. In vain did Boyer tie seven or eight of these vessels; his patient died with an extravasation in the abdomen.* The difficulties encountered by Moebius and Dr. Smith in their attempts to repeat this experiment on animals, are related in my Dictionary, and I need not, therefore, expatiate upon them. In short, experience is decidedly adverse to Ramdhor's practice, either in its original form, or modified by the ingenious introduction of cylinders of isinglass, pasteboard, &c. Flajani tried the artifice on several patients under his care in the hospital at Rome, but death was invariably the consequence.† I am of opinion that Mr. Travers deserves the thanks of the profession, for the attention and talent with which he has investigated the subject before us; but, with respect to the question of sutures, I apprehend that he has gone too far, when he declares that, in order to avoid abdominal effusion, the suture employed should be such as will secure the absolute contact of the everted surfaces of the divided intestine.‡

When the intestine has been completely divided with a cutting instrument, Scarpa§ is decidedly of opinion, that Ramdhor's operation cannot be undertaken with any probability of success. But, setting out of the question this bold method, at once so amusing and captivating to the inexperienced student, this eminent professor offers a variety of arguments against sewing the intestines at all, and asserts that *in all cases of penetrating wounds of the abdomen, attended with injury of the intestine, whether the canal be opened longitudinally or transversely, a suture is always not merely useless, but even dangerous and fatal.* In whatever manner it is practised, says he, one cannot avoid the evils which must originate from the punctures, however few, and from the passage of the ligatures through the coats of the intestine; a part endued with exquisite sensibility, and whose external tunic is much disposed to inflame, and rapidly to communicate the inflammation to all the other abdominal viscera. It has (says Scarpa) been unfortunately proved, by the experience of several ages, that, in most of the cases in which the intestine has been stitched in penetrating wounds of the belly, the patients have died in the greatest agony. If a few escaped the dangers of this operation, it was only because in them the stitches soon cut their way out, and were voided with the feces, which continued to escape from the wound until it was entirely healed.

All surgeons of experience, and particularly those of large hospitals, have often seen wounds of the right or left iliac region accompanied with injury of the great intestine. They may also have noticed in these examples, that, after the subsidence of the local and general inflammatory symptoms, the wound still continues to discharge feces for a certain time; but that afterwards it contracts, and the excrement resumes its usual course. These wounds almost always heal‖ completely: first, because

* Richerand, Nosogr. Chir. t. iii. p. 345. &c., edit. 4.

† Collezione d'Osservazioni, &c. di Chirurgia, tomo iii. p. 60. 8vo. Roma, 1802.

‡ Inquiry into the Process of Nature in repairing Injuries of the Intestines, p. 121. and p. 134.

§ Sull' Ernie Memorie Anatomico-Chirurgiche; mem. iv. fol. Milano, 1809.

‖ See Larrey's Mém. de Chir. Mil. t. ii. p. 161.

the adhesion of the large intestine to the parietes of the abdomen prevents the feces from being extravasated in the cavity of the peritoneum; and, secondly, because the ample capacity of the same bowel always presents a ready passage for the feces, notwithstanding the progressive, and sometimes quick, closure of the external opening.

If, in the instance of a penetrating wound of the belly, attended with injury of the small intestines, it were in the surgeon's power (as indeed it is) to return the bowel into the abdomen, so that the opening in it may exactly correspond to the wound in the abdominal parietes, there could not be a doubt of its quickly acquiring adhesions to the peritoneum, which lines the part around the internal orifice of the external wound. Hence, the feces would readily escape from the outer wound, and at length the artificial anus would close, and the feces resume their natural course, just like what happens in wounds of the large intestines. The narrow diameter of the small intestines would not make an insurmountable obstacle to the passage of the feces, if these were, as they usually are, in this part of the alimentary canal, in a sufficiently fluid state; and besides (as Scarpa observes), is it not proved by experience, that they resume their natural course, after the cure of an artificial anus, even when a considerable noose of the small intestines has been destroyed by gangrene, and when the two ends form by their reunion a very acute angle? Scarpa then feels no hesitation in admitting the possibility of curing wounds of the small intestines, without having recourse to a suture. It would not, he says, be difficult to quote examples of such cures; and one is related, which fell under his own observation. He afterwards describes the incessant pressure made by the abdominal muscles and diaphragm upon all the viscera, as the cause which makes the wounded intestine enter the external wound, and soon adhere to its edges, instead of quitting it. When these adhesions are formed, all danger of extravasation is over. He observes, that one should neglect no remedies, internal as well as external, which may be of use in moderating the patient's sufferings, diminishing the impetus of the circulation, and bringing the inflammation down to the degree suited to the formation of adhesions. He recommends keeping the external wound open, with the same precautions, and according to the same indications, which are to be attended to in the treatment of an artificial anus. The principal object of these precautions is to let the treatment be such, that the external wound may only diminish in proportion as the evacuation from the lower part of the intestinal canal increases.

The very nature of the process, by which the reparation of wounds of the bowels is effected, is a weighty argument against the employment of a suture. In their cicatrisation, they follow quite a different course from that of simple wounds of the skin, muscles, or any other parts of the body. Their edges never become immediately applied to each other, and therefore, strictly speaking, they do not reunite. Their cure is altogether completed through the medium of the surrounding parts; that is to say, by the adhesions which the intestines contract with the great sac of the peritoneum lining the cavity of the abdomen, or with the productions of this membrane, which compose the external covering of the greater part of the viscera.*

Even from the description which Mr. Travers has given of the process of reparation, in the cases where sutures are employed, we may conclude,

* See case recorded by Littre in Acad. Royale des Sciences, an. 1705.

that the stitches can be of little service; for, says he, "the action of the longitudinal fibres being opposed to the artificial connection, *the sections mutually recede as the sutures loosen by the process of ulcerative absorption.*" * Unless, therefore, it be allowable to suppose, not only that the divided portions of bowel can be sewed together so closely and accurately at every point as to remove all possibility of effusion of its contents, but that this can also be done without risk of exciting inflammation of the bowel, thus handled, dragged, and stitched, I must fully agree with Scarpa, respecting the impropriety of thus boldly sewing up wounds of the bowels with as little scruple as a hole in a glove.

In some former editions, I have said, that if a case were to present itself, in which a protruded intestine were extensively cut, or its whole diameter completely divided, I should venture to make a single stitch with a small needle and piece of fine silk. But subsequent reflection and information make me doubt whether this limited employment of the needle would be necessary; and if not necessary, it would undoubtedly be improper. The following case, which, as well as Ramdhor's memorable experiment, is at variance with another statement, that wounds amounting to a direct division of the canal are irreparable, and therefore invariably fatal†, furnishes an unequivocal proof, not only that an intestine may be completely cut through, and the injury not always be fatal, but that the cure may be effected without any stitching whatever of the bowel. At the assault of Cairo, in 1799, M. N—— was struck by a ball, which divided the muscular parietes of the abdomen, and a portion of the ileum. The two ends of the bowel protruded, were separated from each other, and very much distended. The upper end was everted, its contracted edge strangulating the intestinal tube, as the prepuce does the penis in paraphymosis. The progress of the contents of the bowel being thus obstructed, they accumulated above the constriction. Larrey began with making four small incisions in the constricted part of the intestine; he then passed a ligature through the portion of mesentery corresponding to the two ends of the bowel; reduced them as far as the edge of the opening, which he took care previously to enlarge; and, having dressed the wound, he awaited events. Without detailing the subsequent particulars of the case, suffice it to say, that in a few months it ended in a perfect recovery.‡

It is curious that Flajani, who has so decidedly reprobated Ramdhor's practice, and mentioned facts against it from his own experience, should recommend stitching a wounded and protruded bowel in any manner; for, with the exception of his unfortunate trials of inserting one end of the bowel into the other, in the cases which occurred in the hospital at Rome, he records only two instances in which he stitched the intestine, and, in both these, the bowel became gangrenous, and the patients lost their lives. § We may therefore infer, with Mr. John Bell, "that if there be a work of supererogation in surgery, as I believe there are but too many, surely this of sewing an intestine is one." ‖

Every reflection, then, which I can make on this subject leads me to

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* Inquiry into the Process of Nature in repairing Injuries of the Intestines, p. 28.

† Op. cit. p. 133.

‡ Larrey, Mém. de Chir. Militaire, t. ii. pp. 160, 161.

§ Collezione d'Osservazioni, &c. di Chirurgia, t. iii. p. 35—41. In one case, the protruded bowel was a portion of jejunum; in the other, a piece of colon.

‖ Discourses on the Nature and Cure of Wounds, edit. 3d, p. 320.

adopt Scarpa's sentiments in relation to sutures, and the indications, which should be fulfilled. The chief indication, and that on which the patient's safety mainly depends, consists in keeping the external wound open, in order that the feces may find a ready outlet. The wounded bowel soon contracts adhesions to the inner lips of the wound of the belly, and then we have nothing to fear from an extravasation of intestinal matter in the cavity of the peritoneum. Afterwards, in proportion as the feces resume their natural course, the external wound is to be allowed to diminish, and entirely heal up.*

In every instance of a penetrating wound of the abdomen, attended with injury and protrusion of a portion of the intestinal canal, if the patient be not already in a hopeless or dying state, from internal hemorrhage and other lesions, the displaced part is to be reduced, whatever we may choose to do in respect to the free or limited employment of stitches, or their absolute rejection. The reduction should be performed as speedily as possible, before the bowel has suffered much from exposure, constriction, &c., and also before any adhesions have formed at the inner orifice of the external wound; adhesions which would make the reduction of the protruded part impracticable. Of course, when the wound is so small, that the reduction cannot be effected without handling and bruising the bowel immoderately, it ought to be carefully enlarged with a curved bistoury, guided on a director. Indeed, according to Scarpa's principles, one would suppose that the wound, if not free, should always be dilated, as by this means the ready escape of any extravasated matter would be insured. The rest of the treatment consists in antiphlogistic measures, more especially copious and repeated venesection, with the view of counteracting the danger of peritoneal inflammation. With respect to the dressings, they cannot be too light, simple, and superficial, except when the stoppage of evacuation in the natural way, and the issue of the intestinal contents from the breach in the bowel, are such as to lead us to adopt particular means for hindering a premature closure of the external wound. The tepid water dressing is one of the best.

The pressure of the elastic bowels, and of the diaphragm, and abdominal muscles, not only frequently presents an obstacle to the wide diffusion of extravasated matter, but often propels it towards the external wound.† We can conceive no power capable of overcoming the resistance so produced, to the extensive dispersion of extravasated fluids in the cavity of the abdomen. Numerous cases are on record of persons being stabbed, or shot through the body, without any effusion in the abdomen, or other very serious consequences. In some few of these instances, the bowels, perhaps, might have eluded the ball, or point of the weapon; yet it is highly probable that, in most of them, the bowels were injured, and that an extravasation of the intestinal matter was impeded by the pressure to which I have referred. In many of the cases, the intestines were known to be wounded.‡

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* Scarpa sull' Ernie Memorie Anatomico-Chirurgiche; mem. 4.

† On this subject, I would particularly recommend the reader to consult two essays by M. Petit le Fils, one entitled "Essai sur les Epanchemens et en particulier sur les Epanchemens de Sang;" the other, "Suite de l'Essai sur les Epanchemens," in Mém. de l'Acad. de Chir. tom. ii. and iv. 12mo.

‡ Recoveries are recorded in Wiseman's Surgery, p. 371. Œuvres de Paré, liv. x. chap. 35.; La Motte, Traité Complet de Chir. Albucasis, lib. ii. cap. 26.; Ravaton, Traité des Playes d'Armes-à-Feu, chap. 6., &c. &c.

PENETRATING WOUNDS, ATTENDED WITH INJURY OF THE VISCERA, BUT NO PROTRUSION.

A wound of the intestines is indicated by the discharge of blood with the stools, and sometimes by the escape of fetid air, or of intestinal matter from the external wound. Such an injury, however, when the wounded bowels lie concealed in the belly, does not always admit of being immediately known with certainty. In the majority of examples, there is at first no escape either of air, or of the contents of the bowels, from the external wound; the quantity of blood voided per anum may be inconsiderable; and however this may be, none at all will generally be discharged downwards, until a certain time after the accident. Wounds of the small intestines, especially of the duodenum and jejunum, are indeed usually followed by great anxiety, paleness of the countenance, syncope, cold perspirations, and a small, intermitting, tremulous pulse; but these symptoms are far from being unequivocal, and they cannot be said to furnish any positive information, because a superficial cut, or unimportant stab, frequently causes similar indisposition in subjects of nervous, irritable, or timid habits. Our inability, however, to say positively in every case, whether the bowels are injured or not, is of no practical importance; because, when the nature of the accident is not clearly manifested by some peculiarity or severity of the symptoms, the case ought to be treated on common antiphlogistic principles; and also, when circumstances leave not the smallest doubt of the intestines being hurt, the same treatment is the only rational plan. Wounds of the small intestines are more dangerous than those of the large, and the nearer the injury is to the pylorus, the greater is the risk. Such cases are also much more frequently than injuries of the large intestines the cause of extravasation. In the latter examples, the symptoms are generally milder, and either the passage of the intestinal contents outward through the wound more easy and certain, on account of the bowel being more fixed than the rest of the intestines; or their passage towards the anus more ready, by reason of the greater capacity of the cœcum, colon, and rectum.

There are several other facts, highly interesting, and absolutely necessary to be remembered in relation to wounds of the bowels: my limits, however, oblige me to pass over the rest of this subject with as much brevity as possible; for which, the fuller account in my dictionary will also afford a just excuse. Were it not for these considerations, I should have felt myself obliged to enter into explanations of the particular appearances presented, as well by punctured wounds, as by transverse and longitudinal cuts in the intestinal canal; and to comment on the circumstance of small punctures being obliterated by the protrusion of the villous coat. I should also have had to point out the results of Mr. Travers's experiments on dogs, proving that, in these animals, a division of the small intestine as far as the mesentery is always fatal; that generally in wounds of the intestinal canal, the retraction, immediately following the injury, is a chief obstacle to its reparation; and that longitudinal wounds of the bowels are more easily repaired than such as are transverse. This tendency of the two portions of a divided bowel to recede from each other, tends to show, that the only mode of spontaneous reparation consists in the formation of an adventitious canal, by the encircling bowels and their appendages.

In the preceding remarks, I have adduced many arguments, casting

doubt on the propriety of sewing up a wound in a protruded bowel; but, when the injured intestine lies in the cavity of the belly, the rashest surgeon, the greatest admirer of needles, would never think of ripping open his patient for the sake of performing so cruel and fatal an experiment. In fact, as I have already stated, we rarely know at first that the bowel is injured; for extravasation, as will be presently related, is not the most usual consequence of a wound of an intestine: when it happens, the extravasated matter does not always flow out of the external wound, and indicate the nature of the accident; and, if an extravasation should become manifest in a later stage of the case, it would then be impossible to get at the wound of the bowel, on account of the adhesions, which generally form with surprising rapidity. Even if the wound of the intestine were known to exist directly after the receipt of the injury, and a suture were not objectionable, on grounds already detailed, it could not be applied without enlarging the external wound, searching for the wounded bowel, and drawing it out of the cavity of the abdomen. By these steps, a wound, not at first essentially fatal, might be so altered for the worse, as to leave no possibility of recovery. When an intestine is first found to be wounded, from the occurrence of extravasation, a day or two after the injury, a suture is entirely out of the question, as by this time the part is entirely fixed in its situation by the adhesive inflammation, — that salutary process, which also circumscribes the effusion, and throws out an effectual partition between the extravasated fluid and the general cavity of the peritoneum.

When the wound of the intestinal canal is situated in the abdomen, closely behind the external wound, a suture is also unnecessary, because, if care be taken to keep that opening from closing too soon, the contents of the gut will be discharged outwardly, and there will be no reason to fear their diffusion among the viscera. Nor is the wounded bowel at all likely to slip away from the outer wound, if the patient be kept duly quiet for a few hours, after which the adhesions render a change in the situation of the bowel quite impossible.

In a penetrating wound of the abdomen, caused either by gunshot or a pointed instrument, if no protrusion of intestine take place, the lancet, abstinence, and quietude, should be our chief dependence. In short, as the main danger is inflammation of the peritoneum and bowels, the rigorous adoption of antiphlogistic treatment is indispensable. Pain and tension must be relieved by leeches, fomentations, and the warm bath; and if any purgative medicine be given (which, however, I think should never be done before time has been afforded for the formation of adhesions), it should be of the mildest description possible. Castor oil is perhaps the safest which can be employed. In these cases, indeed, clysters are generally to be preferred to any other means of emptying the bowels. By the simple observance of an antiphlogistic plan, wounds, in which several folds of the bowels were hurt, have been happily cured. Authors abound with instances of this kind. One related by Littre, I have already referred to in this chapter. Garengeot and La Motte record others; and Dr. Hennen has seen several: one was the recovery of a soldier, who had been shot through the abdomen with a ramrod at the siege of Badajos, in 1812. The instrument entered the front of the abdomen, and actually stuck in the vertebræ, from which it could not be disengaged without force.*

* Obs. on Military Surgery, p. 436, 437.

Patients, who have recovered from wounds of the bowels, should afterwards be extremely temperate in their diet, and, above all things, avoid taking any kind of flatulent, stimulating, indigestible food. They must also be very careful to keep their bowels regular.

In all cases of penetrating wounds of the belly, the dressings should be light, simple, and superficial. If excrementitious matter be discharged from the opening, the utmost attention must be paid to cleanliness. We should also recollect the precept inculcated by Scarpa, viz. that the external wound should only be allowed to close, in proportion as the feces resume their natural course, with ease and regularity.

Sometimes the intestinal matter continues to be discharged for a considerable time from the wound, and even during the rest of the patient's life, either through a fistula, or an artificial anus. In general, however, this affliction gradually ceases. In almost every collection of cases, we may find examples fully proving, not only that simple stabs of the bowels in the end get well, without leaving a permanent annoyance of this kind, but that large portions of the bowels may even be destroyed by gangrene, and yet the continuity of the intestinal tube be completely re-established. From the facts quoted in this chapter, it would also appear, that a complete division of a bowel is neither certainly fatal, nor necessarily followed by an irremediable artificial anus.

Balls, shot into the abdomen, are occasionally discharged with the stools.

### EXTRAVASATION.

An occasional consequence of a penetrating wound of the abdomen is an extravasation in the cavity of the peritoneum. The extravasated matter may be undigested food, chyle, the succus pancreaticus, feces, bile, urine, blood, &c., according to the nature of the injured parts. Fortunately, this kind of accident is far less frequent than an inexperienced surgeon would apprehend, or than our hearing so much of the *cavity* of the abdomen would lead us to expect. Strictly speaking, no empty space exists within the animal body; and all the parts, contained in the abdomen, are in close contact with one another, and with the inner surface of the peritoneum. Hence, except under particular circumstances, though the bowels may be wounded, extravasation is generally prevented altogether; or when it does happen, the effused matter may all lie in one mass, and become circumscribed by the adhesive inflammation.

If, immediately after a wound of the belly, and of its contents, it be the compact state of the contained and containing parts, which at first hinders extravasation, it is that salutary process, the adhesive inflammation, which afterwards renders the occurrence quite impossible; or bounds or circumscribes the effusion, if it should have already taken place. In fact, all the surfaces in contact with each other, and surrounding the track of the wound, become generally so intimately connected together, by the adhesive inflammation, that the wound forms a sort of canal, entirely destitute of all communication with the cavity of the peritoneum; and the rapidity with which such adhesions occur is very great.

According to the investigations of Mr. Travers, the following are the only circumstances, in which an effusion of the intestinal contents can happen. If the gut be full, and the wound extensive, the surrounding pressure is overcome by the natural action of the bowel tending to the expulsion of its contents. But, in defect of either of these states, effusion cannot follow. When, however, air has escaped from the bowel, or blood

has been extravasated in quantity within the abdomen, at the time of the injury, the resistance made to effusion will be less effectual, although the pressure of the sides of the abdomen is the same, as such fluids will yield more readily than the solids naturally in contact with each other. Effusions more generally follow ruptures of the bowels by blows or falls upon the belly, than ordinary penetrating wounds.*

When an extravasation is perceived, in the first instance, a part of the wound is to be left open, and the posture of the patient is to be so regulated, that the wound may be as depending as possible, and the effused fluid readily escape. If the extravasation should not be perceived till after the wound has been dressed, we are directed to remove the means employed to close a part of it, and to place the patient in a proper posture, with a bandage applied round his body. When internal hemorrhage is suspected, and the state of the pulse will admit of it, venesection is proper.

When symptoms of irritation exist, attended with local inflammation, pain, and a fluctuating tumour, denoting the seat of the extravasation, the effused fluid is to be let out by a puncture.† In the Memoirs of the Academy of Surgery may be found observations, recorded by Petit and Le Vacher, illustrating the advantages of such treatment.

When there are no symptoms denoting the exact seat of the extravasation, the treatment should be restricted to the prevention, or diminution, of inflammation. Venesection is to be resorted to, or not, according to the state of the pulse; the belly fomented two or three times a day; and only liquid aliment allowed, sometimes merely barley water. In some cases, a bandage is applied round the body, as a means of promoting that compact state of all the parts in the abdomen by which the ill consequences of extravasations are so materially diminished.

Musket balls may pierce and lodge in the bladder, in which circumstances a surgical operation, resembling lithotomy, will become necessary, as soon as the dangers of the first injury are past.‡ In wounds of the bladder, a great deal of difference in the degree of danger will depend upon whether this organ happens to be full of urine at the time of the accident, and whether the injured part of it is one over which the peritoneum is reflected. In all cases, however, the principal danger depends upon the chance of the urine becoming effused, and exciting inflammation and gangrene of the peritoneum, bowels, cellular tissue, and, in short, of every part with which it comes into contact. The obvious indications are to make a free and depending outlet for any urine already effused; to prevent a further extravasation by the continual use of an elastic gum catheter; to keep down and diminish inflammation by copious bleeding and low diet; and to avoid every sort of dressing at all likely to irritate or obstruct the wound itself. The best applications, indeed, are light, simple pledgets, or lint kept soft with tepid water, the strictest attention to cleanliness being paid. The cases are now numerous, in which considerable wounds of the bladder terminated favourably under such treatment.§

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* See an Inquiry into the Process of Nature in repairing Injuries of the Intestines, &c., p. 25—36.

† Richter's Anfansgr. der Wundarzneykunst, band. v. p. 38.

‡ See Larrey's Mém. de Chir. Mil. t. iv., and Hennen's Mil. Surgery.

§ Such facts are abundant in Larrey's excellent work, especially the 4th vol. Flajani relates another case, in which the means were restricted to antiphlogistic remedies. Collez. d'Osservazioni, t. iii. p. 39. Thomson saw fourteen examples of wounded adder recovering. See Obs. in the Military Hospitals in Belgium, p. 108. &c.

## THE PSOAS, OR LUMBAR ABSCESS,

Is a collection of matter, formed in the cellular tissue of the loins, behind the peritoneum, and mostly descending in the course of the psoas muscle, until it produces a swelling below or above Poupart's ligament, or glides under the fascia of the thigh. In a few cases, it descends into the pelvis, whence it passes through the sacro-ischiatic foramen, and forms a swelling near the anus. Sometimes it passes backwards on the outer edge of the quadratus lumborum, and sacro-lumbalis muscles, so as to cause a swelling on one side of the loins; and, in some rare cases, it takes the course of the spermatic chord, and forms a tumour projecting through the abdominal ring, such as superficial observers might easily mistake for a hernia. The disease furnishes one of the best illustrations of the nature of large chronic abscesses, and especially of those usually regarded as scrofulous. It begins with slight uneasiness in the loins, and a weakness in walking; but no acute pain may have been experienced, though the matter be already copious enough to produce an external swelling. By degrees, however, the quantity of matter becomes considerable, producing a sense of tension and weight about the loins, pains shooting down the lower extremity, and some degree of hectic disturbance of the system. As the disease advances, the lower extremity of the same side becomes more and more weakened, and the thigh inclines forwards. In a girl, who was under my care in University College Hospital, with a double lumbar abscess, both thighs were drawn close up to the abdomen.

Lumbar abscess may or may not be combined with caries of the vertebræ; and the disease of the bone may be either the cause or the accidental accompaniment of the collection of matter. At the same time I ought to mention, that my friend Sir Benjamin Brodie is led by his experience to believe, that lumbar abscess is rarely the primary disease, but commonly originates from caries of the vertebræ. When a psoas abscess is joined with disease of the lumbar vertebræ, there is no paralysis, a peculiarity referred by Sir Benjamin Brodie to the greater magnitude of the bodies of the lumbar as compared with those of the cervical or dorsal vertebræ, in consequence of which the former are not destroyed by the same degree of caries which would be sufficient for the destruction of the latter. In the lower part of the spine, the disease seldom reaches the theca vertebralis. It is the disposition of lumbar and other chronic abscesses to begin very slowly and insidiously, and to increase in the same way, until, from containing a few ounces of matter, they include at last several quarts. The matter of a lumbar abscess frequently presents flakes of a curdy substance, like those seen in other scrofulous abscesses; and the whole cavity, in which it collects, is lined by a membrane called *the cyst of the abscess*, which has somewhat the appearance of a mucous membrane, and is the organ by which, after the disease is established, the matter continues to be incessantly undergoing secretion and absorption. The extent of the surface of such a cyst may well be conceived, when it is recollected that a lumbar abscess sometimes contains a gallon of matter. Until the quantity of matter is enough to produce an external swelling and fluctuation, we rarely have any positive knowledge of the existence of the disease, which is often mistaken for rheumatism.

I have seen several lumbar abscesses, the swelling of which in the bend of the groin more or less resembled that of a hernia, and was attended with impulse when the patient coughed. One case was brought to my

house: there was a small soft prominent tumour, with impulse, near the groin, but rather more towards the ilium than the place of a hernia, and accompanied by a larger swelling, — evidently an abscess behind the os innominatum. I recommended the tumour behind to be opened, when, if it had a communication with that in the thigh, the latter would subside, and indicate, at all events, the nature of the case. Another surgeon of great experience advised the introduction of a needle into the femoral tumour, in order to learn the quality of its contents.

Attempts have been made to disperse lumbar abscesses by exciting the action of the absorbents, by emetics, blistering the surface of the swelling, and the employment of purgatives. The plan has been attended with little success. Now, as it is the nature of lumbar and all chronic abscesses to become larger and larger, and sometimes to attain vast magnitude before they burst, it is, I think, a good general rule to open them as soon as a fluctuation can be plainly distinguished. It is found, however, that the plan of opening a considerable lumbar abscess is frequently followed by a violent and even fatal attack of *irritative fever;* and hence, some caution is requisite if the tumour be large. In fact, when we puncture the abscess, discharge its contents, and leave the opening unclosed, the cyst often inflames over its whole extent, and the patient now suffers that violent derangement of the system, excited by any fresh irritation operating upon a hectical constitution, which is well known by the name of *irritative fever.*

The knowledge of this fact made surgeons fearful of following this practice, when the cyst was of considerable size. Hence arose the method of introducing a seton across the tumour, and letting the matter escape gradually; and Mr. Abernethy's more successful way of letting out the matter by a puncture, and then closing it with adhesive plaster, and healing it by the first intention. The skin is to be drawn to one side, the lancet introduced, and the matter having been discharged, the skin is allowed to resume its natural place again. Thus the openings in the skin and the fascia and cyst do not afterwards correspond, and the admission of air is more likely to be excluded. The cyst remains for some time undistended — it has an opportunity of contracting — and, as soon as a certain quantity of matter accumulates again, the same proceedings are repeated.

With such treatment should be combined the administration of tonic and alterative medicines, and especially bark, preparations of steel, the iodide of potassium, and such as are found to be the best for scrofulous constitutions in a state of hectic. After the abscess has been considerably lessened, blistering the skin, or rubbing the skin freely with ung. iodidi comp. will sometimes promote the dispersion of the remains of it. If the vertebræ be diseased, counter-irritation will be advisable; especially an issue or blister kept open. The fact established by Sir Benjamin Brodie, that a psoas abscess is almost constantly attended with caries of the vertebræ, must have a very unfavourable influence on the prognosis, on account of the greater difficulty of curing any abscess combined with disease of the spine, than an abscess free from so serious a complication. The double lumbar abscess in University College, above referred to, was opened, and terminated in the girl's recovery.

## SCROFULOUS CARIES OF THE SPINE.

Perhaps I may not be altogether justified in calling this affection a caries of the vertebræ, because it is alleged that one variety of it begins, not with a morbid alteration of the cancellous structure of any of those bones, but with ulceration of the intervertebral substance. But as the disease, in whatever texture it begins, generally leads to caries of the spine, I think the name sufficiently appropriate. By adding the epithet *scrofulous*, we also distinguish this caries from other forms of it, as well as from necrosis, and simple absorption of parts of the vertebral column, the effect of aneurism, or other tumours, not usually productive of any paralytic affection of the lower extremities.

In whatever manner the disease commences, if it be not checked in its progress, it occasions a destruction of the bodies of the vertebræ and intervertebral substance, leaving, as Sir Benjamin Brodie correctly says, the posterior parts of the vertebræ unaffected by it; the necessary consequence of which is an incurvation of the spine forward, and a projection of the spinous processes posteriorly. The same pathologist adverts also to the frequent and early complication of the disease with chronic inflammation of the membranes of the spinal cord, and even of the latter organ itself, which in consequence of the curvature, and, as I have reason to believe, still oftener in consequence of the disease around the spine, quite independently of the mechanical effect of the curvature itself, becomes disqualified for the performance of its highly important function. This observation is founded on the fact of many cases being upon record, in which the most surprising degrees of curvature, from destruction of the bodies of the vertebræ, were not accompanied by paralysis. In the museum of University College is a preparation, illustrating the earliest change perceptible in the most common form of the disease, — that which begins in the bones. In the cancellous structure of the cervical vertebræ, small cells are seen, which are produced by the removal of a portion of the natural texture.

Frequently in caries of the spine, and especially in scrofulous cases beginning in the bones, suppuration occurs at a very early period of the disease, and, in other examples, not until a late stage of it.

I have explained, in the first section of this treatise, the changes in the shape of the spine produced by rickets; where the curvature is lateral, and the spine twisted, not from any carious affection of the vertebræ, but from their being only imperfectly developed, and not calculated to resist the preponderating influence of the muscles and the weight of the parts, which the column has to sustain. However great such ricketty curvature and deformity may be, no paralysis is induced. I have also made some remarks upon that kind of absorption of the bones, which arises from the pressure of aneurism and other tumours upon them, and which has peculiarities marking it very completely as a different affection from what is denominated caries; for, in no situation, does it lead to the formation of abscesses; and, in the spine, it is particularly remarked by all pathologists that it does not give rise to paralysis. Not, however, that the thing is absolutely impossible; for, in the museum of University College, is a specimen of aortic aneurism, which had occasioned such an absorption of the lateral part of the spine, that the medulla spinalis was exposed; though even in that case, I believe, there was no paralytic affection of the lower limbs. It is conceivable, however, that the mischief might have gone on, till palsy had been excited by its effects upon

the medulla spinalis; and I have certainly read of a case or two, in which the pressure of an aneurismal tumour in the abdomen was the cause of paralysis. Such an occurrence, however, is at all events rare.

The greater number of individuals, afflicted with scrofulous caries of the spine, are infants or children; yet many adults also suffer from it, especially after having been weakened by fever, or a long mercurial course. It is very uncommon for it to begin after the age of forty-five.

It may be asked, how are we to distinguish scrofulous cases, commencing in the bodies of the vertebræ, from others, which begin in the intervertebral substance? Now, the only information that I can deliver, in reply to this question, is a remark made by Sir Benjamin Brodie, that where the disease is of a scrofulous origin, affecting the cancellous structure, he suspects, that it is more immediately followed by suppuration, than where it commences in the intervertebral cartilages; and that, in the latter cases, the pain and tenderness in the carious part of the spine are more considerable than in scrofulous examples.

With regard to the general symptoms of caries of the spine, I may remark, that, in the early stage, the patient has pain and tenderness in that portion of the spine which is the seat of disease; and, as I have stated, perhaps these symptoms will be most strongly manifested in those cases in which the disease begins in the intervertebral substance. If the patient be old enough to describe his complaints, he will tell us, that he is annoyed with a feeling of tightness of the chest, uneasy sensations at the pit of the stomach, a torpid sluggish state of the intestinal canal, perhaps some disturbance in the functions of the urinary bladder, and weakness, aching, numbness and cramps in the muscles of the lower extremities. Now, it is scarcely necessary for me to say, that very similar symptoms may proceed from other causes; and even some of the information respecting the symptoms now enumerated, as appertaining to the early stage, cannot always be obtained, because the patient may be an infant. Hence, until some inequality or projection becomes perceptible on the spine itself, and until the want of control over the muscles of the lower limbs and the paralysis are more established, the diagnosis is generally obscure. The muscles and parts affected with paralysis must, of course, be those, which derive their nerves from the portion of the medulla spinalis below the seat of the disease. Generally there is impairment of motion and sensibility together; but sometimes one limb will retain more or less sensibility, yet be deprived of the faculty of motion.

In different cases, the symptoms differ considerably. Sometimes there is great pain in the part affected; sometimes none. In many instances, the paralysis comes on early, and often even before there is any material curvature forwards; but, in some cases, we see the spinous processes making a considerable angle posteriorly, in consequence of the bend of the spine forwards, and the destruction of the bodies of the diseased vertebræ, yet without any paralysis having taken place. The true cause of most of the symptoms is a morbid state of the spine and parts connected with it, attended with irritation and disease, and perhaps sometimes with compression of the medulla spinalis itself. The morbid state of the spine always precedes the deformity observable in the vertebral column itself. Indeed, the curvature forward, in such a degree as to produce the angular projection of the spinous processes posteriorly, cannot happen until the bodies of the diseased vertebræ have been seriously injured by caries. The deformity is of a peculiar kind, and such as nothing can produce, except the destruction of one or more of the corpora vertebrarum, the spine being bent forwards, as I have already explained, so

as to form an angle backwards. The body of one, and sometimes the bodies of several vertebræ may be completely absorbed, permitting those below and above the deficiency to join, and be united by anchylosis. The spinous processes may also be soldered together; and the sides of the thorax pressed downwards and backwards, so as to lessen, in a very serious manner, the dimensions of the hypochondriac region. In this disease, the bones are large and well developed, which is very different from what is noticed in rickets. In curvatures from other causes, there is not an angular projection of the spinous processes; but the bend forms the segment of a circle, generally affecting a great extent of the spine, and often assuming the lateral inclination or spiral figure, with a very conspicuous leaning above, towards the right side.

In most cases of scrofulous spine, paralysis of the lower extremities, and even a more extensive paralysis, will come on sooner or later; but, in rickets, where the spine may be said to be deformed, rather from an im perfect development of the bones, than from disease of them, palsy of the legs is not produced, however great the lateral or spiral curvature of the back. Professor Cruveilhier, in the 4th Livraison of his Anatomie Pathologique, gives us the particulars of a case, which proves how very far even scrofulous disease of the vertebræ will sometimes advance, without causing paralysis, though this is a deviation from what is most common. In Cruveilhier's case, no paraplegia existed, though not less than five of the bodies of the dorsal vertebræ had been totally annihilated; and the alteration in the shape of the vertebral column was such, that the upper half formed with the lower an extremely acute angle, which would have been still more acute, if it had not been prevented by the eleventh and fifth actually touching one another. The intervertebral foramina were all preserved, though more or less deformed, contracted, or displaced backwards. In those which were most diminished, the corresponding intercostal nerves must have been compressed, and consequently the action of the intercostal muscles impaired, explaining partly the cause of the asthmatic disorder, with which the patient was troubled. The engraving in the above work shows how nature contrived to maintain the integrity of the vertebral canal, and to keep the spinal cord from being compressed, in the midst of such a surprising deviation of the vertebral column from its natural configuration. Although the bodies of five vertebræ were demolished, anchylosis took place, and the medulla suffered no pressure or irritation adequate to paralyse the lower extremities. A beautiful specimen, illustrative, I think, of an equally extensive destruction of the bodies of the vertebræ, and of as sudden a bend of the spine, will attract the attention of every pathologist who visits the museum of University College. Cruveilhier also gives the particulars of a child, ten years old, brought to the dissecting room, in which only a few vestiges of the bodies of the third, fourth, fifth, sixth, seventh, eighth, ninth, tenth, and eleventh dorsal vertebræ were left. According to this pathologist, diseases of the vertebral column, like those of every other part of the osseous system, are seated, not in the osseous tissue itself, but in the cellular or medullary tissue occupying its interstices. When this cellular tissue inflames, sometimes it pours out pus in abundance, constituting an abscess, but sometimes in a more scanty quantity so as to admit of absorption. The cells of the osseous tissue, being distended by the development of the cellular tissue, and deprived of the materials of nutrition, may be entirely absorbed; and thus Cruveilhier accounts for the total disappearance of the texture of bone, without a vestige of it being left. In fact, his doctrine is, that all

disease is seated in the cellular tissue of organs, the other tissues being, according to his views, only liable to simple atrophy or hypertrophy.

The view, now taken of this subject, must render it manifest, that the removal of the deformity of the spine, even when we succeed in curing the disease, must be altogether impracticable. There must always remain an angular projection backward, which will be greater or less, according to the part of the spine affected, and the extent of the destruction of the bodies of the vertebræ.

Nevertheless, we are not to conclude, that every bend of the spine forward is from scrofulous disease. We have the authority of Sir Benjamin Brodie for the observation, that a curvature of the spine in this direction may arise from other causes, as a weak condition of the muscles, or a ricketty affection of the bones. Generally, he says, in such cases, the curvature occupies the whole spine, which assumes the form of a segment of a circle. Occasionally, however, the bend occupies only a portion of the spine, usually that composed of the superior lumbar and inferior dorsal vertebræ, the curvature being always gradual, not angular, a circumstance in which it particularly differs from the curvature resulting from caries.

One common effect of scrofulous caries of the spine is the production of an abscess around the diseased bone. Yet, it frequently happens, that the caries will go on to a vast extent, and even so as to demolish the bodies of several vertebræ, without any abscess being produced. Disease of the spine may continue for years without suppuration; but abscesses sometimes lie upon the diseased bone, and are not detected till after death, when the body is examined.

With respect to scrofulous disease of the upper cervical vertebræ, and of the articulations between the atlas and the condyles of the os occipitis, I may remind the reader of an observation made by Sir Benjamin Brodie, which is, that the pain is greater in such cases, than in others, where the disease is in the dorsal or lumbar vertebræ. When abscesses form from disease of the cervical vertebræ, the matter generally collects amongst the muscles of the neck, or behind the pharynx, into which it may pass. As the disease advances, the arms become paralytic: and this while the muscles, which derive their influence from the spinal cord below the neck, remain under the control of the will. Afterwards, however, the paralysis extends to the muscles of the trunk and lower extremities. In the case of a girl, eight years old, with disease of the spino-occipital articulation, as recorded by Mr. T. R. Blackley, "the countenance was peculiarly expressive of caution, and was florid and full, if not bloated; the chin was advanced preternaturally beyond the chest; the mouth slightly opened; and she kept the arms parted from the side, as if to poise herself. On looking laterally, she strained her eyes in the direction of the object, and, failing in this, turned her entire body for the purpose. The effect produced, when she attempted to observe any thing placed near her feet, was yet more remarkable; for this purpose, she generally put her hand to her forehead, as if fearful of undue weight in the head, and bent her body, thus avoiding the least motion between the first and second vertebræ. In getting up from bed also, or in lying down, she invariably supported the head with the hand." During the last four days of her life, the right arm was powerless.* The *post mortem* appearances, which are interesting, my limits compel me to omit.

The most approved plan of treating scrofulous caries of the spine consists in employing, in the early stage, cupping or leeches over the part,

* See Dublin Journ. of Med. Science, vol. xii. p. 62.

followed by the application of blisters, caustic issues, a seton, or the moxa. With the local abstraction of blood, are of course to be joined other mild antiphlogistic remedies, especially aperient medicines, composed of rhubarb, and the carbonate of soda, castor oil, or the sulphate of magnesia. After beginning with these means, counter-irritation, or issues, setons, a perpetual blister, or the moxa, may be tried; and these remedies may be assisted with the medicines and regimen usually recommended for other scrofulous diseases, particularly bark, chalybeates, and iodine, with the benefit of a light nutritious diet, and pure country air, if it can be conveniently had. One thing is quite essential, namely, the diseased spine should be kept as quiet as possible, and therefore the patient ought to remain very much in the recumbent position. When the disease has existed a considerable time, and a conspicuous angular curvature is formed, I think Sir B. Brodie's advice should be followed, which is, to let the patient recline on his side, instead of on his back; or if this posture be disagreeable, he should not lie on an absolutely flat surface, but be supported with pillows, so that his position may have no tendency to restore the spine to its original figure, which would only have the pernicious effect of disturbing the completion of the anchylosis, by which alone the cure can be accomplished.

Of late years, issues and blisters, from having been employed in these cases for immoderate periods of time, and without discrimination, have become objects of abuse by certain practitioners. Yet, that they frequently produce great benefit, I am convinced by repeated experience. We often find paralysis suddenly cease, or diminish, on the application of a blister. At the same time, I am of opinion with Sir B. Brodie, that issues are chiefly useful in the early stage of the disease, with the view of preventing suppuration, and that they are of no service after an abscess has actually formed. He likewise suspects, that issues are of little or no service where scrofulous disease of the cancellous texture precedes ulceration of the cartilages. If this be true, we see, then, the reason why so many cases are not benefited by this plan; but it is a point for further investigation, and one on which, I cannot say, that my experience agrees with what has now been suggested.

I may next observe, that the medulla and its coverings are liable to chronic inflammation and its effects, as a consequence of external violence. Cases are likewise sometimes met with, where scrofulous tubercles form in the medulla itself. Any of these changes may of course impair the functions of this important organ, and bring on paralytic affections. The treatment must be regulated by principles applicable to diseases of joints, and comprise very much the same means which have been advised for scrofulous disease of the bodies of the vertebræ; local bleeding, counter-irritation, quietude in the recumbent position, and medicines and regimen for the improvement of the health in general.

### SPINA BIFIDA, HYDRO-RACHITIS, OR THE CLOVEN SPINE,

Is a congenital malformation, consisting in a deficiency of one or more of the spinous processes and arches of the vertebræ, which, indeed, are sometimes deficient throughout the whole extent of the vertebral column. In consequence of the deficiency of the back part of the spinal canal, the theca vertebralis protrudes, and forms a kind of pouch filled with a limpid fluid. The swelling is of different sizes in different cases, according to the extent of the malformation in the bones, and the age of the individual. The most common situation of it is on the lumbar vertebræ; but it may

take place on the dorsal or cervical ones, and even the sacrum. In some cases, an aperture is left in the bodies of the vertebræ, in addition to the absence of the spinous processes. All the processes are occasionally deficient, and the vertebræ small, and not properly developed. The swelling is soft, and attended with fluctuation, and sometimes a degree of transparency. It generally subsides when compressed, but returns as soon as the pressure is removed. The skin retains its natural colour, and there is no pain in the part, unless it be compressed.

Children born with spina bifida seldom live more than a year. They are generally weakly and emaciated; and very often afflicted with paralysis of the lower limbs, and of the sphincters of the bladder and rectum. However, I have seen children with spina bifida, who had a healthy appearance and suffered no paralytic complaints. Sometimes, also, instead of dying in infancy, they live to the adult age, as was the case with a young woman, whom I saw many years ago under the care of Mr. Copland Hutchison. The urine and feces passed involuntarily. The tumour was of such enormous size, that it measured in the vertical diameter thirty inches.

With very few exceptions, spina bifida proves fatal; and this, in the greater number of instances, within the first year from the period of birth. Some children thrive for a few years, and appear to suffer little or no inconvenience; but no sooner does the tumour burst, or is it punctured, than convulsions usually come on, and the little patient suddenly dies. This was the final result of a case, in which I saw a little boy, about two years old, that was in perfectly good health, and with the free use of his legs, though he had a spina bifida on the sacrum nearly as large as his head.

Gentle pressure on the tumour was suggested as worthy of trial by the late Mr. Abernethy, with the view of producing an absorption of the fluid; and, if that object could not be accomplished, he deemed the experiment of letting out the fluid by a small puncture, and then closing the opening with sticking plaster, quite warranted by the commonly fatal course of the disease. This was done in one example, the puncture being repeated every fourth day for six weeks, and regularly healed; but, at length, one of the punctures failed to unite, the sac inflamed, pus was formed, and the result was fatal.

Sir Astley Cooper tried the effect of puncturing spinæ bifidæ with a fine needle. In one case, the fluid was discharged, and the cavity obliterated by the adhesive inflammation, so as to produce a radical cure. This gentleman, however, besides the radical treatment, if it can be so called, as it is only supported by one or two instances of success, has a palliative method, which consists in treating the protrusion on the principle of a hernia, and applying a compress and bandage to it.*

Spina bifida, when joined with hydrocephalus, paralysis of the lower extremities, and involuntary discharge of the urine and feces, is entirely a hopeless case. The same observation applies to examples, in which the spinal cord itself is deficient.

In many children, the bodies of the vertebræ are not perfectly developed, the ossification of the cranium is not complete, and the disease is associated with other deformities, such as club feet. All these circumstances were illustrated in a case, from which a preparation in the museum of University College was taken. The child lived only three days.

* Two patients, treated in their infancy on these plans, and now grown up to be strong men, I have lately examined by the favour of Sir Astley Cooper, under whose care hey were about twenty years ago, or more.

## HERNIA.

The term *hernia* is applied to a protrusion of parts from any of the greater cavities of the body: thus, there may be herniæ of the brain, lungs, or abdominal viscera. The expression *rupture*, employed synonymously with *hernia*, signifies, however, only the abdominal form of the disease, and came into use from an erroneous notion, that the parts, through which the protrusion happened, were constantly burst or torn. When any of the viscera of the abdomen protrude, they almost always push out, along with them, a portion of the peritoneum, which forms a kind of pouch in which they are contained, and is called the *hernial sac*. Of this the narrow part is termed the *neck*, and the more expanded part the *body*.

But hernia is attended with infinite variety, so that it will not always admit of being defined to be a protrusion of the viscera, included in a peritoneal sac; for the parts may not protrude at all; the displaced or entangled bowels may form no external swelling; they may be entangled in some unusual aperture in the mesentery, or be compressed by adhesions formed within the abdomen; or, if they do protrude, they may not be entirely covered by a peritoneal sac. The total or partial absence of a sac, however, is the peculiarity of but few cases, as when a hernia follows the cicatrisation of a penetrating wound of the abdomen, or when the sac is rendered imperfect by ulceration or absorption, or is torn by accidental violence directly applied to the tumour. The bladder and cœcum are not contained in the peritoneum, and hence, when they form herniæ, they have not a complete hernial sac; they do not push out the peritoneum before them, but draw after them the portion of that membrane with which they are naturally connected. Thus a kind of sac may follow them, without covering them, and into such sac other bowels may fall.

The most common situations for herniæ are the abdominal ring, the navel, and a limited point below Poupart's ligament, just at the inner side of the femoral vein. They are also met with at every point of the linea alba, and, in less common instances, at the foramen ovale, at the ischiatic notch, in the perinæum, or the vagina. Hernial protrusions are also possible through the diaphragm into the chest, sometimes through a lacerated opening in that muscle, sometimes through a natural aperture in it, or one from congenital malformation. The *contents* of a hernia are mostly either intestine or omentum, or both together. The small intestine, being more moveable than the large, is more frequently protruded, especially that portion of it named the ileum, which lies very near the ring and the space below Poupart's ligament. Sometimes the protrusion will comprise merely a part of the diameter of the intestine; and sometimes several inches or feet of it may be contained in the sac. In rarer forms of hernia, other parts are met with, as portions of the stomach, or liver, the spleen, uterus, ovaries, or bladder.

From the two circumstances of *situation* and *contents*, are derived nearly all the various names of herniæ. Thus, when the tumour contains intestine alone, it is called *enterocele;* when *omentum* alone, *epiplocele;* and, when its contents consist of both parts, *entero-epiplocele*. We hear also of *herniæ of the stomach, bladder,* &c. With respect to names derived from situation, when the protrusion is at the abdominal ring, or even merely within the inguinal canal, the case is termed a *bubonocele* or an *inguinal*

*hernia;* but if the parts come out of the same aperture, and descend further, so as to get into the *scrotum*, such form of the disease is termed *oscheocele*, or a *scrotal hernia.* The protrusion below Poupart's ligament, just on the inner side of the femoral vein, receives the name of *crural* or *femoral hernia.* A protrusion at the navel is termed an *exomphalos*, or an *umbilical hernia;* and, at any other point of the front of the abdomen not yet specified, a *ventral hernia.* Protrusions by the side of the vagina, at the foramen ovale, in the perinæum, through the diaphragm, or the ischiatic notch, are named accordingly, *herniæ of the vagina, foramen ovale,* &c. One kind of hernia, named from the circumstance of children being born with it, or having it very soon after birth, is called *congenital*, which is likewise singular in another respect, viz., that of having the tunica vaginalis for the hernial sac.

When the protruded viscera create no disturbance, and readily admit of being put back into the abdomen, the hernia is said to be *reducible;* but when they cannot be put back, owing to adhesions, or their large size in relation to the opening, through which they would have to return, the hernia is called *irreducible*, or *incarcerated.* If the parts be not only difficult of reduction, but subjected to such pressure, or constriction, as impedes or deranges their functions, stopping the passage of the intestinal matter towards the anus, causing frequent sickness, with inflammation or worse consequences in the constricted parts, the case is well known among surgeons as a *strangulated hernia.*

The *causes of hernia* are divisible into the *predisposing* and *exciting.* With respect to the first, I may remark, that a natural deficiency of resistance in any part of the boundaries of the abdomen, and a loose, very moveable state of certain viscera, must be regarded as the common predisposing causes. According to the observations of Sir Astley Cooper, debility predisposes to hernia by occasioning a relaxation of fibre, and a dilatation of the aperture through which the spermatic vessels pass. If a person, debilitated by fever, return to habits of violent exertion before his strength is fully re-established, a hernial swelling will frequently take place. It is on the principle of general relaxation, that the same distinguished surgeon explains the remarkable frequency of the disease in old persons, especially those who work hard. Hot climates, by producing relaxation, and all circumstances which tend to bring on a sudden absorption of fat, are well known to give a tendency to the formation of hernial swellings. Many facts also support the doctrine, that herniæ are sometimes particularly prevalent in certain families, so as to be called hereditary, and no doubt this depends upon a weaker conformation of the parts where the tumours form, than is exemplified in the generality of individuals.

The *exciting causes* may all be referred to the powerful action of the abdominal muscles and diaphragm on the viscera; and this is the reason of the great frequency of the disease in the labouring classes, in dancers, in the inhabitants of mountainous countries, in the cavalry, in persons who ride hard, &c.; persons who lift heavy weights, who suffer from asthma, or from long-continued cough, or who habitually exert their lungs in any kind of manner, are principally subject to hernia. Costiveness likewise creates a risk of hernia, which usually comes on when the person is straining at stool. Strictures of the urethra also promote the formation of hernia, the abdominal muscles being required to act with unusual force in order to empty the bladder. Cases are recorded, in which several hernial tumours were thus occasioned in the same individual. The

same causes, which first produced the complaint, are constantly tending to promote its increase. The tumour becomes larger, in proportion as the pressure against the hernial sac is stronger and more frequent. Hence the great size which it often attains in persons following laborious occupations. Its increase will also be in proportion to the less considerable resistance of the parts in which it is situated; hence the magnitude of scrotal ruptures, and the generally small size of a femoral hernia. Sir Astley Cooper adverts to one condition conducive to hernia, through an altered state of the viscera, the abdominal muscles being nearly passive; this is when the viscera become, as it were, too large for the belly, from extreme obesity, the fat accumulating in extraordinary quantities in the omentum and mesentery. The enlargement of the uterus in pregnancy, as every surgeon knows, gives a great tendency to the occurrence of umbilical and ventral herniæ, by over-distension of the abdominal parietes.

At the first moment of the occurrence of a *suddenly formed* hernia, the protruded peritoneum must be unconnected with the parts amongst which it lies; but, in a very short time, it becomes firmly bound to them by the adhesive inflammation, which then prevents the return of the sac into the abdomen on the viscera being reduced.

The great apparent increase in the thickness of the sac is mostly owing, not to such change in the peritoneal sac itself, but to that of the more external coverings of the tumour, as the fasciæ, cremaster, and cellular tissue. However, there are exceptions, in which the hernial sac is really much thicker than the rest of the peritoneum; especially when the tumour, after having been long reduced, protrudes again, and is not kept up; when it has been repeatedly affected with inflammation; or there are extensive adhesions between the sac and its contents.

### REDUCIBLE HERNIA.

The *general symptoms of a reducible hernia* are an indolent tumour, situated at one of the points of the abdomen, already specified as the places for hernia; sometimes originating gradually, sometimes suddenly, and subject to change of size, being smaller when the patient lies down on his back, and larger when he stands up or holds his breath. Frequently it diminishes when compressed, and grows large again when the pressure is removed. Its size and tension often increase after a meal, or when the patient is flatulent. In many cases, colic, constipation, and vomiting occasionally take place, seemingly from the bowels being out of their natural situation, and less capable of their usual action on their contents; but, in others, the functions of the bowels go on quietly and regularly.

When the sac contains only a piece of intestine, forming what is termed an *enterocele*, the tumour is characterised by elasticity and uniform smoothness. No pain attends the handling of it; and, on the patient's coughing, while the surgeon's hand is applied to the part, a forcible impulse is felt, as if air were blown into the swelling. The bowel generally returns into the abdomen with great facility, a guggling noise being frequently heard at the moment.

If the sac contain only omentum, constituting *epiplocele*, the tumour has a more flabby and unequal feel; is more inclined to be oblong than round; and if the quantity of protruded omentum be considerable, the disease is in some degree indicated by its weight, which is greater than that of an enterocele. Here, also, an impulse is felt in the tumour when the patient coughs. In very young subjects, the contents of a hernia are generally intestine, and seldom omentum.

With respect to the signs of an *entero-epiplocele*, or hernial tumour, containing both omentum and intestine, if a part of the contents slip up suddenly and with a guggling noise, leaving behind something which is less easily reduced, the disease is an entero-epiplocele.

The *general treatment of a reducible hernia* is perfectly obvious. The protruded viscera are to be returned into the cavity of the belly, and a truss applied for the purpose of preventing their descent again. The manual proceedings, by which the contents of a hernia are reduced, without the use of the knife, are termed the *taxis*, the manner of performing which varies according to the situation of the tumour.

If no means be employed for reducing the parts, and keeping them reduced, there will be a constant risk of the hernia becoming strangulated by an additional protrusion of more bowel or omentum into the sac. But, besides this danger, and the loss of all chances of a radical cure, when a reducible hernia is neglected, other considerations should be pressed upon the patient, to make him understand the necessity of regularly keeping up the parts with a truss. It should be represented to him, that, if he neglect this precaution, the hernia will increase in size, so as not only to prevent all active exertion, but, if a bubonocele, to impair the genital function by involving the integuments of the penis, and sometimes also, by the pressure, causing a wasting of the testicle. In particular, as the early period of life is that in which the opening has the greatest disposition to close, infants and children should never be suffered to be without a proper truss; and it is now perfectly ascertained, that they can wear trusses with steel springs just as well as adult subjects.

Though such are the doctrines which I have to offer in relation to the general treatment of reducible hernia, cases sometimes present themselves in which the contents of the hernia are so bulky that, though reducible, they cause, after their return into the belly, so much pain and indisposition, that it becomes necessary to let them continue in the sac, which should then be supported with a suspensory bandage.

### IRREDUCIBLE HERNIÆ FREE FROM INFLAMMATION, AND TROUBLESOME OR DANGEROUS SYMPTOMS.

The usual causes, preventive of reduction in such cases, are, first, the bulk of the protruded parts, in relation to the opening through which they would have to return; secondly, alterations in their form and texture; thirdly, adhesions to one another, or to the inside of the sac; fourthly, transverse membranous bands within the sac, or the neck of it; fifthly, some herniæ are rendered irreducible, because the viscera are bound down by their natural cellular connections, though in a state of displacement. The bladder is generally incapable of being completely returned; and the hernial sac, where the cœcum protrudes, is deficient behind and at the outer side of the tumour, where the bowel has only its usual cellular attachment.

The course of the intestinal matter is always more or less obstructed in that portion of the bowels which is included in the hernia; and hence, patients with irreducible enterocele are frequently subject to complaints of the digestive organs, colic pains, or even a total stoppage of evacuations per anum; not the result of any constriction of the protruded bowel, but of the difficulty with which its contents pass through it.

Persons with irreducible ruptures should avoid rough exercise, support the tumour with a bandage, and keep it out of the way of all harm from

pressure or bruises. They should also be careful to avoid costiveness, and irregularity of diet.

An irreducible omental hernia, free from constriction and inflammation, may not be the cause of much present inconvenience; but, when affected with inflammation from any accidental cause, or when a portion of bowel slips into the sac with it, severe and fatal consequences may ensue.

### GENERAL SYMPTOMS OF A STRANGULATED HERNIA.

The first symptoms are a tumour in the situation of the hernial protrusion, attended with pain, not only in the part, but about the diaphragm, followed by eructations, sickness, inclination to vomit, suppression of stools, and acceleration of the pulse. The suppression of stools is often as complete and as irremoveable by purgative medicines, when only a small portion of the diameter of the bowel is strangulated, as when an entire fold of it is pinched. The action of a clyster on the bowels below the stricture often produces a stool after strangulation has taken place; but when they have once been emptied, the most irritating clysters have no effect. If the reduction be delayed, the bowels are distended with air; the belly is tense and swollen from this cause; the vomiting and eructations become more frequent, — all the contents of the stomach, and afterwards those of the bowels down to the stricture, being rejected. Afterwards, the pulse, which was previously about 90, and, perhaps, strong and hard, becomes much quicker and weaker, and the belly is very sore on pressure. Peritonitis has now come on. There is great anxiety and restlessness, with a small, quick, hard pulse, and generally cold extremities. After a time, hiccough occurs, the pulse sinks, and the whole body becomes covered with a cold clammy perspiration. Mortification next takes place, beginning in the protruded viscera and extending to the containing and neighbouring parts. The patient may now experience a sudden feeling of relief, but this is only temporary. The tumour becomes emphysematous, a sure sign of the gangrenous mischief within it. In this state, the gut either goes up spontaneously or is returned with the smallest degree of pressure; but, the hiccough and cold sweats continuing, the pulse becomes more and more rapid and irregular, and death soon follows.

When the body is examined, the whole surface of the peritoneum is found inflamed, the intestines participating in the disorder, particularly those above the stricture, which are considerably distended with air. From the strangulated part downwards, the intestine is generally smaller than usual, and sometimes not inflamed. The convolutions are also frequently connected together by recently formed adhesions; a turbid puriform fluid is effused in the abdomen; and, not unfrequently, spots of gangrene are seen on the intestines.

The symptoms of a strangulated epiplocele are less severe and rapid, and stools may generally be procured by purgatives and clysters; but this is sometimes attended with great difficulty, and the sickness and vomiting are, for the most part, truly distressing. In the museum of University College is a preparation, exhibiting the production of a permanent stricture of the inner coat of a portion of bowel that had suffered strangulation: an exceedingly rare occurrence.

*General Treatment of a Strangulated Hernia.*—Surgeons should always remember the necessity of not losing too much time in the trial of means not to be depended upon for procuring the reduction of the parts; for the

rapidity with which gangrenous mischief sometimes takes place in the hernia, attended by a dangerous and fatal degree of inflammation within the abdomen, is very remarkable. The greater number of patients, who die after operations for strangulated herniæ, do not die of those operations abstractedly considered, but rather of the effects of the disease; and if the knife were used more promptly, life would more frequently be saved. I fully coincide in the opinion entertained by many surgeons, that we should save many more lives by operating on strangulated hernia much sooner than is generally done. I would recommend a fair and prompt trial of those means which are the most likely to promote the reduction of the hernia; and if they failed, and the symptoms were urgent, it seems to me, that time ought not to be wasted in the useless repetition of them, or the employment of others known to be less efficient.

The *taxis*, or an attempt to reduce the parts with the hand, is, of course, the first proceeding for adoption. For this purpose, the abdominal muscles and femoral fascia should be relaxed by inclining the chest forwards, and bending the thigh and rotating it inwards. In the external inguinal hernia, the pressure should be directed upwards and outwards, along the course of the spermatic cord; but, as the femoral hernia passes first downwards and then forwards and upwards, the pressure in this case must be directed first downwards and then backwards. In umbilical and ventral herniæ, it is to be made directly backwards. No violence ought to be used, as it can be of no service, and must increase the inflammation of the bowels. The intestine may even be burst by too much force, or the sac forced into the abdomen, with the viscera strangulated by its neck. While the tumour is grasped with one hand, and moderate pressure on it steadily kept up, the fingers of the other hand are to be employed in the endeavour to get up any portion of the contents of the hernial sac, and to keep it reduced, until followed by another portion. If air be felt to return, this will be encouraging. Dr. O'Beirne's plan of lessening the contents of the abdomen, and thereby some of the resistance to the reduction, by discharging the air from the large intestines with an elastic gum tube, appears to me to deserve greater attention than it has yet received from the profession. If the first trial of the taxis should fail, we may put the patient into a warm bath, if it can be prepared without too much loss of time; and while he is in it, take blood from his arm. If the warm bath should require much time for its preparation, I would advise it to be dispensed with, and blood taken from the arm.

The object of the warm bath and bleeding is to render the patient weak and faint, to bring on a kind of general collapse, during which the taxis may often be practised with success. If the patient should fall into this state, therefore, the opportunity of trying the taxis again is to be taken.

Supposing, however, we were not yet able to succeed, what ought to be done? If the patient were not a very old or debilitated subject, I should next try the united effect of cold or ice applications to the swelling, and of an infusion of tobacco thrown up the rectum: ʒj. of tobacco is to be infused for ten minutes in a pint of boiling water poured upon it; the liquor is then to be strained, and one-half of it injected first; and if, in about a quarter of an hour, this produce not too violent effects, the other half is to be thrown up. When the patient is under the influence of the tobacco, and the tumour has been subjected to the cold applications some little time, the hernia will sometimes return of itself, or with the slightest assistance. If it should not, the taxis is to be tried for

the last time; and, if it now fail, and the symptoms be urgent, and peritonitis present, the operation ought to be performed without further delay. Although I would not generally employ the tobacco enema in old weak subjects, one exception deserves notice; and this is, when such an individual absolutely refuses to submit to an operation. One, or two cases of this kind have been attended by me in University College Hospital, and the practice was so successful, that, as soon as the patients came under the influence of the tobacco, the contents of the hernial sac returned into the abdomen, almost without the aid of any manual proceedings.

I have little faith in purgatives and opium, except in cases of strangulated epiplocele, or where there is reason to believe that a part of the contents of the tumour has been reduced. We are sometimes called to cases in which so much time has been lost, that we only just have an opportunity of trying the effect of tobacco and cold, or even not of them.

### ANATOMY OF INGUINAL HERNIA, OR BUBONOCELE.

It will be impossible to understand the subject of inguinal hernia, unless we are acquainted with the anatomy of the passage through which the spermatic cord naturally proceeds, in order to reach the scrotum, and through which the most common form of inguinal hernia takes place. We must also understand the coverings of the spermatic cord, because they are also the coverings of inguinal hernia; and, in addition to these matters, we should have a clear idea of the situation of this hernia, in relation both to the spermatic vessels and the epigastric artery.

The *abdominal ring*, or triangular opening in the tendon of the external oblique muscle, the base of which corresponds to the crista of the os pubis, is the external termination or outlet of the canal through which the spermatic cord passes. The upper, inner, and weaker pillar of this opening is inserted into the symphysis of the os pubis, and its lower, outer, and stronger pillar into the angle and crista of that bone. In the living subject, it is not an unclosed aperture; for, besides being occupied by the cord, it has the *intercolumnar fascia* extended over it. The inner opening or commencement of the passage, designed for the spermatic cord, — the very place, in fact, where the viscera first protrude in the most common kind of inguinal hernia, — is not situated directly behind the *abdominal ring*, but about an inch and a half from it, in the direction towards the anterior superior spinous process of the ilium. Or, I may say, that the *inguinal canal*, as it is generally named, is about an inch and a half in length; the *internal ring* being situated very nearly midway between the symphysis of the pubes and the anterior superior spinous process of the ilium.

From this description, it is manifest, that the direction of the inguinal canal must be oblique, extending downwards, inwards, and forwards.

But the student will naturally ask, what parts form the inguinal canal? In order to understand this part of the subject, it should be remembered, that a thin fascia, termed the *fascia transversalis*, first accurately described by Sir Astley Cooper, is extended from the inner margin of Poupart's ligament, over the posterior surface of the transverse muscle, thus forming a kind of partition between the abdominal ring and the peritoneum, and also forming, with a portion of the united fibres of the transverse and internal oblique muscles near the crista of the os pubis, the posterior boundary of the inguinal canal, the anterior side of which is formed, to the extent of its first third from the inner ring, by the transversalis and internal

oblique muscles, and, in the remainder of its continuation, by the aponeurosis of the external oblique.

The precise point, at which the most common forms of inguinal hernia begin, corresponds, in the adult, to the passage of the spermatic cord under the edge of the transverse muscle. In the sound state, this part of the peritoneum has a small funnel-shaped depression in it; and it is this small digital kind of pouch, whose progressive enlargement constitutes the hernial sac, the hernia in its course always following the direction of the spermatic cord, in front of the vessels of which it is situated.

In point of fact, the opening which constitutes the internal ring, or commencement of the inguinal canal, is the aperture in the fascia transversalis, designed for the passage of the spermatic cord into that canal. Now the cord, in passing through this opening, carries along with it a covering derived from the margin of such aperture in the fascia transversalis, which covering is termed the *funnel-shaped process* of the fascia transversalis. It is the least important of the investments of the hernia; for, after it has descended a little way, it is lost in the cellular tissue, between the peritoneal hernial sac and the cremaster.

The spermatic cord, invested by the *funnel-shaped process*, then passes under the lower edge of the transverse and internal oblique muscles, and here it receives its second covering from the *cremaster muscle*.

The abdominal ring is closed by the *intercolumnar fascia*, and from this the cord also derives a third investment, termed the *spermatic* or *intercolumnar fascia;* and, in addition to these several coverings, namely, — the *funnel-shaped process* of the fascia transversalis, the *expansion of the cremaster*, and the *spermatic* or *intercolumnar fascia*, — the cord is also covered by the *superficial fascia*, placed immediately under the integuments.

These investments of the cord are also the coverings of the common bubonocele, or oblique inguinal hernia, which descends through the inguinal canal. The hernial sac has between its external surface and the inner surface of the cremaster the *funnel-shaped process*, or investment derived from the margin of the aperture in the fascia transversalis, and named in some schools the *internal spermatic fascia*. On the outside of the cremaster, the sac has the covering derived from the intercolumnar; and, external to this, the *fascia superficialis*, which is immediately under the common integuments.

Sir Astley Cooper believes the inguinal canal to be endowed with muscular contraction, which, under the action of the abdominal muscles, serves to close it, and lessen the propensity to hernia. He observes, that the lower edge of the transverse muscle begins to be attached to Poupart's ligament almost immediately below the commencement of the internal ring, and that it continues to be inserted behind the spermatic cord into Poupart's ligament as far as the attachment of the rectus. Sometimes, he has found a portion of muscle descending from the tendon of the transversalis, in the course of the linea semilunaris, to be inserted into the fascia transversalis, behind the cord, and into Poupart's ligament, and a preparation exhibiting this conformation he was so obliging as to show me some time ago. Sir Astley believes, that this encircling of the internal ring and upper part of the inguinal canal by muscular fibres, may be a cause of strangulation in the external bubonocele. However, the anatomical facts, on which this doctrine is founded, are sometimes considered to be only deviations from what may be regarded as the normal, or most usual, conformation of the parts. Although we may not be disposed to explain the supposed spasmodic nature of some kinds of strangulation by

the cause referred to by Sir Astley Cooper, we ought to feel obliged to him for his original explanation of the internal ring being occasionally surrounded by muscular fibres derived from the transversalis. His greatest discoveries on the subject of this hernia, however, appear to me to be those relating to the first correct description of the internal ring, and of the fascia transversalis.

### OF THE SITUATION AND COURSE OF THE SPERMATIC VESSELS AND EPIGASTRIC ARTERY, IN RELATION TO INGUINAL HERNIA.

As the epigastric artery naturally runs first behind the spermatic cord, and then about a quarter of an inch from the pubic margin of the internal ring, and as the viscera protrude through this aperture, and follow the course of the cord, they must be situated on the outer side of that artery, which passes first behind the neck of the sac, and then at its inner side, in its way to the inner surface of the rectus muscle. Hence, the inner margin of the neck of the sac is encircled, as it were, by the track of the vessel.

In recent bubonoceles, the internal and external opening of the ring are at some distance from each other, the first being situated obliquely upwards and outwards in relation to the former; but the pressure of the protruded viscera gradually forces the internal opening more towards the pubes, and nearer to the abdominal ring, so as to render the posterior side of the neck of the hernial sac and of the inguinal canal very short. Thus, in an oblique inguinal hernia of long standing, the opening into the abdomen is almost direct, and the epigastric artery becomes situated nearer the pubes than in the natural state.

But, though in the most frequent form of bubonecele the protrusion begins at the point which I have described, and follows the course of the spermatic cord, passing all through the inguinal canal, and having the epigastric artery behind and at the inner margin of the neck of the sac, circumstances are very different in another less common variety of bubonocele, where the viscera, instead of beginning to protrude at the internal and upper opening of the inguinal canal, and descending through that canal by following the course of the spermatic cord, are thrust out at the point directly behind the abdominal ring, together with the portion of the fascia transversalis, forming, with the conjoined fibres of the internal oblique and transverse muscles, the posterior boundary of the inguinal canal, immediately behind the abdominal ring, out of which the viscera then protrude in a direct manner. Here the hernial sac, instead of passing over the spermatic cord, as in the most frequent form of bubonocele, lies on its inner or pubic side; and the epigastric artery now pursues its course in front of the neck of the sac, at the usual distance from the upper and outer angle of the abdominal ring.

As in the most common inguinal hernia, the protrusion is on the outside of the epigastric artery, which winds under and round the inner margin of the neck of the sac, the case is sometimes termed the *external bubonocele;* while the less frequent one, in which the protrusion takes place immediately behind the abdominal ring, out of which the viscera pass without having descended through the rest of the inguinal canal, is named the *internal bubonocele;* a case, most particularly claiming recollection, as the protrusion *is at the inner or pubic side of the epigastric artery.* One case is also called the *oblique* inguinal hernia; and the other the *direct* or *ventro-inguinal.*

In this internal direct inguinal hernia, the sac pushes out with it the

fascia transversalis, situated immediately behind the ring, and must either lacerate or displace the united fibres of the internal oblique and transverse muscles at this point. As the hernia does not follow the spermatic cord through the inguinal canal, in general the cremaster only covers it near the abdominal ring. With this exception, the coverings of the hernia are the same as in the external bubonocele.

The explanation of the very different situation of the epigastric artery, in relation to the neck of the sac of an internal bubonocele, from what prevails in the external one, immediately shows how important it is to distinguish one case from the other in practice. In fact, if we were to divide the stricture in the same way in each case, we should often wound the epigastric artery. The discrimination of one case from the other is also important, with reference to the manner of performing the taxis, and the kind of truss that should be selected.

In scrotal herniæ of large size, the spermatic vessels, instead of forming a cord, may be disjoined by the pressure of the swelling, the vas deferens being situated on one side of the sac, and the spermatic artery and veins on the other. In general, towards the upper part and neck of the sac, the cord is not much unravelled: but, as its component vessels proceed downwards, they diverge more and more, and spread themselves over the sides, or even over the front of the sac.

The close adhesions, which a hernial sac soon contracts to the cellular substance on the outside of it, make its reduction a rare occurrence. Such an event, however, sometimes happens, especially in the femoral and internal bubonocele; for, in the external one, the prompt and intimate manner in which the sac becomes connected to the spermatic cord, makes it much less likely to take place.

Bubonoceles are most common in the male sex; but are occasionally met with in women, and then the round ligament of the uterus bears the same relation to the tumour as the spermatic cord does in males. Of course, in such a case, the hernia has not the covering which, in the male subject, it derives from the cremaster. There are also rare examples in which the direct bubonocele occurs in women. I operated upon a Mrs. Smith for a strangulated hernia of this description, a tailor's wife, in Cumberland Street, Middlesex Hospital. As she had had no stools for three or four days when I went to her, and the symptoms were urgent, I performed the operation at once, without trying any previous means but the taxis, and, in about a week, she was perfectly well.

### DIFFERENCE IN THE SYMPTOMS OF OBLIQUE, AND DIRECT INGUINAL HERNIÆ.

In the oblique inguinal hernia, there is an *oblong swelling*, extending obliquely inwards and downwards; in the direct hernia, the parts pass from behind straight forwards, and form, on the outside of the abdominal ring, a circular globular swelling, in general suddenly occasioned by some violent effort. If any obliquity occur in the direct inguinal hernia, it is in a course towards the linea alba, and not towards the anterior superior spinous process of the ilium. Then, in the oblique inguinal hernia, the spermatic cord is situated behind or under the sac; but, in the direct bubonocele, it lies to the outer side, or upon the external half of the front of the neck of the hernial sac. In the direct inguinal hernia, where the sac adheres to the cord, the testicle is not situated exactly under the fundus of the sac, as in the oblique inguinal hernia, but either at the forepart, or on the outer side of it.

In the direct bubonocele, the epigastric artery ascends obliquely inwards at the outer side of the neck of the hernial sac, though Hesselbach found an exception to this in one rare case, where that artery proceeded from the obturatrix. This hernia occurs where the tendon of the transversalis is unnaturally weak, or from malformation does not exist at all, or from violence has been broken. Sometimes the fascia transversalis protrudes before the peritoneum, and there may be between the two membranes a stratum of fat. In certain instances, the hernia neither distends nor lacerates the conjoined tendon, but the protrusion takes place under the edge of the transversalis, and then through the lower opening of the inguinal canal. Sometimes this hernia consists of two protrusions, divided from each other by strong tendinous fibres.

In other instances, the fascia transversalis is lacerated, not dilated. In general the sac is not covered by the cremaster; but all the best authorities concur in the statement, that this investment is not unfrequently met with. A direct inguinal hernia is now and then accompanied by an oblique one.

From the previous description it is sufficiently clear, why, in the oblique hernia, the pad of a truss should always press, not merely upon the abdominal ring, but upon the track of the inguinal canal; and why, in the direct hernia, the pad should only act upon the abdominal ring. In the taxis, the direction of the pressure should be different; for, in the oblique bubonocele, the viscera should be pushed upwards, backwards, and outwards; in the internal, upwards and backwards. Then, in the operation on strangulated cases, a still more important thing to be remembered is the different directions which should be given to the incision for the division of the stricture: in the oblique case, we may cut upwards and outwards, with perfect safety to the epigastric artery, but not inwards or towards the linea alba; whereas, in the direct hernia, the cut must not be made outwards, but inwards, the epigastric not being displaced from its natural situation. In order to avoid doing mischief by mistaking one sort of hernia for another, Sir Astley Cooper recommends the incision always to be made directly upwards.

### OPERATION FOR OBLIQUE INGUINAL HERNIA.

The hair having been removed from the parts which will be in the track of the knife, and the bladder emptied, the first incision should commence an inch above the external angle of the abdominal ring, and extend obliquely downwards, and inwards over the middle of the tumour to its lower part, except when the hernia is very large. This incision divides the skin and the superficial fascia, and sometimes the upper branch of the external pudic artery, as it crosses the tumour near the abdominal ring. By directing the incision obliquely downwards and inwards, we lessen the chance of injuring the spermatic vessels, should they happen to be situated towards the front of the sac. The division of the integuments, subcutaneous fat, and the fascia superficialis, exposes the fascia derived from the intercolumnar, at the abdominal ring, and generally forming one of the thickest coverings of the hernia. We should then make a small opening through this covering derived from the intercolumnar fascia, which may be safely done by taking hold of a small portion of it with a pair of forceps, and then dividing it cautiously close to the point of the forceps, with the edge of the knife turned horizontally. Having made an opening, we introduce a director, and, with a probe-pointed curved bistoury, divide the fascia upwards and downwards

as far as the external incision reaches. Thus the next covering of the hernial sac is brought into view, namely, the expansion formed by the cremaster, which must be opened and divided in the same manner as the fascia. Having done this, we come to the funnel-shaped process, or the continuation of the fascia transversalis between the upper portion of the cremaster and the hernial sac, but which is so thin and so soon lost in the cellular tissue between the sac and the cremaster, that it is not recognised by some of the best writers on hernia. Now the cellular tissue on the outside of the sac will be brought into view; and, after having carefully divided it, we arrive at the hernial sac itself; a little piece of the anterior and lower portion of which is to be lifted up between the thumb and fore-finger, and carefully examined to learn whether the fold thus raised includes any portion of bowel. If it does not, we take hold of it with a pair of forceps, and cautiously open it with the edge of the knife directly horizontally. Surgeons choose to open the hernial sac at its anterior and lower part, because if there be any fluid in it, it will gravitate to this part, and be a kind of protection to the intestine from the edge of the knife. Sometimes much perplexity is evinced in distinguishing the sac itself from the intestine. However, the circular arrangement of the vessels of a piece of intestine, and its smooth polished surface, sufficiently characterise it from the hernial sac, which has a rough cellular surface, bloodvessels pursuing an arborescent course, and is closely connected to the surrounding parts. Having made an opening into the hernial sac, we are to introduce a director, and, with a probe-pointed bistoury, lay it open to the extent of the other incisions.

The next thing is to divide the stricture, which may be situated either at the abdominal ring, and be formed by the margins of this opening; or else, what is more frequent, within the inguinal canal, where it is produced by the lower edge of the internal oblique and transverse muscles; or, lastly, at the internal ring itself, about an inch and a half from the external ring, in the direction towards the anterior superior spinous process of the ilium.

If the case require it, we may now introduce a director, or the end of the left fore-finger, into the neck of the sac, within the abdominal ring, and, with a probe-pointed bistoury, cut the stricture *upwards and outwards*, or if it be preferred, *directly upwards;* the recommendation of which last plan, suggested as a general one by Sir Astley Cooper, is, that we shall not endanger the epigastric artery by it, whether the case be an external or an internal bubonocele. Were we completely sure, however, that the case were a *direct* bubonocele, we might safely divide the stricture upwards and inwards, the epigastric artery lying on the outer side of the neck of the sac, the reverse of what happens in the *oblique*, or most common form of bubonocele.

When the stricture is at the upper opening of the inguinal canal, the abdominal ring itself should not be cut, unless it prevent the operator from reaching the more deeply-seated strangulation.

The next business is to return the protruded parts, if sound, and free from adhesions; and this will be considerably facilitated by bending the thigh, and rotating the limb inwards. Sometimes, it is true, there is a good deal of difficulty in separating adhesions, which may even be such as to prevent the reduction of the protruded parts altogether; but this is unusual. In such a dilemma, by dividing the stricture, we render as much service as surgery can accomplish; and the patient will not always be lost, though we may be obliged to leave some of the bowels pro-

truding. The intestine, if possible, should always be reduced, unless it be found in a state of actual mortification. The appearance of dark-brown chocolate discolourations is no objection; and they should be discriminated from the *black* or *purple spots*, which indicate mortification.

With respect to *adhesions*, the intestines are not often firmly adherent to one another. In general, the strongest adhesions are those between the omentum and the inside of the sac. Slight adhesions of the intestine to the inside of the sac may be gently broken with the fingers. If such connection should require the use of the knife, the safest plan is not to cut too near the bowel, but to remove the adherent parts of the sac, and return them with the intestine into the abdomen. But, if the adhesions should be within the neck of the sac, the inguinal canal should be more freely laid open, so as to bring them into view.

One important rule, after the reduction, is, to introduce the finger tenderly, and ascertain that the parts are all fairly and freely returned, and not suffering any degree of constriction, either from the margin of the internal oblique and transverse muscles, or the inner opening of the inguinal canal, or other causes, and not confined by any adhesive bands, formed across the mouth of the hernial sac.

*Treatment of Omentum.* — In entero-epiplocele, the omentum, if healthy, is to be reduced after the intestine. If much enlarged and indurated, or gangrenous, diseased, or mortified, the unsound portion is to be cut off, and the arteries taken up with a tenaculum, and secured with fine thread or silk. One half of each thread is to be cut off close to the knot. I do not return the portion of omentum, that lies in the upper part of the sac; by which means all risk of bleeding into the abdomen is avoided.

*Treatment of Mortified Intestine.* — In many cases, when the intestine mortifies in a hernial sac, the latter part, its coverings, and the integuments, also become gangrenous. If the patient continue to live, the intestine bursts, and the feces at length find an outlet, either through the wound made by the surgeon, or an opening formed by the separation of the sloughs. Of course, before the bowel mortifies, the neighbouring inflamed part of it becomes adherent to the neck of the sac. After this the final result may be of three kinds: either the death of the patient; his recovery, with the loathsome annoyance of an artificial anus; or the gradual diversion of the feces from the wound to their natural course again, the cicatrisation of the part, and a complete cure.

The principal thing, on which the re-establishment of the continuous state of the intestinal canal depends, is the adhesion which the living portion of bowel, adjoining the mortified part, contracts with the peritoneum all round. In this manner, the escape of the contents of the bowel into the cavity of the abdomen is in general completely prevented. The two ends of the sound portion, after the sloughs have been thrown off, become connected together through the medium of a membranous cavity, which previously constituted a portion of the peritoneal sac. The gradual contraction of the wound closes the membranous cavity externally, and thus the continuity of the canal is restored. The two ends, however, are not joined, so as to form an uninterrupted cylindrical tube, like that of the natural gut; but they are united at an angle more or less acute; and the matter, which goes from one to the other, describes a half circle in the membranous cavity, while the two ends of the bowel always lie in a more or less parallel manner by the side of each other; the upper with its orifice directed towards the external wound by the feces, so long as they take that direction. The lower is less capacious than the upper.

This account renders it plain, that there must be a considerable projection, or jutting angle, between the orifices of the bowel, directly opposite the communication between the cavity of the intestine and that of the *semicircular funnel-shaped membrane*, as it is termed by Scarpa. Now, it is this projecting ridge, or angle, that forms a material obstacle to the direct passage of the feces from the upper into the lower portion of the intestinal tube. It constitutes one of the chief hinderances to the cure of an *artificial anus;* and it is by destroying it with the pressure of a pair of forceps constructed for the purpose, that Baron Dupuytren's plan often succeeds in curing this loathsome affliction. One of the blades of the instrument, which is blunt, being one line in breadth, is received into a groove in the other, so that the jutting angle, or l'éperon, as it is termed by the French surgeons, is crushed, not suddenly divided, which would afford no opportunity for the adhesive inflammation. The first blade is passed into the upper part of the bowel, the second into the lower, and the instrument is then firmly shut by means of a screw, which connects the handles, and by which the degree of pressure can be regulated. The adjoining portions of the peritoneum unite by the adhesive inflammation; the jutting angle included between the blades sloughs; the cavity of the peritoneum is saved from an effusion of intestinal matter into it; and the canal of the bowel remains free and perfect. Much of the danger of an *artificial anus* will depend upon its degree of nearness to the stomach. Thus, if the opening be in the jejunum, there will be so small an extent of surface for the absorption of chyle, that the patient will die of inanition.

If mortification of the bowel be first detected on opening the sac, and there should be only one or two spots, we are to divide the stricture; and, if the gut be not adherent, it is to be reduced.

When the chief part, or the whole diameter, of the bowel is mortified, the indication is to make an outlet for the intestinal matter, by a free incision through the sloughs, and by cutting the stricture if it should still exist. Here, of course, all idea of reduction of the parts is out of the question.

In *operating upon very large hernia* of long standing, the proper plan is to divide the stricture, if possible, without laying open the hernial sac. The plan will answer, if the stricture be at the abdominal ring. When the sac must be opened, it should be so only towards the latter opening, and not more extensively than circumstances demand. The free exposure of the cavity of a bulky hernia is itself a frequent source of fatal mischief.

In operating upon *hernia within the inguinal canal*, but not protruding through the ring, we should make the incision in the direction of that canal. In such a case, the stricture will be found at the internal ring.

*After the operation*, the wound is to be closed with a suture or two, and lightly dressed. Evacuations from the bowels are to be promoted by means of small doses of sulphate of magnesia, dissolved in peppermint water, or by clysters. The patient must not, however, be allowed to sit upon the night-stool, as doing so would be likely to bring on a protrusion of the bowels again. It is safer to put a bed-pan under him. If tenderness and tension of the belly, with costiveness and febrile symptoms, come on again, in the course of a day or two, we must have recourse to local and general bleeding, poppy-head fomentations, and castor oil. If the stomach be much disturbed after the operation, the sulphate of magnesia may be given in the effervescing saline draught, with or without a few minims of the tincture of opium or hyoscyamus.

Before the patient leaves his bed, a truss is to be applied.

When the bowel has been much discoloured, it will sometimes give way two or three days after the patient has appeared to be going on well; and the patient is destroyed by peritonitis, resulting from effusion of the contents of the bowels into the cavity of the peritoneum.

### OPERATION FOR DIRECT INGUINAL HERNIA.

In this case, the coverings of the sac are the skin and superficial fascia, the intercolumnar fascia, the fascia transversalis, and sometimes the tendinous fibres of the internal oblique and transverse muscles, if not torn or burst. It is only in the vicinity of the abdominal ring, that this hernia commonly has any fibres of the cremaster spread over it. The several investments, here specified, are to be divided much in the same way as those of the oblique bubonocele, and the stricture cut, either upwards and inwards, or directly upwards, as preferred by Sir Astley Cooper, for a reason already explained.

### THE FEMORAL OR CRURAL HERNIA

Is so called, when the hernial sac and its contents protrude under Poupart's ligament at the inner side of the femoral vein, so as to be situated in the bend of the groin, upon the pectinalis muscle, between the gracilis and sartorius. The protrusion takes place, in fact, through the *crural* or *femoral* ring into that compartment of the crural sheath which is destined for the passage of the absorbent vessels of the lower extremity. When once the sac has descended as low as the saphenous opening in the fascia lata, the hernia has more room to extend itself forwards, and to each side, and the integuments now become raised into an oval swelling, the greatest diameter of which is nearly transverse.

The femoral hernia is frequent in women * who have had children; but rare in young girls. In men, a hernia more readily forms through the inguinal canal, by following the course of the spermatic vessels, than under Poupart's ligament; but the latter case is far from being so uncommon in them as sometimes represented.

The tumour, produced by a femoral hernia, may be mistaken for an enlarged gland. A gland can only become enlarged by the gradual effects of inflammation; the swelling of a femoral hernia comes on suddenly, and, when strangulated, occasions the train of symptoms already described, which an enlarged gland could never occasion. As my friend, Mr. Morton, also correctly observes, in consequence of the extensible and yielding nature of the deep lamella of the superficial femoral fascia, glandular swellings are readily moved upon their bases by lateral pressure, and even allow the tips of the fingers to be pressed underneath them, so as to lift them up, as it were, from the fascia of the thigh. On the other hand, the neck of the tumour, formed by a femoral hernia, is deeper and more fixed.

When the expanded part of a femoral hernia lies over Poupart's ligament, it may be mistaken for a bubonocele; but, the true nature of the case may always be made out by observing, that the neck of a femoral hernia has Poupart's ligament above it. In the bubonocele, the spine

* A large proportion of the patients, on whom I have operated, were old women. One, on whom I operated towards the end of October, 1839, in University College Hospital, was eighty-seven, and is at this date (Nov. 2. 1839) nearly well. I remember no instance where the operation was performed on a subject of this very advanced age.

of the pubes is below and behind the neck of the sac; but in the femoral hernia, it is on the same horizontal level, and a little on the inside of it.

When a femoral hernia expands in the bend of the thigh, its shape is oval, and its greatest diameter is placed transversely; but, whatever may be the size of an oblique inguinal hernia, it has an oblong pyramidal shape, with its fundus not inclined towards the ilium, but in the direction of the spermatic cord towards the scrotum.

Besides the symptoms, common to all hernial swellings, the femoral hernia, when of a certain size, has some which are peculiar to it, as stupor, and sense of weight in the thigh, and sometimes œdema of the leg and foot: circumstances, accounted for by the pressure of the hernia on the bloodvessels, lymphatics, and nerves, which pass out of the pelvis in its vicinity.

### SURGICAL ANATOMY OF FEMORAL HERNIA.*

The *crural arch* is a term applied to the lower margin of Poupart's ligament, the space intervening between which and the ilium and os pubis is, in a great measure, closed on the side towards the abdominal cavity by the union of the *iliac* and *transverse fasciæ* at Poupart's ligament, which fasciæ, in fact, shut up all that space which is between the anterior superior spinous process of the ilium and the femoral vessels. Hence, a hernial protrusion scarcely ever happens in the space below the crural arch to the outside of the femoral artery and vein. The occurrence is prevented not only by the junction of the iliac and transverse fasciæ within, but also by the *fascia lata* without, which, in this situation, is strong and closely attached to the subjacent parts. The femoral hernia takes place through the *crural ring*, a small oval aperture, which is situated under the crural arch, more towards the pubes; in fact, between the thin posterior border of the *crural arch*, termed *Gimbernat's ligament*, and the septum at the inner side of the femoral vein.

As the protrusion does not take place through a simple aperture, but follows a course of some trivial length, the expression *crural canal* is employed by Scarpa and Cloquet. It is at all events the superior or posterior aperture of the *crural canal* which is implied by the *crural ring*, the canal itself extending obliquely downwards and forwards for a half or three quarters of an inch, and terminating below at the oval depression for the vena saphena major; or, in the words of Mr. Morton, the *crural canal*, is the short passage which extends between the *saphenous opening* of the fascia lata and the *crural ring*. It is formed by the innermost of the compartments into which the funnel-shaped sheath of the femoral vessels is subdivided.

The viscera descend at first nearly in a perpendicular direction, and come into the hollow in front of the pectinalis, but the hernia then turns forwards, and directs itself rather towards the ilium, the fundus of the sac sometimes inclining over the crural arch.

As the protrusion descends over the pectineal line, or close attachment of the pectinalis muscle to the pubes, it must be situated over the pubic portion of the fascia lata. *Gimbernat's ligament*, which is a part of so much importance in the anatomy of femoral hernia, I think, will be best

* An excellent description of this subject, which I recommend to all students, is contained in "Morton's Surgical Anatomy of the Groin, the Femoral and Popliteal Regions." 8vo. Lond. 1839. The lithographic plates and wood engravings are superiorly executed from original drawings; and the book is replete with valuable surgical remarks.

understood by considering it as a prolongation or extension of Poupart's ligament, which, when it approaches the os pubis, becomes suddenly broader, and is attached by this broad portion to the angle and crista of that bone, and ileo-pectineal line. The posterior edge of Gimbernat's ligament is concave, thin, and sharp, the ligament itself about three quarters of an inch in breadth, but broader in the male than the female subject. In the erect position of the body, it is nearly horizontal.

The *crural ring*, through which the absorbents of the thigh ascend to the lymphatic glands situated upon the inner border of the psoas muscle, is formed by this posterior edge, or, as it is sometimes termed, the base of Gimbernat's ligament, directed towards the crural vein; externally by the femoral vein, or rather by a production of fascia, or a kind of septum placed between that vessel and the compartment of the femoral sheath, through which ascend the great lymphatics of the thigh; anteriorly by the thin posterior edge of the crural arch, or Poupart's ligament; and posteriorly by the horizontal branch of the os pubis. But into the crural ring productions both of the fascia transversalis and fascia iliaca always descend, so as to form at once a part of the *tubular or funnel-shaped sheath for the femoral vessels*, and a lining for the crural canal, the front half being formed by the fascia transversalis — the back by the fascia iliaca; and, as Sir Astley Cooper has clearly explained, it is through the inner side of the sheath, next to the pubes, that the femoral absorbent vessels pass into the abdomen, the openings for which give a cribriform appearance to this portion of the tubular sheath. The femoral sheath is wider above than below: its external side, which is straight, being closely applied to the femoral artery; while its inner margin extends downwards and outwards from Gimbernat's ligament to the femoral vein, just on the inner side of which vessel is an oval aperture, frequently occupied by a lymphatic gland, and some absorbents and loose cellular tissue (the septum crurale of J. Cloquet), through which opening the hernia, in its descent, passes towards the point of the fascia lata, at which the vena saphena major gets to the femoral vein, which point is included within what is called the *falciform process*. It should then be clearly understood, that the *tubular* or *funnel-shaped sheath* of the femoral vessels is subdivided into three distinct compartments by the membranous septa, which are situated on each side of the femoral vein, and connect the anterior and posterior parietes of the sheath more firmly together. The most external of these subdivisions contains the common femoral artery, the second, or middle, the great femoral vein, while the third, or that which is nearest the tuberosity of the os pubis, corresponds with the crural ring, and is closed in the natural condition of the parts by some loose cellular tissue, and lymphatic vessels, an absorbent gland also occasionally lying within it.* Into this last compartment, the viscera protrude in a femoral hernia.

The very lucid and original explanations of the anatomy of femoral hernia by Sir Astley Cooper reflect the highest honour on himself, on his profession, and, I would also say, on his country. We knew little about various points in the minute anatomy of femoral hernia until he demonstrated them, and published a clear description of them. If we turn to this source of information, or, what is better, if we dissect and open the tubular sheath, we find that it contains two membranous partitions, or septa, one passing between the artery and vein, and another between the vein and the absorbents. The artery and vein completely fill

* See Th. Morton, Op. cit. p. 90.

up the spaces in the sheath allotted to them; but the absorbents, being but loosely connected by cellular tissue, do not always afford sufficient resistance to prevent the descent of the viscera in this situation, and the formation of a crural hernia. It is this opening, then, in the inner part of the sheath, which is really the aperture by which the bowels descend, and which is situated, as already stated, between the thin crescentic edge of the base of Gimbernat's ligament and the femoral vein, or rather the septum. Or I may say, that the hernia protrudes into the division of the tubular sheath, designed for the transmission of the principal trunks of the absorbents from the lower extremity, scrotum, and superficial parts of the hypogastric region into the pelvis.

The *falciform process* is easily comprehended when we remember, that the fascia lata has two origins, one from the lower border of Poupart's ligament, all the way from the anterior superior spinous process of the ilium, to the tuberosity of the os pubis. This, which is the thickest and strongest, is called the *iliac portion*, and it covers the psoas, iliacus, sartorius, and rectus muscles, the femoral artery and vein, and the anterior crural nerve, its breadth in the adult subject being from four to five inches. The *inner* or *pubic portion* of the fascia lata arises from the pubes in front of the origin of the pectinalis muscle, which muscle it covers, together with the adductor longus, and the gracilis, and afterwards unites with the iliac portion of the fascia lata, under the great saphena vein. Of course, it lies behind or under the femoral vessels, while the iliac portion is in front of them; and above, it is continuous with the iliac fascia. From this description, it is manifest that, where the pubic portion of the fascia lata joins the iliac portion under the vena saphena major, there must be an aperture left for the passage of that vessel. This opening is termed the *saphenous opening*, the concave external margin of which consists of part of the *falciform process*, first correctly described by Mr. Allan Burns.*

Scarpa represents the iliac portion of the fascia lata as connected with Gimbernat's ligament; and Mr. Lawrence describes the upper end of the falciform process, not merely as passing in front of the femoral vessels, just as they emerge from behind the crural arch, but as bending under Poupart's ligament, so as to unite with the thin border of the arch called Gimbernat's ligament.

The great saphænal vein passes over the inferior sharp edge or lower horn of the falciform process, and there joins the femoral vein. Then, between the parts just described and the skin, is the *fascia superficialis*, quite distinct from the fascia lata, and consisting of two layers, between which lie some adipose matter and the superficial inguinal glands. Where it covers the saphenous opening, it has several apertures in it, and this portion of it, or rather of the deep layer of it, is sometimes termed the *cribriform fascia*.†

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* "It is in a great measure owing to the connection that exists between the margin of the saphenous opening and the sheath of the vessels, that the fundus of the sac of a complete femoral hernia is usually prevented from descending any further downwards, but is rather turned, or tilted forwards and upwards, so as to rest upon the falciform process and the lower part of the aponeurosis of the external oblique muscle." Morton, Op. cit. p. 110.

† "The fascia cribriformis adheres pretty closely to the margins of the saphenous aperture of the fascia lata; it is covered externally by the cutaneous vessels and superficial absorbent glands; while its internal surface is in apposition with the anterior part of the funnel-shaped sheath of the vessels, where it is formed by the fascia transversalis." Morton, Op. cit. p. 103.

The anterior wall of the crural canal is formed by the fascia transversalis, covered by the falciform process of the iliac portion of the fascia lata. The posterior wall is formed by the fascia iliaca, supported on the pubic portion of the fascia lata, which here covers the pectineus. The external wall is formed by the septum at the inner side of the femoral vein, and the internal by the transverse and iliac fasciæ, where they unite to complete the inner side of the funnel-shaped sheath.

In femoral hernia, the viscera descend through the crural ring, pushing before them the peritoneum. They then pass into the internal compartment of the tubular sheath of the femoral vessels, that designed for the transmission of the lymphatics, and afterwards turn forwards, and even upwards, through the saphenous opening in the fascia lata, so as to lie over the iliac portion of the fascia lata.*

The coverings of the femoral hernia are the *integuments*, the *fascia superficialis*, and the *fascia propria*, or tubular sheath of the femoral vessels, besides the peritoneal hernial sac. The epigastric artery passes obliquely upwards and inwards, about half an inch from the external side of the neck of the sac. When the obturatrix artery arises from the epigastric, it may go either near the outer or inner side of the neck of the sac to the obturator foramen. When the common trunk of these vessels, so originating, is long, and the place where the obturatrix goes off from it is high up, the latter vessel may descend near the upper and inner border of the crural ring. But, when it arises from the epigastric lower down, it will then pursue its course downwards near the external margin of the neck of the sac. On this point, Mr. Morton makes the following remark: — "When the obturator artery is given off from the epigastric (a variety that occurs about once in three subjects), it most frequently descends upon the pubal side of the external iliac vein to reach the thyroid foramen; and, when it does so, will always be placed upon the iliac, or external side of the crural ring, and therefore altogether removed from the edge of the knife, as commonly directed in the operation for femoral hernia." Sometimes, however, it runs, for a short distance, along the superior margin of the crural ring, and then descends behind the lunated border of Gimbernat's ligament, in its way to the thyroid foramen. When this latter arrangement prevails, the neck of the hernial sac is surrounded for at least three fourths of its circumference, by large and important vessels. The spermatic cord, or, in women, the round ligament, as it lies within the inguinal canal, passes directly over the superior part of the hernia; or, in other terms, is situated close above the anterior margin of the crural ring. All these are essential things to be considered in operating on a femoral hernia.

The peritoneum, as it descends before the hernial protrusion, pushes before it the subserous cellular tissue, and the septum crurale. So long as the hernia is lodged within the crural canal, and does not project through the lower opening of it, the case is termed an *incomplete femoral hernia*. On account of the tumour being small, and bound down by the falciform process, its detection, as Mr. Morton justly observes, requires much attention, especially in corpulent subjects.

When the fundus of the sac protrudes through the saphenous opening, the case is a *complete femoral hernia*.

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* In a few instances, where the septum on the inner side of the femoral vein is defective, the hernia, instead of protruding at the saphenous opening, descends further into the sheath of the femoral vessel, and then, of course, it lies under the fascia lata.

OPERATION FOR STRANGULATED FEMORAL HERNIA.

The bladder should first be emptied; for, a wound of it has been known to occur in the operation. This is not always performed in one way, different surgeons having different modes of proceeding, according to their view of the parts chiefly concerned in forming the stricture, and of the safest place for the incision, with reference to the epigastric artery and spermatic vessels; for the round ligament in the female ought not to have much influence on the question, a wound of it being of little importance. At St. Bartholomew's, the school where I was brought up, the surgeons usually began the operation by making an incision, which commenced about an inch above the crural ring, or pubic portion of Poupart's ligament, and extended obliquely downwards and outwards over the centre of the swelling. This plan answered very well where the intention was to divide Gimbernat's ligament near the pubes, in order to free the protruded parts from strangulation in the crural ring itself, and to be able to reduce them. Sir A. Cooper and Baron Dupuytren make two incisions through the integuments, in the form of the letter T reversed. The transverse cut, extending over the middle of the tumour, is safely made by pinching the skin into a fold in the direction of the femoral vessels, and then cutting it across. The second incision is then to descend from a little above Poupart's ligament to the central part of the transverse incision, after which the angles or flaps are to be carefully dissected up. The first transverse cut is likely to wound the superficial epigastric artery: but this is a matter of no importance. The division of the integuments exposes the superficial fascia, which is here generally thicker than what lies over an inguinal hernia, though, in thin persons and recent cases, it may be so delicate as to escape notice. It also includes between its layers the superficial absorbent glands. Sometimes, when we have made the incision through the skin, we find the hernia concealed by dense fat and enlarged absorbent glands; but we are not to be perplexed by the circumstance, provided we are clear and certain respecting the existence of hernia. I remember being sent for to a poor woman in St. Giles's, one twelfth-night, for a strangulated femoral hernia, when, as the symptoms were urgent, and I had not much time to spare on account of a private engagement, I proceeded to the operation directly after the taxis had failed. Now, on making the incision through the integuments, I came to such a mass of diseased fat and glands, that I was a little staggered, and led to consider for a minute or two whether I might not have been in too great a hurry to operate, and mistaken a case of enlarged glands for a hernia. But a little reflection convinced me, that the patient's symptoms could not depend upon the latter cause; and, on dissecting more deeply, I came to the fascia propria of a small hernial tumour. The patient recovered, as, I think, most patients do, in whose cases the operation is not deferred till too much inflammation and other mischief have had time to take place. After the division of the superficial fascia, we come to the tubular sheath of the femoral vessels, or *fascia propria*. Our next object is to lay open the fascia propria, first lifting up a piece of it with the forceps, and then making a small opening in it with the edge of the knife directed horizontally. A director is then to be introduced into the aperture so made, and the fascia propria divided upwards and downwards to the neck and fundus of the sac. After having laid open the fascia propria, we may meet with a quantity of fat, which, in consequence of the long pressure

of trusses, sometimes presents a thickened dense feel, and assumes very much the appearance of indurated omentum, so as to cause an erroneous suspicion of the hernial sac having been already divided, followed by pernicious efforts to push back the parts into the abdomen. This is a subject, on which excellent practical information is contained in Key's edition of Sir Astley Cooper's work on Hernia, who has given a plate exhibiting an unopened sac pushed back into the abdomen, with the strangulated bowel in it. In University College Hospital, I operated last winter (1838-39) on a woman of sixty, for a strangulated femoral hernia of long standing. On opening the fascia propria, a portion of a cyst, imbedded in fat, and filled with fluid, presented itself, looking very much like a fold of intestine. On dissecting more deeply, another cyst of the same kind was met with, before the hernial sac was exposed.* Circumstances of this kind, if the surgeon be not aware of their possibility, create much embarrassment in the operation. The hernial sac, having been exposed, is now to be cautiously opened, in which step of the operation we are to nip up a small portion of the fundus of the sac, and feel that no portion of the contents of the hernia is directly within it. Then we are to take hold of it with the forceps, and make a small opening in it with the edge of the knife directed horizontally, and kept close to the extremity of the forceps. On this being done, a certain quantity of clear or turbid serum mostly gushes out, but not invariably. The director is now to be introduced, and the sac laid open upwards and downwards to the crural sheath and fundus of the sac itself.

Having proceeded thus far, we may sometimes easily return the contents of the hernia without the further use of the knife; but, unless this be practicable without any squeezing and bruising of the parts, the stricture ought to be cut. In this important stage of the operation, I have generally divided Gimbernat's ligament, and with it the neck of the hernial sac, and the contiguous part of the fascia transversalis. A director is introduced along the inner side of the protruded viscera into the crural ring, with the groove turned towards the pubes. Then with a narrow probe-pointed bistoury, or with Sir Astley Cooper's hernial bistoury, which has but a limited cutting edge, and none at all towards the handle, in order to occasion less risk of wounding the bowel, we are to cut the base or deep-expanded part of Gimbernat's ligament in the direction inwards, or inwards and upwards. In this part of the operation, the bowel is continually exposed to injury, on account of the small space in which we have to act; and I recommend all surgeons, therefore, not only to use the kind of bistoury suggested by Sir Astley Cooper for the division of the stricture, but to be particular in keeping the intestine out of the way of the instrument with the left fore-finger, or with the hand of an assistant. Of late, I have sometimes cut the posterior edge of Poupart's ligament upwards and inwards either with a common probe-pointed bistoury, or Sir Astley's knife, passed along the nail of the fore-finger of the left hand, which is sometimes safer than a director. "The tip of the finger nail (as Mr. Morton observes) should be insinuated underneath the band which forms the stricture, and the blunt extremity of the probe-pointed bistoury (placed flat upon the finger) guided just within the sharp margin of the stricture; after which the edge of the knife is to be turned up-

* See Clinical Lecture in Lond. Med. Gaz. for March, 1839. Cysts of this description I find noticed in the last edition of Lawrence's Treatise on Hernia; also by Sir Charles Bell, in his Illustrations of the Great Operations of Surgery, p. 41.

wards, and the handle being raised, the tendinous band, which resists the return of the bowel, will be easily divided." The stricture having been divided, the thigh should be fixed, and rotated inwards, in order to relax still further the crural ring, and facilitate the reduction.

When the bowel has been strangulated beyond a certain time, it becomes dark-coloured; and, though not actually gangrenous at the period of the operation, it will sometimes give way afterwards. This happened in a case, where I operated rather too late on the sister of the celebrated harlequin, Bologna. She was a dancer, a profession particularly exposed to the risk of hernia. After the operation, her sufferings ceased, she had several motions, and her pulse came down to 80; but, all on a sudden, forty-eight hours after the operation, she was seized with excruciating agony in the abdomen, faintings, quick faltering pulse, and cold sweats, with which symptoms she soon died; and, on opening her, it was found that a small point of the ileum had given way, that the contents of the bowel had become effused, and that a rapidly fatal inflammation of the peritoneum had been the consequence.

It would not be safe to cut the crural ring upwards in a male subject; because we should wound the spermatic cord. In a female, however, in whom we find that this hernia is most common, I do not know, that the round ligament ought to deter us from cutting in this direction, if we had any reason for selecting it. We could not cut upwards and outwards, because we should injure the epigastric artery; and we could not turn the edge of the knife precisely outwards, or in the direction away from the pubes, because we should wound the femoral vein. The safest plan, therefore, seems to be generally that of making the requisite division of the crural ring by cutting inwards, or inwards and a little upwards.

The only case, in which the division of the deeper part of the stricture, in the direction inwards, would be attended with danger, is that in which the obturatrix artery arises from the epigastric, high up, and, in its way into the pelvis, descends round the inner margin of the crural ring. This position of the obturatrix artery, however, in relation to the neck of the sac and the crural ring, is computed not to occur more frequently than once in about eighty cases of femoral hernia. The division of Gimbernat's ligament inwards has not the sanction of some surgeons, for whom I entertain the highest respect; and though it is the method which I have frequently adopted, and found answer, let not the reader suppose that I do not see reasons for sometimes following other plans. Sir Astley Cooper cuts the anterior part of the crural canal, by carrying the knife as far as the front margin of the crural arch, in the direction upwards and inwards. When this is not sufficient, he next cuts the thin posterior border of Poupart's ligament in the same direction. There ought, indeed, to be some variety in the method of operating, according to the circumstances of each individual case: and the valuable investigations of that eminent surgeon tend to prove, that the seat of strangulation in femoral hernia is not always in the same place, but may be either in the crural sheath, where the stricture is occasioned by the semilunar edge of the fascia lata, or the saphenous opening, or at the posterior edge of the crural arch; or, lastly, at the mouth of the hernial sac, in the fascia which surrounds it.*

* On this interesting part of the subject, the following is Mr. Morton's statement. "In by far the greater number of instances, the constriction is relieved by the division

Having laid open the hernial sac, Sir Astley Cooper introduces his probe-pointed bistoury, which does not cut near the point, into the crural sheath, at the anterior part of the sac, and divides with it the sheath as far as the front edge of the crural arch. This cut, which does not exceed half an inch, is sufficient for the reduction of small herniæ. But if the bowel cannot now be returned by gentle pressure, he passes in his finger about half an inch higher, and divides the posterior edge of the crural arch and fascia transversalis immediately next to it. As these two incisions are made from within the sac, they will of course remove any stricture formed by the sac itself. The direction of an incision for the division of the stricture, which he deems most eligible, is upwards, with a slight obliquity towards the umbilicus.

Baron Dupuytren, in operating on femoral hernia, used to divide the same parts as Sir Astley Cooper; but employed a curved probe-pointed bistoury, which cuts on its convexity; it is introduced into the hernial sac flat on the left fore-finger, and its edge is then turned upwards and outwards, and the upper extremity of the falciform process divided as far as the front margin of the crural arch. Hesselbach also regards an incision through the front side of the crural canal safer than one through Gimbernat's ligament. Although Dupuytren directed the knife towards the spermatic cord, he did no injury to it; because he took care not to cut far enough to endanger it. He also avoided the epigastric artery by making a very limited cut.

### CONGENITAL INGUINAL HERNIA.

The great peculiarity of this case is, that the protruded viscera lie in the tunica vaginalis, which serves as the hernial sac. The bowel, or omentum, is therefore in contact with the testicle.

The congenital inguinal hernia arises in the following manner:—In the fœtus, the testes are situated immediately below the kidneys, on the fore-part of the psoas muscles, with their anterior and lateral surfaces covered by reflected peritoneum, and their posterior surfaces connected to the psoas muscles by means of cellular tissue. About a month or six weeks before birth, but sometimes subsequently to this event, the testes descend through the abdominal ring into the scrotum, where there is a production of the peritoneum already formed for their reception, and afterwards constituting the tunica vaginalis. The testes in their descent do not fall loose into the tunica vaginalis, but carry with them the peritoneum immediately adherent to them. Soon after the testes have got into the scrotum, the upper part of the tunica vaginalis is closed, by which change all communication between the cavity of that membrane and the belly is shut. Sometimes, however, this closure is delayed, and then, if any of the bowels insinuate themselves into the passage, they become of course, so long as they continue unreduced, an impediment to its further obliteration; and the case is a congenital inguinal hernia, which differs from all common herniæ in having no hernial sac produced by a protrusion of the peritoneum with the bowels themselves.

No doubt, one of the most frequent predisposing causes of congenital hernia is the occasional delay in the descent of the testicle, which cir-

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upwards and inwards of the falciform process of the fascia lata, and the lunated edge of Gimbernat's ligament, where they join with each other. In some instances, it will be the fibres of the deep crescentic arch; in others again, the neck of the sac itself," within the circumference of the crural ring.

cumstance has the effect of retarding the closure of the passage between the belly and the scrotum. The disease is not generally produced by the insinuation of the bowel into the tunica vaginalis at the same time as the testicle itself. Before birth, the small intestines are but little distended; and, in the absence of respiration, they can suffer no compression from the diaphragm and abdominal muscles. Hence, notwithstanding the expression *congenital,* the disease is hardly ever noticed in infants directly they are born, but makes its first appearance afterwards. One accidental circumstance, however, may really make the hernia strictly congenital, namely, — the intestine or omentum may become adherent to the testicle previously to its leaving the abdomen, and consequently descend with it into the scrotum before birth.

The formation of such adhesions between the bowels and testicle before birth may also sometimes prevent, or retard, the descent of the latter organ.

Surgeons are frequently consulted for congenital hernia, where the testicle has not yet descended through the ring.

The congenital inguinal hernia must always necessarily be external, or oblique; because the neck of the tunica vaginalis invariably corresponds to the point, at which the spermatic cord passes under the border of the transversalis muscle. Also, as the tunica vaginalis enters the inguinal canal beyond the point at which the spermatic cord crosses the epigastric artery, it must have this artery on the internal side of the inner ring.

In young children, the congenital hernia more frequently contains intestine than omentum, because in them the latter part is very short.

The impossibility of feeling the testicle, while the bowels are down, is the most important criterion between this hernia and a common bubonocele, where we can always feel the testicle at the lower and back part of the swelling. Then a suspicion of the nature of the case may be entertained, if the hernia has existed from early childhood; not that infants may not be occasionally the subjects of common bubonoceles.

The viscera, included in a congenital hernia, but more especially the omentum, are frequently adherent to the testicle; a complication attended with serious inconvenience, unless removed, as it prohibits the reduction of the protruded parts, and the use of a truss. The bowel and omentum may also adhere to the sac, and sometimes to the sac and testis at the same time.

A congenital inguinal hernia is to be treated on the same general principles which apply to other herniæ. If the bowels admit of reduction, the patient be young, and a proper truss constantly worn, the communication between the abdomen and scrotum will frequently become obliterated, and a radical cure be the result. The chances of this desirable event diminish, however, as the individual grows older, and, after the adult age, a truss can hardly ever be safely dispensed with. Unfortunately, we cannot always apply a truss, as when a piece of intestine or omentum is in the sac, while the testicle is in the groin, or even within the abdomen; for, in the first case, it would press upon and inflame the testicle, and, in the second, prevent its descent. However, if the patient should be beyond the age, when any chance of the descent of the testicle exists, I would recommend the hernia to be reduced, and a truss applied.

In young subjects, in whom no congenital hernia exists, but one or both testicles have not yet passed the ring, their descent should be watched, and, as soon as they are low enough, a truss should be worn, constructed so as not to make any hurtful pressure on them.

A congenital hernia is remarkable for the thinness of its sac; a fact dictating caution in the first steps of the operation. The sac is, indeed, frequently not thicker than the natural peritoneum. This hernia is also well known to be particularly often strangulated at the inner opening of the ring, or by a contraction of the neck of the sac within the inguinal canal. It has also another peculiarity, which is, that it sometimes becomes strangulated by constrictions in the body of the sac itself.

As the epigastric artery is always on the inner side of the neck of the sac, the division of the stricture may be safely made upwards and outwards.

Great care should be taken not to handle, wound, or, in any manner injure the testicle in the operation.

A peculiar case is sometimes met with, consisting of a protrusion of the viscera, together with a peritoneal hernial sac, into the cavity of the tunica vaginalis. It is formed after the recent obliteration of the communication between the abdomen and the tunica vaginalis. Were we not aware of the possibility of such a case, we might be considerably perplexed on meeting with it. In the museum of University College is a preparation of a double kind of hernia: first, a congenital one, with omentum in it; and, secondly, another hernial sac pushed down into the tunica vaginalis.

### HERNIA OF THE CŒCUM AND COLON.

Scrotal herniæ of the right side, formed by the cœcum, the appendix vermiformis, and commencement of the colon, draw after them into the scrotum that portion of the great bag of the peritoneum by which those viscera are naturally fixed in the right ileo-lumbar region; and, on opening the sac, we find the cœcum and colon connected to this part of the peritoneum, just as they were in the abdomen previously to the displacement. The same kind of natural adhesion of the large intestines to the hernial sac may also take place in a scrotal hernia of the left side, when the protrusion consists of that part of the colon which is naturally fixed in the left ileo-lumbar region by duplicatures of the peritoneum.

Another peculiarity of these herniæ arises from the cœcum and beginning of the colon being partly situated out of the peritoneum: hence they can only be partially surrounded by a hernial sac, a portion of their external side being in immediate contact with the adjacent cellular tissue. In such a case, were the surgeon to cut too much towards the outside of the tumour, he would find the cœcum and colon immediately under the cremaster and infundibular process of the fascia transversalis.

From what has been stated, we discern the cause of another peculiarity of herniæ of the cœcum and fixed portion of the colon, namely, the impossibility of their reduction. The appendix vermiformis may be returned, but the cœcum itself cannot be reduced, unless the sac itself admit of being replaced.

These circumstances render it a matter of importance to discriminate a hernia of the cœcum and beginning of the colon from others. Now, *such a case can only form gradually;* the displacement of the cœcum and colon, fixed as they are in their natural situation, must be a slow process. Herniæ of sudden formation, therefore, cannot be of this kind. The tumour will also generally be of large size, of long standing, and of an irregular knobby shape.

In this species of hernia, as well as in all others of large size, the symptoms of strangulation are seldom violent, on account of the width of the

opening through which the protrusion takes place. We should in such cases be cautious not to mistake the colic and irritation, to which the viscera in the tumour are liable, for the symptoms of strangulation. When a large old scrotal hernia is really strangulated, the evacuations from the bowels are soon totally suppressed, the swelling is painful, and the patient is affected with vomiting, eructations, and fever. On the contrary, in the colic from irritation, resembling strangulation, the discharge of air and feces from the rectum is never entirely suppressed; and the evacuations are increased when mild purgatives and clysters are given. If nausea and tendency to vomiting occur, it is at long intervals; there is not much fever; and the swelling, though tense and bulky, is not painful on being handled. Under such circumstances, mild saline purgatives, clysters, and cold applications, may frequently be employed with success, and we should not be in haste to perform an operation.

But, if a large hernia of the cœcum were to be truly strangulated, we should remember, that the bowels will not admit of being completely returned, on account of their particular and natural adhesions to the sac; and in this, as well as in all scrotal herniæ of large size, the neck of the hernial sac is not the seat of strangulation. Here, perhaps, the best plan would be merely to expose the abdominal ring, and make a division of it, upwards and outwards, without opening the hernial sac at all, and then to try to reduce the viscera as far as practicable.

### THE EXOMPHALOS, OR UMBILICAL HERNIA,

Is a protrusion of the viscera through the navel, or in the neighbouring part of the linea alba. The first case, whether met with in the infant or adult, has a *circular neck*, at the circumference of which the tendinous margin of the umbilical ring can be felt. Whatever may be the size of the tumour, its body always retains nearly a spherical shape; nor can any wrinkle of the skin, nor any thing at all resembling the cicatrix of the navel, be seen upon the convexity or the sides of the swelling. On the contrary, in a hernia of the linea alba, the *neck of the swelling* is of *an oval shape*, like the fissure through which the protrusion has taken place; and, if the hernia be very near the navel, the *umbilical cicatrix may be seen on one of the sides of the swelling* — a sure proof that the viscera do not protrude through the umbilicus itself.

In a true exomphalos, the tumour in a thin person is free and pendulous; in a fat subject, broad at its base, less prominent, and hence spherical. The protruded parts will naturally tend downwards, so that the opening into the abdomen is from the upper part and not from the middle of the swelling.

The umbilical hernia is not only furnished with a true peritoneal sac, but with a superficial investment of condensed cellular substance. The coverings of this hernia, however, are frequently very thin, and, in old cases, portions of the sac are sometimes absorbed. Nay, the viscera may be adherent to the integuments, and strangulated by the opening in the sac, through which they have protruded, and which has been occasioned by its partial absorption.

An umbilical rupture in an adult rarely contains intestine unaccompanied by omentum. The disease happens with much greater frequency in women than men; a fact explicable by the consideration that pregnancy has more influence than any other cause in bringing on the complaint. Dropsical and corpulent subjects, however, of both sexes are particularly liable to it.

HERNIÆ IN THE LINEA ALBA, OR VENTRAL HERNIÆ,

Are much slower in their progress than a true exomphalos. On account of their small size, they are frequently unobserved, especially in corpulent subjects, or when situated on one side of the ensiform cartilage. However, they bring on complaints of the stomach and habitual colics, and are more liable to simple obstruction, than strangulation with inflammation and tendency to gangrene. But when this state unfortunately does occur, the symptoms are more intense, and the accession of mortification more rapid, than in any other species of hernia. Even when merely the omentum is strangulated, the symptoms are particularly violent, a circumstance ascribed to the proximity of the stomach.

When practicable, the exomphalos and ventral herniæ should be reduced, and a truss worn. In Hey's Surgery is a description of an excellent truss for umbilical hernia. In young subjects, the pressure of a truss will often radically cure the disease; and the plan is much more commendable, than that of reducing the viscera, and then extirpating the integuments and sac with a ligature.

When, in adult subjects, an operation is unavoidable, the sac should be laid open with the greatest caution, and the umbilical ring divided either directly upwards or downwards. When the hernia is very large, but not attended with gangrene, we should be content with cutting the umbilicus, without opening the sac at all, or as little of it as possible.

The division of the stricture in ventral hernia may also be made upwards or downwards, due regard being paid to the epigastric artery which crosses the linea semilunaris.

CYSTOCELE, OR HERNIA OF THE BLADDER.

The protrusion is most frequently through the abdominal ring; and generally in male subjects who have been repeatedly afflicted with retention of urine. Cystocele has been noticed, however, in children, from the irritation of stone, and even in women from the effects of dropsy and pregnancy.

Only the fundus and a part of the posterior surface of the bladder, down to the insertions of the ureters, are covered by peritoneum. Now, as it is usually the anterior and lateral part of the bladder which first passes through the ring into the scrotum, the peritoneum will not protrude at the same time, and the displaced part of the bladder will not be covered by a hernial sac; but, as more of it descends, its fundus at length passes into the scrotum, drawing after it the peritoneum naturally attached to it. Thus the bladder first protrudes, and a hernial sac follows, into which a portion of the omentum or intestine may glide. Here the bladder is invariably excluded from the other hernia, and situated at its posterior and inner side. Sometimes the case is reversed, and the cystocele is the consequence of an ordinary hernia.

The symptoms of cystocele are a fluctuation in the tumour, the swelling becomes large and tense when the patient holds his water, and diminishes when the urine is discharged. If the scrotum be compressed, an inclination to make water is experienced. Sometimes, the muscular coat of the bladder being paralytic, the patient cannot expel the urine from the swelling, unless he raise and compress the scrotum; indeed, as the bladder is always drawn to one side, the patient invariably has more or less difficulty in making water, and is sometimes afflicted with a total retention.

The disease has been mistaken for hydrocele, though the marks of difference are great. Thus, the tumour produced by the bladder always extends into the ring, the testicle is plainly perceptible below the swelling, and the tumour diminishes when the patient voids his urine.

Cystocele may occur also under the crural arch, in the perinæum, or the vagina.

The reduction of a cystocele is soon rendered totally impossible by adhesions; and all that can be done is to apply a suspensory bandage. If a total retention of urine were to attend it, caused by the displaced condition of the organ, and not to admit of a catheter being passed, the swelling should be punctured. If a calculus were to form in the protruded bladder, an incision might be practised for its extraction.

This is all the information which I can offer on the subject of hernia in this treatise. Some forms of the disease, like herniæ at the foramen ovale, or ischiatic notch, in the vagina, or perinæum, or through the diaphragm, are rare; though I would advise all surgeons to remember them, and be prepared for them. They will be still more likely, I think, to meet with cases, in which the bowels within the abdomen become strangulated by accidental displacements, bands of adhesion, or various other causes.

## DISEASES OF THE GENITAL ORGANS.

The testicle is particularly often the seat of inflammation and disease, owing, perhaps, to circumstances adverted to by Sir Astley Cooper, namely, the slow manner in which the blood returns from it against its own gravity; the occasional immoderate distension of the seminiferous tubes; its exposure to injury from blows or pressure; its sympathy with morbid conditions of the urethra and prostate gland; and the changes, which it almost naturally undergoes in old subjects.

The classification of the diseases of the testicle, adopted by this able pathologist, is, first, into those which are the result of *common inflammation, acute*, or *chronic;* secondly, into those which are of a *specific nature*, but *not malignant;* and thirdly, others, which are both *specific* and *malignant.*

The first division comprises *acute* and *chronic inflammation*, and *atrophy of the testicle.* The second, embracing diseases, attended with specific, but not malignant action, comprehends what Sir Astley Cooper names the *hydatid* or *encysted disease of the testicle;* the *irritable testicle*, or *neuralgia testis; the swelling of this organ* frequently *occurring in* the disorder of the system termed *mumps; ossific changes in the part; solid tumours of the epidydimis*, or *the testis;* the *scrofulous testicle;* and what has been occasionally denominated the *venereal sarcocele.* The third division of the classification, including specific and malignant affections, comprises *medullary cancer*, or *fungus hæmatodes*, and *scirrhus.* But, besides the numerous varieties of disease now referred to, there are several diseases of the coats of the testicle and spermatic cord, for which the advice of a surgeon is often requested. Now, if attention be not paid to the subject, the ignorant practitioner will be likely to get into serious scrapes, by confounding one disease with another; mistaking diseases of the body of the testicle either for hernial swellings or hydroceles; or these again for enlargements of the testicle itself; and varicous swellings of the spermatic

veins for herniæ, or herniæ for varicoceles. I am continually meeting with patients who either have herniæ, and, not being aware of the nature of their cases, do not wear trusses, or who are wearing trusses on the supposition of their having herniæ, when, in truth, they have no such complaint.

### ACUTE INFLAMMATION OF THE TESTICLE,

When it arises from gonorrhœa, or some other kind of irritation in the urethra, is frequently, though absurdly, termed *hernia humoralis*. It is often excited by strictures, and still more commonly by the means ordinarily employed for their cure, namely, bougies, the irritation of which becomes the cause of the affection of the testicle. When inflammation of the latter organ is thus excited by disease in the urethra, it is preceded by soreness or irritation about the membranous and prostatic portions of that canal; the spermatic cord becomes swollen and tender, and in particular the vas deferens, which seems much thickened, and, on being touched, is extremely painful. When the case is still further advanced, the swelling extends to the whole of the testicle, the hardest part of it being the epidydimis. In general, so considerable is the enlargement of the organ in every severe case, that the scrotum is exceedingly distended, and its rugæ being effaced, its surface is completely smooth. Painful as the inflamed testicle is itself, a still greater degree of suffering is often experienced in the lumbar and inguinal regions, with great uneasiness about the hip and thigh. Sometimes the agony in the part affected seems to have paroxysms of increased severity, which are alleged to depend upon spasmodic contractions of the fibres of the cremaster. The scrotum, besides losing its naturally corrugated appearance, is also reddened. These symptoms are accompanied by an acceleration of the pulse, constipation, restlessness, thirst, heat, and dryness of the skin, and other symptoms of inflammatory fever. The blood taken away from the patient is also found to be buffy. Sometimes the stomach is disordered sympathetically, and nausea, and even repeated vomitting may occur. I once attended a man for an acute inflammation of the testicle, who laboured under so obstinate a suppression of the stools, and such a repetition of vomiting, that a suspicion of strangulated hernia was created for a short time, but quickly abandoned on a careful examination of the swelling. In fact, a general enlargement of the testicle, like that from acute inflammation of the organ, is not at all likely to be mistaken for any kind of hernia, excepting the congenital; because in bubonocele the testis may always be felt at some point or another below the hernial tumour.

Inflammation of the testicle may be the consequence of external violence; and it is often purposely produced by various surgical proceedings, employed for the radical cure of *hydrocele*. Sometimes it is brought on by the pressure of badly constructed trusses; sometimes as one of the effects of the disorder of the system, well known by the appellation of mumps.

When the testicle inflames and swells in gonorrhœa, the pain in making water and the discharge of matter are almost always suddenly diminished, or even suspended; a circumstance ascribed by some pathologists to metastasis; and by others to sympathy between the urethra and the testicle. All that I can say upon this point is, that we seem to know little more than the fact itself, which is exemplified, I think, with remarkable frequency in patients, who, while they have a clap, take rough exercise,

indulge in wine, and live altogether too freely. One thing here merits attention, and it is perhaps what would not have been expected, namely, the swelling of the testicle does not always come on exactly at the period when the inflammation in the urethra is worst, but requently when it is on the decline, or even nearly cured. Occasionally, also, the inflammation of the testicle is not followed by any diminution or stoppage of the discharge; a fact clearly overturning the doctrine of metastasis. A suspicion is entertained, that the inflammation is sometimes propagated to the testicle from the mouth of the vas deferens. Mr. Hunter did not, however, adopt this view, because he found a swelling of the testicle to be as frequent in gonorrhœa, where the inflammation did not extend further than an inch or so from the orifice of the urethra, as where it reached to the neck of the bladder. Another idea is, that a swelling of the testicle is particularly disposed to come on when gonorrhœa is suddenly checked by the employment of copaiba, cubebs, or astringent injections; but, the correctness of this opinion may be doubted; for, many experienced surgeons believe, that they have seen an inflammation of the testicle arise as frequently under other modes of treatment as that now alluded to. At the same time, I feel it right to mention, that Sir Astley Cooper inclines to the belief, that injections really have a tendency to bring on hernia humoralis, especially when they are made to pass far into the urethra. Notwithstanding Mr. Hunter's view, I am disposed to think, that inflammation may sometimes extend to the testicle from the urethra, by the course of the vas deferens; and Sir Astley Cooper describes certain appearances, noticed in the dissection of the urethra of a criminal, who had been executed, which confirm the possibility of this occurrence. The man had a gonorrhœa at the time of his death; and when his urethra was cut open, although the inflammation was greatest in the first three inches of the canal, yet it extended also to the membranous portion of it, and even blood had been extravasated under the mucous membrane. Under such circumstances, the verumontanum, and the terminations of the common ducts of the vesiculæ seminales and vasa deferentia in the urethra, participate in the inflammation, which may then be propagated along the vas deferens to the cord, epidydimis, and testicle.

One fact, relative to this subject, is certain; which is, that inflammation of the testicle rarely or never comes on in the early stage of gonorrhœa, but usually between the tenth day and the end of the third week. When the pain and swelling begin to abate, the discharge from the urethra very commonly returns. Within the tunica vaginalis there is generally a quantity of serum effused, which, after the inflammation has subsided, is absorbed again. We find likewise that fibrine is thrown out within the same membrane, and in the interstices of the glandular part of the testicle, occasioning considerable hardness, the remains of which will often continue a long time.

The treatment of acute inflammation of the testicle must, of course, be antiphlogistic, comprehending quietude, and even the horizontal posture in bed, if the case be severe. When the patient is young and robust, the swelling considerable, and the pain in the lumbar region violent, we should have recourse to venesection, and this pretty freely; and in all cases, leeches, saline purgatives, and low diet, are absolutely necessary. If leeches cannot be procured, the veins of the scrotum may be punctured, whereby a copious and beneficial discharge of blood may generally be obtained. With respect to local applications, we may employ cold evaporating lotions; or, if the patient seem to derive great relief

from emollient poultices and fomentations, these may be used. Perhaps, in very severe cases, the latter ought always to be preferred. But, nothing will lessen the patient's sufferings more effectually, than the plan of taking off the weight of the testicle from the spermatic cord with a bag-truss or suspensory bandage; it has, indeed, the greatest effect in diminishing the pain experienced in the back and inguinal region, particularly when assisted by bleeding, saline purgative medicines, and the occasional exhibition of eight or ten grains of the compound powder of ipecacuanha. When the disease has arisen from the irritation of bougies, their employment must, of course, be suspended. One plan that has sometimes proved expeditious in stopping the inflammation, and bringing down the swelling, is that of prescribing tartarised antimony, so as to keep up a degree of the nausea; but the practice is not commonly adopted, because patients more readily submit to other means of relief.

In general, a considerable hardness of the testicle, and especially of the epidydimis, remains after the inflammation has been completely removed: sometimes during the rest of the patient's life. Mr. Hunter even suspected that, in some cases of this description, the canal of the epidydimis was impervious, and the function of the testicle annihilated. However, this suspicion does not coincide with the examinations instituted by Sir Astley Cooper, who says, that, when the swelling is at the lower part of the epidydimis, it is seated in the cellular tissue of the vas deferens, where it forms its first convolutions, and is not an effusion within the cavity of the duct. The induration, according to his researches, frequently affects merely the tunics; and when situated in the upper part of the globus major, it arises either from fibrine effused in the cellular substance between the coni vasculosi, or else from a sac filled with a viscid fluid.

For promoting the dispersion of the chronic induration, remaining after all acute inflammation is over, we may employ camphorated mercurial ointment, with or without two scruples or a drachm of the hydriodate of potash in each ounce of it. Or we may try poultices of vinegar and oatmeal, or the hydrochlorate of ammonia lotion, where friction cannot be borne. In some cases, good seems to be produced by internal alterative medicines, as the compound calomel pill, and sarsaparilla, or the tincture of iodine.

Acute inflammation of the testicle, when a consequence of gonorrhœa, or irritation in the urethra, rarely suppurates; but when produced by external violence, the chance of an abscess is greater.

### ATROPHY OF THE TESTICLE,

Or a more or less complete wasting away or absorption of this organ, may follow the subsidence of acute inflammation of it; but it more frequently takes place when such inflammation has been brought on by external violence, than when it originates as a consequence of gonorrhœa. No doubt, under these circumstances, the structure of the testicle has been irreparably damaged by the inflammatory process; and probably in some instances, the atrophy may depend upon an obliteration of the vas deferens; for, in the museum of St. Thomas's Hospital, there used to be a testicle in this condition, the vas deferens of which could only be filled with quicksilver for about half an inch of its extent from the abdominal ring towards the testicle itself. This fact is reported in Sir Astley Cooper's work. An atrophy of the testicle sometimes takes place with-

out any previous inflammation of it: the pressure of a truss on the spermatic cord will produce it; and many curious cases are recorded by Larrey, where sabre wounds about the occiput and nape of the neck were followed by it.

### CHRONIC ENLARGEMENT, OR CHRONIC INFLAMMATION OF THE TESTICLE,

Usually commences with hardness and swelling of the epidydimis, at first attended with but moderate uneasiness, scarcely amounting to pain; at length the glandular part of the organ becomes involved, and the testicle seems rather larger and more tender than that of the other side. If the disease arise from a blow, then it may begin in the body of the testicle, which may present a globular, instead of its naturally oval form, and sometimes, though enlarged and altered in shape, it has no inequalities upon its surface. In other instances, however, it is at first unequal, so that knobs can be felt upon it; and this, according to Sir Benjamin Brodie, is usually the case in the beginning; a general uniform enlargement, without any knobs, being the more advanced state of the disease.

The case is rarely so painful as to compel the patient to keep himself quiet, and refrain altogether from labour and exercise. In some cases, a clear transparent serum is effused in the tunica vaginalis, constituting one of the forms of disease, to which the term *hydro-sarcocèle* is vaguely applied. In ordinary cases, the spermatic cord is not hardened, but its veins are somewhat enlarged; and when the disease has existed some considerable time, and has attained magnitude, the patient complains of pain and a sense of weight in the loins and thigh.

This chronic inflammation of the testicle, the *sarcocèle tuberculeux* of Cruveilhier, which has been well described by Sir Benjamin Brodie, leads to the production of a yellow tubercular substance in the texture of that organ; an unorganised yellow matter, collected at first in small masses, but afterwards in larger ones at certain parts of the testicle; while, in other places, the glandular structure is quite healthy. In a later stage, the yellow matter, which is secreted within the tubuli testis and epidydimis, assumes a harder consistence, and is generally laminated. This disease is met with in various unhealthy states of the constitution, whether connected with rheumatism, syphilis, or other causes. It often presents itself in persons who have been scrofulous in their youth, or whose constitutions have been broken by the long use of mercury. What has been termed the *venereal sarcocele* is only a variety of it. In this latter case, according to Cruveilhier, the tubercular deposit always takes place first in the epidydimis. He describes one remarkable instance, in which the tubercular substance was deposited not only in the epidydimis and body of the testicle, but in the vas deferens, the vesiculæ seminales, seminal ducts, and the prostate gland.*

According to Sir Astley Cooper, when a solid effusion has taken place in the seminiferous tubes, or even in the substance of the testicle, or epidydimis, the disease may be cured by the strict observance of the recumbent posture, and the exhibition of three grains of calomel and one of opium, night and morning, so as to keep the gums affected for a month at least. A black dose and fifteen or twenty minims of the liquor antim. tart. are to be given every fourth morning. The topical treatment should consist of leeches twice a week, and a lotion composed of the liq. ammon. acet. ℥v.

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* Cruveilhier, Anat. Pathol. liv. ix. p. 2.

and one ounce of spirit of wine. Cruveilhier supports the same view, observing that a deposit of tubercular matter in the epidydimis, or even the body of the testicle, is not an adequate reason for castration.

### GRANULAR PROTRUSIONS, OR FUNGOUS GROWTHS FROM THE TESTICLE,

May follow the formation and bursting of an abscess in the part; or they may occur in the advanced stages of chronic inflammation of it. At one point, the testicle adheres to the skin, inflames, and ulcerates; and then, through the ulcerated opening, a fungus of small size at first projects, but, gradually acquiring greater bulk, makes its way through openings, not only in the tunica vaginalis, but in all the investments of he scrotum. Now, according to Sir Benjamin Brodie's investigations, we may trace on the surface of this fungus the same kind of yellow matter, found in the glandular portion of the testicle, which glandular texture itself likewise protrudes, until no part of the testicle is left within the scrotum, and the spermatic cord can be distinctly traced into the centre of the fungus. In a still more wasted condition of the glandular structure, the cord terminates in a small tubercular mass, the only remains of the organ. The height to which the *fungous* or *granular* protrusion rises, prevents the skin from healing over it; but it may generally be reduced by the pressure of a dossil of lint, fixed on it with adhesive plaster, or it may be got rid of with escharotic applications. However, the surest mode of cure is that of cutting away the protruding mass on a level with the inner reflexion of the tunica vaginalis, making two semicircular incisions, and afterwards bringing their edges together. This plan is not, however, approved of by Sir Benjamin Brodie, because in doing it we actually slice away the tubuli testis; and hence, he prefers sprinkling the fungus with red precipitate, and giving mercury. Then, as soon as healthy granulations form, he dresses the sore with a solution of the sulphate of copper in camphor mixture. I believe it to be a very good practice, when abscesses of the testicle leave deep and fistulous openings, to prescribe calomel and opium in the manner directed by Sir Astley Cooper, and to inject into the fistulæ a lotion of the sulphate of copper, or bichloride of mercury.

### THE IRRITABLE TESTICLE, OR NEURALGIA TESTIS,

Is a case analogous to tic douloureux, or neuralgia in other parts. It is a highly sensitive and painful state of the organ, often without any very obvious cause, the suffering produced by it being frequently of the most excruciating kind, and of long duration, though subject to occasional remissions. The part is but little, if at all, swollen; and, on dissection, no change of structure can be detected. One example, however, of this affection in a medical student, in which I was lately consulted, and in which Sir Astley Cooper was also kind enough to give his advice, had been attended with repeated swelling of the testis, though it mostly remained with scarcely any perceptible change of size. The most successful treatment consists in giving large doses of the sulphate of quinine or carbonate of iron; or, when the disease assumes an intermittent type, the liquor arsenicalis. Opium, the acetate or hydrochlorate of morphia, the extract of conium, hyoscyamus, and other narcotics, with calomel, may also be given. If the secretions of the skin and liver be defective, calomel, opium, and antimony may be tried in combination.

As local applications, I may recommend leeches, ice, or a plaster composed of one third of the extract of belladonna and two thirds of soap cerate. This is a disease, in which the ointment of veratria may deserve trial. In one instance, Professor Gibson dissected down to the spermatic nerves, and divided them; a difficult operation, but alleged to have answered.*

No doubt, neuralgia testis frequently depends upon some disorder of the system at large, the removal of which is an essential thing in the cure. That severe pain in the testicle may arise from sympathy between this organ and other parts, without any alteration of its structure, is illustrated in cases, where great agony in the testis is experienced on the descent of a calculus from the kidney into the ureter. In particular instances, however, a degree of swelling of the part, a varicose fulness of the spermatic veins, or even some hardness or prominence about the epidydimis, may be observed.

### OF THE SCROFULOUS TESTICLE.

The secreting glands are rarely affected with scrofula; but this organ forms an exception. Even in young children, it may become enlarged and hardened, without pain, and remain in this indolent state for many weeks, months, or years; and then, as the health improves, gets well. More frequently, the disease occurs towards puberty, preceded or accompanied by some other marks of scrofula, and sometimes it affects both testicles. Scrofulous disease of the testicle is remarkable for its indolent character, and the little pain attending it; we perceive a trivial swelling of some part of the organ, mostly the epidydimis; and, afterwards a small superficial lump at another point. These little tumours increase, and by degrees create greater uneasiness in the part. The skin becomes adherent to them; they suppurate; the abscesses burst, but discharge only a scanty quantity of matter; and the openings, having little tendency to heal, remain fistulous. At length, the testis sometimes diminishes and wastes away, until but a small portion of it is left; but, more commonly, the organ is not entirely destroyed, and a considerable part of the glandular structure remains.

The treatment is to be conducted on the same principles as are applicable to other forms of scrofulous disease. We may prescribe rhubarb and carbonate of soda in equal proportions (ten grains of each) to be taken once or twice a day; liquor potassæ; preparations of iodine, or tonics of various kinds, according to the circumstances of the case, and the effects which are produced by such means on the part and the whole system. With respect to iodine, I prefer the way in which it is prescribed by Lugol, to the less diversified mode in which we employ it.

### CYSTIC SARCOMA.—HYDATID DISEASE OF THE TESTICLE.

This latter term is objected to, as conveying the erroneous notion, that hydatids exist in the part. The morbid mass, into which the organ is converted, is partly composed of a solid structure, and partly of cysts, varying in size from that of a large pin's head to that of a small marble; some of them containing a thin, transparent, yellow serum, and others a more turbid fluid. The disease occurs chiefly between the ages of thirty and thirty-five, and is sometimes mistaken for hydrocele; though the shape

* Gibson's Institutes, &c. of Surgery, vol. ii. p. 179., ed. 5. Philadelphia. 8vo. 1838.

of the tumour ought to serve as a criterion, since it is oval, not pyriform, like that occasioned by a collection of fluid in the tunica vaginalis. The particular character, however, of enlargement of the testicle with cysts cannot always be known with certainty previously to the examination of the part after its removal by operation. It is not malignant, for it never extends to other parts: it may however be conjoined with medullary cancer, which is itself malignant. No treatment is of any use, because the disease is truly an organic one, accompanied by a total disorganisation of the testicle, and changes of structure, leaving no possibility of a return of the part to its healthy state again. The pain, caused by the weight of the tumour on the spermatic cord, and the annoyance of its bulk, frequently compel the patient to submit to castration.

What we call cystic sarcoma of the testicle, is termed by Cruveilhier, *Cancer Alvéolaire*, of which he has given an excellent representation in pl. 1. liv. 5. of his Anatomie Pathologique. In the dissection of the specimen from which the engraving was taken, he ascertained, that the proper substance of the testicle did not participate in the morbid change, but was pressed by the new formation towards the surface of the tumour, where it formed a thinnish stratum of a grey semi-transparent appearance. "The further," says he, "we advance in the study of morbid alterations, the more we shall be convinced of the truth (which, I believe, was first announced by me), that our textures are unalterable, and that what are called morbid lesions, are new productions, endued with an independent life of their own, and that our tissues are only susceptible of hypertrophy and atrophy. Here the atrophy is admirably explained by the compression which the substance of the testicle had undergone."

### MEDULLARY CANCER OF THE TESTICLE

Is a malignant disease, that has received a variety of names; by some it is called the *pulpy testicle;* by some it is denominated *medullary sarcoma;* by others *fungus hæmatodes;* a term that is only warranted in an advanced stage of the disease, when a mass, which, from its look, is mistaken for a fungus, occasionally, though not often, protrudes through the scrotum. It is the *soft cancer* of the testicle, as it is denominated by some writers, on account of its malignancy; that is to say, its having a tendency to extend itself in the course of the absorbents; its disposition to attack other textures; its incurable nature; its general character to show itself again in the same, or other parts, after removal by operation; and its connection with some undefined, but highly unfavourable condition of the system. By Cruveilhier it is named *sarcocèle aréolaire encéphaloide.* The disease begins in the body of the testicle, which it enlarges, the swelling extending to the whole of this part of the organ in the course of three or four months. Afterwards the epidydimis becomes involved. While confined to the body of the testicle, the swelling is of an oval figure; one circumstance, by which the case may be known not to be a hydrocele: but as soon as the epidydimis is diseased, the tumour may assume a somewhat pyramidal shape, and be not unlikely to be mistaken for a hydrocele, more especially as the disease is attended with a softness and elasticity, which often lead the practitioner to think, that he feels a fluctuation in the part. Indeed, there is sometimes a small quantity of fluid in the tunica vaginalis. I should say, however, that, with due attention, a medullary tumour of the testicle may almost always be discriminated from hydrocele, by the tumour presenting a more decidedly oval form than the latter disease; by its greater weight; its having no trans-

parency; its being harder in some parts than others; its not being, after a time, so uniformly smooth as a hydrocele; and its being accompanied by a sallow, unhealthy look, such as is usually indicative of a malignant organic disease of an important part. At first, the swelling is not attended with pain; but, after a little while, the patient begins to experience shooting, darting sensations from the testicle, up the spermatic cord to the lumbar region and the groin; and the part will not bear much handling, without a great deal of tenderness being produced in it. The period of life in which medullary sarcoma of the testicle is most frequent, is that between puberty and the age of 35 or 36; but Mr. Earle has recorded a rare instance of its occurrence in a very young child. These circumstances deserve attention; because, though medullary disease of the testicle is seldom met with in children, the same disease of the eye is chiefly confined to them.

The swelling consists of a mass of medullary very albuminous matter, or of a pulpy substance, firmer than the medullary matter of the brain, included in the interstices of a thin, delicate, transparent membranous texture. It would not be correct to say, that the organ is always converted into this kind of substance; for, in many cases, the medullary substance is not a molecular deposit, after the manner of nutrition, but an adventitious formation, an additional growth, which by its pressure seems to cause the removal of the original tissues. Sometimes the glandular portion of the testicle remains unaltered, while a medullary tumour lies beneath the tunica albuginea, or grows from the superficial part of the testicle, and fills the cavity of the tunica vaginalis, of which Sir Benjamin Brodie relates one instance, and Cruveilhier another. At last, however, the substance of the testicle always suffers atrophy from the compression of the new and extraneous substance, whether this be first formed within the testicle, or on its surface.

In the latter stage of the disease, the tumour becomes adherent to the scrotum; the spermatic cord becomes knotty and unequal; at length ulceration of the scrotum may take place, and a large mass of the medullary substance protrude, from which copious hemorrhage every now and then occurs. The protrusion of such a mass, however, I believe, is much less frequent in medullary disease of the testicle than in the same disease of the breast, eye, and limbs. Sometimes, when the scrotum is implicated, the inguinal glands become affected; but it is the lumbar, which are so liable to be involved in the disease.

This malignant disease of the testicle has a tendency to extend itself in the course of the absorbents, and to attack many different parts and tissues in the same person. As the absorbents of the testicle pass to the lumbar glands, these are frequently involved, and sometimes are transformed into an immense mass, equal in size to a child's head, readily perceptible when the abdominal are relaxed, and causing, by their pressure on neighbouring organs, various functional disturbance. Such may be the case, even when the spermatic cord itself is sound. Too frequently, indeed, the testicle is only one of numerous parts which are implicated; and soon after this organ has been removed, the patient may die, and on his being opened, we may trace various other medullary tumours in the organs or membranes of the cranium, chest, or abdomen. Cruveilhier gives the particulars of one case, in which the ascending vena cava was filled with medullary matter. In another, in University College Hospital, after I had removed the testicle, the medullary growth of one of the lumbar glands made its way into the pelvis of the kidney. Even

the beginning of the thoracic duct has been obliterated by the pressure of the diseased mass. Some surgeons of great experience, who have removed many testicles, affected with medullary cancer, have not known one instance of a permanent cure being effected by such operations. This fact, at all events, is a lesson to us in delivering a prognosis; we should candidly explain the chances of a return of the disease, and let it not be said, that we have persuaded the patient to submit to the operation as a certain means of cure. In the museum of University College is a fine specimen of a medullary cancer of the testicle, one of considerable size, which I removed from a young man about thirty years of age, who had a remarkably sallow unhealthy look. The case illustrates several interesting circumstances. The patient came from Oxford, where a surgeon had introduced a trocar into the swelling, on the supposition, no doubt, that the case might be a hydrocele. Another practitioner had been led to do the same thing. The punctures, however, healed up very well, without any subsequent inflammation, or any protrusion of the morbid substance; a circumstance, which I had an opportunity of noticing; for, not being aware of these fruitless operations, and fancying one morning that a fluctuation was perceptible, I also passed in a trocar, but no material harm resulted from the experiment, only a very slight degree of pain, the wound healing up completely in two or three days. I showed the case to Sir Astley Cooper, who advised castration, which I performed, and then sent the diseased testicle to him, which he injected and carefully dissected. One section of it, with the spermatic vessels, he retains himself; the other he was so obliging as to send to me as a present. In the examination of the cord, minute extraneous substances, some of them less than pins' heads, were noticed in the cellular tissue, which were suspected by Sir Astley Cooper to be of a medullary character. This was a very discouraging circumstance, one that fully prepared me to expect a return of the disease; yet, contrary to my expectation, the wound, caused by the operation, healed up favourably, the man's health improved, and he continued well more than three years from the period when the testicle was removed. We learn from this case, that the introduction of a trocar into the swelling is not attended with any serious consequences; and that even when the patient has a very unhealthy, sallow look, and the cord is not entirely sound, there may not be a return of the disease. We must not, however, anticipate success as a common occurrence under these unfavourable circumstances, and we should always be guarded in our prognosis, though the case may present much less discouragement than the one which I have mentioned. Here, also, the best chance of benefiting the patient permanently can only be obtained before the disease has extended itself to other parts; and, if they are already involved when we are first consulted, it will be too late for us to recommend an operation; for the case is of a hopeless description. But, operate when we will, we shall find that, in a large majority of cases, the disease will show itself again in some part of the body or another, and bring on fatal consequences. Thus, in one case, where Mr. Cline had removed the testicle for medullary disease, another tumour of a similar nature formed in the lumbar region*, and by its pressure destroyed the bodies of the vertebræ near it, so as to injure the medulla spinalis, occasioning paralysis and fatal consequences. This case is recorded by Sir Benjamin Brodie. As, however, we have no medicines, nor appli-

* See also Cruveilhier, Anat. Pathol. liv. v. p. 4.

cations that have the power of stopping this malignant form of disease, the knife is the only means that can be resorted to, with any prospect of success, and this, as I have explained, is very uncertain. In some cases, medullary disease and cystic sarcoma, appear to be blended together in the testicle, as well as in the absorbent glands, which happen to become affected. This modification of the disease is as bad, and difficult to control, as where no cysts are present, and the morbid mass is simply a medullary substance.

The rule of operating early, if an operation is to be performed at all for medullary disease of the testicle, is inculcated by every surgeon, whose judgment is worth having. It is only at this period, that there is any hope of other parts of the system not participating in the disease. Possibly, in some few instances, the disorder may be at first strictly local, and afterwards become a constitutional one, by reason of the absorption of the medullary matter into the system. In a former part of this work, however, I have described the common characters of this terrible disease, and mentioned the situation and organs in which the medullary matter is found. Sometimes the absorbent vessels, leading from the disease, have been found full of a cerebriform substance; a fact, which Sir Benjamin Brodie regards as giving some probability to the hypothesis, that the disease may thus, from being at first local, become more widely diffused, and extend from one to several organs in the body. We may therefore operate early, though we are sure that the case is a medullary tumour. But if we have doubts, we should first try the plans that were recommended for the cure of chronic inflammation, or enlargement of the organ,— in particular, the free use of mercury, iodine, and other alteratives. If these fail, and we are certain that it is not a hydrocele which we are dealing with, we may conclude that the testicle is disorganised, and that, in all probability, the disease is medullary. If there be any suspicion of fluid in the tunica vaginalis, we should introduce a trocar before we resort to castration; for the puncture will do no harm to the testicle, if it be already disorganised by medullary disease; and if the case be a hydrocele, with a thick tunica vaginalis, the light thrown on the nature of the complaint will save the patient from a dreadful mutilation.

### SCIRRHUS OF THE TESTICLE,

Exhibiting precisely the same morbid structure as in the breast, is accounted by some of the best pathologists a very rare disease, if it exist at all. Sir Astley Cooper doubts whether a hard swelling of the testicle, intersected by a net-work of strong fibres or bands, has any existence. However, we meet with solid, heavy, particularly indurated, almost cartilaginous enlargements of the testicle, with a tuberculated feel, severe pains in the part, the cord, and the lumbar region; some fluid in the tunica vaginalis; and, at length, followed by anasarca of the lower extremities. The patient's countenance is sallow, he becomes surprisingly emaciated, and at length he sinks under impaired digestion, constant suffering, diarrhœa, and loss of rest. This is the kind of disease, which the late Dr. Baillie described as scirrhus of the testicle. Certainly, though, in texture, the part affected may not correspond to other examples of scirrhus, it does so in malignancy and incurableness. Here, the early extirpation of the diseased organ is as strongly indicated as in fungus hæmatodes. If the case should be too far advanced for an operation, and the part be ulcerated, all we can usefully do, is to palliate the patient's misery with opium, hyoscyamus, morphia, and other narcotics, at the same time applying

the nitric acid lotion, the liquor opii sedativus, the chloride of soda wash, or the carrot or fermenting poultice; or one made with bread and water, with a proportion of the extract of hemlock, or henbane mixed with it.

## HYDROCELE.

The common hydrocele is a collection of serous fluid in the tunica vaginalis, producing a pyriform, fluctuating, and, generally, a more or less transparent swelling in the scrotum. I have seen it in persons of all ages, but less frequently in boys than adult subjects. The swelling commences opposite the lower part of the testicle, unattended with pain; at all events, the cases in which pain is felt at the beginning of the complaint, are not the most common. At first, the tumour is soft, and readily allows the testicle to be felt through the fluid; but, by degrees, it becomes tense, and then the testicle can no longer be perceived. The largest part of this pyriform swelling is below, its diameter lessening gradually as it approaches the abdominal ring. It is only after it has attained a certain magnitude, that its weight and tension cause uneasy sensations in the lower part of the back.

In a dark room, if a lighted wax taper be held close behind one side of the scrotum, and the swelling be viewed from the opposite side, while the surgeon's hand is placed over the external portion of the tumour, the transparency will generally be very manifest. It will always be so if the fluid be clear, and the tunica vaginalis, cremaster, and other coverings, be not too much thickened. This thickening is found to prevail chiefly in large hydroceles; but, as Sir Benjamin Brodie has noticed, sometimes it occurs where the tumour is but of diminutive size; and then, if we have an opportunity of examining the parts after death, we find the inner surface of the tunica vaginalis exhibiting a slightly honeycomb appearance, which is suspected by the latter gentleman to denote, that the hydrocele began with inflammation.

Another symptom of hydrocele is the fluctuation, which on the surgeon grasping the scrotum, and propelling the fluid forwards, may be very plainly distinguished, except when the tunica vaginalis is of considerable thickness. When the tumour is of some size, the testicle is commonly placed about two thirds of the way down the posterior part of the cavity, a circumstance deserving recollection when we are about to introduce a trocar for the discharge of the fluid.

Sometimes hydroceles take place on both sides of the scrotum.

Although a hydrocele is mostly of a pyriform shape, with the thicker part of the tumour downwards, it may assume other shapes. Thus, if much pressed upon by tight small-clothes, or any thing else, the form of the swelling may be altered by that circumstance. Perhaps, however, a deviation of the disease from its common shape may not always be referrible to a cause that we can trace. In the museum of University College is a preparation, in which, in addition to the principal cavity of the hydrocele, there is another pouch freely communicating with it. Sometimes the hydrocele forms two swellings, with the hour-glass contraction between them. If we puncture the lower compartment of such a hydrocele, we may discharge the fluid from both, which proves that they communicate. Such is the usual state of the case: but it sometimes happens that the two compartments do not communicate, a perfect septum being interposed between them. We are to believe, however, that the communication is open for a time at the contracted part, but

that, in consequence of the adhesive inflammation, or other causes, the constricted part is at length entirely shut. Sir Benjamin Brodie records an interesting case, proving that a hydrocele is sometimes divided in this manner into two portions, perfectly distinct from each other. In the case alluded to, the first time the hydrocele was punctured, the trocar was passed into the lower cavity, which emptied both this and the upper one. About a year afterwards, the same method was repeated; but the upper swelling could no longer be emptied in this manner, the incomplete contraction having become a complete one in the course of twelve months.

Some hydroceles communicate with the cavity of the abdomen, in consequence of the upper part of the tunica vaginalis continuing unclosed. This case, which is termed *congenital hydrocele*, is seen principally in children, but occasionally in adults likewise. The quantity of fluid in hydroceles, which have existed some time, is mostly about eight or ten ounces; but Gibbon, the historian, who was attended by the late Mr. Cline, had a hydrocele, from which six quarts of fluid were drawn; and many instances are recorded of the tumour reaching down to the knees. Such an occurrence can only be the result of great neglect.

The fluid is also subject to variety in its quality as well as quantity. Sometimes it contains flakes of fibrinous matter, the product of inflammation. The fluid is generally very transparent, and of an amber or pale straw colour: it is also coagulable by heat, acids, and alcohol, and resembles the serum of the blood, except in having less albumen in it. Sometimes, however, it is of a much higher colour, and even reddish, particularly when the case has originated with a degree of inflammation about the parts. We also meet with certain cases, in which loose cartilaginous or osseous substances are contained in the fluid. Occasionally, small, shining, greasy particles are observed in it, which are probably adipocire. In particular instances, the fluid, instead of being clear, is quite turbid and opaque, a circumstance generally proving, that the inner surface of the tunica vaginalis has been previously the seat of an inflammatory process.

When a hydrocele is complicated with a loose cartilaginous body in the tunica vaginalis, Sir Benjamin Brodie believes, that the loose cartilage is the original disease, and that it is the irritation of it which keeps up the increased secretion of fluid within that membrane. If the extraneous substance could be felt, and secured in one place directly after the discharge of the fluid, we should cut upon it and take it out. This proceeding would, no doubt, bring about the radical cure of the hydrocele, both by removing its cause, and by exciting a degree of inflammation. Sir Benjamin Brodie relates the following case: — A patient with hydrocele, whom he used to see occasionally for some years, always experienced vast suffering whenever the fluid was let out. On those occasions, the patient invariably threw himself on the floor, and groaned dismally for a quarter of an hour. After his death, it was ascertained, that the tunica vaginalis contained a cartilaginous body, which, whenever the fluid had been voided, appeared to have been the cause of the patient's agony.

In hydroceles of long standing, the tunica vaginalis, the cremaster, and the cellular tissue, are often excessively thickened. Examples also occur, in which that membrane has ossifications upon it.

The testicle itself is usually healthy; sometimes, however, trivially increased in size; sometimes rather lessened. The testicle may also be diseased, constituting what is termed *hydrosarcocele*.

Among the best diagnostic signs of a hydrocele, I would specify its transparency, its fluctuation, its commencement at the lower part of the tunica vaginalis, its gradual extension upwards, its pyriform shape, and the circumstance of a portion of the spermatic cord between the abdominal ring and the upper part of the swelling remaining free and unsurrounded by the fluid.

We are able to discriminate a hydrocele from a sarcocele, or diseased testicle, by the latter being much heavier, more globular or oval, and flatter at the sides than a hydrocele; by its being also more solid, and productive of a peculiarly sickening pain when compressed; by its being attended with a greater degree of pain in the loins, and very frequently with an unhealthy sallow look, which is not by any means a characteristic of a hydrocele, which is often seen in very healthy persons.

Then a hydrocele may generally be known from a hernia, by the present or previous possibility of reducing the latter, the impulse in it on the patient's coughing, the direction in which the tumour has passed, its course from the abdominal ring downwards into the scrotum and not upwards to the ring, its lying over the upper part of the cord, and, if the case be a bubonocele, and not a congenital hernia, by the possibility of feeling the testicle below the swelling.

But sometimes a hydrocele is conjoined with a hernia. Under these circumstances, we generally find, that the hydrocele lies in front of the hernia, and if we should be called upon to operate for the latter disease in a state of strangulation, it would obviously be the safest mode of proceeding first to lay open the hydrocele.

A hydrocele, though not a very painful disease in its ordinary states, is a considerable annoyance; for it interferes with all active pursuits, and the tumour is much exposed to the effects of external violence. When large, it draws over it likewise a great part of the integuments of the penis, which appears buried, as it were, in the swelling, so that the disease is certainly a serious obstacle to coition.

I have seen a few cases, in which hydroceles were accidentally burst by falls or blows. The result is various; sometimes one of the veins of the tunina vaginalis being ruptured, hemorrhage takes place into the cavity of that membrane, and the hydrocele is converted into what is termed *hæmatocele*. In other instances, the tunica vaginalis is rather more extensively torn, and the fluid of the hydrocele passes into the cellular tissue of the scrotum, the original tumour subsiding for a time, but almost always returning after the opening in the tunica vaginalis has closed again. However, if much inflammation were to ensue, the hydrocele might be radically cured by the accident; but the termination will commonly not be so fortunate.

Hydrocele of the tunica vaginalis, I mean the common form of it in adult subjects, that which comes on without pain, very seldom undergoes a spontaneous cure. Sir Benjamin Brodie gives one example, however, of such an occurrence. Probably, whenever a spontaneous disappearance of a hydrocele takes place, the event is owing to some previous accidental inflammation of the parts, or the effusion has happened as the effect of inflammation, on the subsidence of which the fluid is absorbed again, and the vessels resume their proper action.

*Treatment.* — In children the disease, when not attended with a communication between the cavity of the abdomen and that of the tunica vaginalis, may generally be cured by lotions containing the liquor ammon. acet., the hydrochlorate of ammonia, or other ingredients calculated to

excite the absorbents. Iodine ointments rubbed into the scrotum, friction with soap liniment, strengthened with the tinct. cantharidum, or blistering the scrotum, as practised by Dupuytren, will also frequently succeed.

The common hydrocele of adults will rarely yield to such plans, and we are obliged to resort to other measures. Now the nature of our proceedings should be chiefly regulated by the consideration, whether the patient is desirous of temporary or permanent relief; in other terms, whether he is willing to submit to what is called the *palliative*, or the *radical treatment*, which latter is necessarily attended with more pain. The *palliative* treatment simply consists in discharging the fluid by means of a small trocar and cannula. We are to grasp the back portion of the swelling with the left hand, and puncture it in the central line, about two thirds of the way downwards from its uppermost part, taking care to incline the point of the instrument a little upwards. In choosing a trocar, we are to be careful that it is well adapted to the cannula, and, in particular, that the extremity of the latter does not form too great a circular projection on the trocar by being too wide or too thick; for when this is the case, the entrance of the trocar into the tunica vaginalis will be very likely to be stopped by the circular prominence of the cannula, and then we shall either not get the cannula into the hydrocele at all, or succeed only by forcible and repeated trials, which give the patient considerable pain, and form a display of awkwardness not likely to keep us in favour with the party operated upon. Attention to minute things in the practice of surgery, such as the make of a trocar, is often of great importance to a man who values his professional reputation; and I have known serious mischief done by inattention to the construction of this instrument. Having withdrawn the trocar, and let out the fluid, during the flow of which we must keep the cannula well introduced (for if it slip out of the tunica vaginalis we shall not be able to put it in again), we may place a bit of plaster over the puncture, and apply a suspensory bandage, which latter, however, is not essential, and is often dispensed with.

If any accidental circumstance bring on inflammation after the operation, it may lead to a complete cure; but this only happens in a small proportion of cases, and hence the method, now described, is called by surgeons the *palliative treatment.*

The *radical* consists in discharging the fluid, and then adopting some measure calculated to excite inflammation of the testicle, or rather of the inner surface of the tunica vaginalis. We may fulfil these indications by different proceedings. About half a century ago, surgeons sometimes applied caustic to the scrotum, which produced a slough, the separation of which was followed by the issue of the fluid, and the requisite inflammation of the tunica vaginalis. This plan was at length renounced as unnecessarily severe, and uncertain of success. At the same period, the practice also prevailed of passing tents and setons into the tunica vaginalis for the cure of this disease. The seton was in favour for a long time, and even now, though not used for the present form of hydrocele, is sometimes employed in another variety of it. Then, another plan of cure consisted in making a free incision into the swelling, so as at once to let out the fluid, and make such an exposure of the cavity of the hydrocele as was followed by inflammation, suppuration, granulation, and the obliteration of it. This last mode of treatment is still advisable under particular circumstances. But, in general, the best practice, and that to which all the most experienced surgeons in this country give the pre-

ference, is to discharge the fluid, and immediately afterwards to throw some stimulating fluid into the cavity of the tunica vaginalis, for the purpose of bringing on the necessary degree of inflammation. This operation requires a simple but well-made apparatus, composed of a trocar and cannula, and either a syringe with a pipe adapted to the cannula, or else an elastic gum bottle with a brass neck, furnished with a stopcock, and of a size exactly adapted to the mouth of the cannula. Some surgeons use an injection containing sulphate of zinc; others, employ a solution of alum, or brandy and water. Port wine and warm water in equal proportions, were preferred by the late Sir James Earle. Of late, an injection, composed of ʒij. of tinct. iodinii, and ʒvj. of tepid water, has been used, on the ground, that the cure is sooner accomplished by means of it than other injections, a larger quantity of which is also stated to be necessary, so that the passage of some of it into the cellular tissue is more likely to happen. The port wine and zinc injections are the only ones, which I have hitherto employed. The wine injection should be made stronger than what is above specified; if two thirds of it be wine, it will not be too stimulating. I have also frequently put ʒiss. of the sulphate of zinc into a pint of warm water, and believe that the chance of a failure of the operation is thereby lessened. The fluid of the hydrocele having been discharged, and the elastic bottle filled with the lotion, we push the end of the stopcock into the mouth of the cannula, and throw the injection into the tunica vaginalis. Before we do this, however, we are to be sure, that the internal end of the cannula has not receded from the cavity of that membrane; for if it has done so, the injection will pass, not into that cavity, but into the cellular tissue of the scrotum, and bring on extensive abscesses, or even a dangerous sloughing of the parts. I remember once assisting a surgeon in this operation, and telling him to be on his guard against this accident, the risk of which he seemed to think very trivial. He told me that he had tapped numerous hydroceles without the occurrence; and yet, from not paying attention to keep the cannula well in during the discharge of the fluid, and the shrinking of the tunica vaginalis, the very thing now happened which he considered to be impossible under his management. Abscesses and some gangrenous mischief followed; but I believe the hydrocele was radically cured, which might not have been the result. On the average, the injection may be kept in from five to ten minutes. In young persons, three minutes will suffice. The quantity of injection should not be quite equal to the quantity of fluid discharged, because if we distend the tunica vaginalis too much, some of the injection is apt to flow out by the side of the cannula into the cellular tissue, and occasion suppuration, or even sloughing. If the testicle should be affected with chronic enlargement, this circumstance ought not always to deter us from employing the injection, which, in such a case, has often brought about a cure. After the operation, we are to put a piece of adhesive or soap plaster over the puncture, and when inflammation has come on, apply a poultice. At one time, it was supposed, that this method could not produce a cure, except by obliterating the cavity of the tunica vaginalis, or by exciting the adhesive inflammation in it, followed by the union of the loose tunica vaginalis to the portion of it reflected over the testicle; and that, unless such union took place, the hydrocele would return. But it is now well ascertained, that a hydrocele is often cured without the cavity of the tunica vaginalis being obliterated, and on another principle, namely, the injection excites inflammation of the interior of that membrane, followed

by some permanent change in the state and action of the vessels of the part, whereby they are prevented from continuing to secrete a redundant quantity of fluid; and there seems to be a restoration of the due equilibrium between secretion and absorption.

With regard to the variety of hydrocele, in which its cavity is divided into distinct bags or cells, one circumstance merits notice, namely, that we cannot treat it efficiently, or, indeed, with the slightest prospect of a cure, by injection; and the proper plan is that of making a free incision into the tumour, and discharging the fluid from the several pouches in which it is confined. Thus a radical cure may be accomplished with tolerable certainty. In some cases, where a hydrocele is found to have two distinct cavities, this peculiarity depends upon a hydrocele of the tunica vaginalis being combined with an encysted hydrocele of the spermatic cord.

In all ordinary cases, the treatment by injection should be preferred, as the mildest and surest. Where, however, the hydrocele contains several different cavities, not communicating together, where likewise the nature of the disease is doubtful, or the case is variously complicated with a hernia, or the presence of a hernial sac, or the method of injection has already failed, it may be the most prudent course to practise an incision, in preference to a puncture, and this, under some of these circumstances, even with extreme caution. When, however, the doubt is, whether the disease is hydrocele or a medullary tumour, a puncture with a small trocar seems to be followed by no ill consequences; and it is, I think, preferable to an incision, which, in the event of the case being hydrocele, would be an unnecessarily severe mode of cure. When an injection has not answered, the seton may be employed, if the surgeon prefer it, as a milder practice than the treatment by incision. In a few such cases, I have tried acupuncture with success; but in others without it. In two or three examples, I have resorted to acupuncture after a partial return of hydrocele, and completed the cure. If acupuncture be tried, pressure may be combined with it.

We should never proceed to puncture a hydrocele of the tunica vaginalis, without having examined it most carefully; for various cases are recorded, in which the testicle, instead of having the fluid in front of it, has been adherent to the front of the interior surface of the tunica vaginalis, and actually been wounded with the trocar, none of the fluid collected at the sides of this body being discharged. One of the best ways of avoiding this serious error is to examine every hydrocele with a wax taper, in the manner already specified; for if the forepart of the tumour seem opaque, and, when compressed, occasion the sickening pain always arising from compression of the testicle, we may infer, that this body is adherent to the front of the cavity of the hydrocele, and would be wounded by the introduction of the trocar in the usual place.

### CONGENITAL HYDROCELE

Signifies a collection of water in the tunica vaginalis, attended with a narrow communication between the cavity of the latter membrane and the interior of the peritoneum. In the fœtus, the testicle is contained in the abdomen, whence it descends into the scrotum, generally a little while before birth, but sometimes not till after this event. The production of the peritoneum, by which it is accompanied, and which is to constitute the future tunica vaginalis, usually closes soon after the descent of the testicle is completed. But before this happens, fluid may pass into

it from the cavity of the peritoneum, and a peculiar form of hydrocele, termed *congenital*, be the result. This case has one symptom that does not characterise other hydroceles; namely, pressure makes the swelling disappear by forcing the fluid up into the cavity of the peritoneum. In this respect, then, we see a similarity to hernia. The hydrocele, however, is a transparent, soft, pyriform swelling, in which a fluctuation can be plainly felt. A congenital hydrocele not only diminishes or disappears under pressure, but also when the patient lies on his back; resuming its ordinary shape and dimensions as soon as he puts himself in the erect posture again. It may take place either when the testicle has descended properly into the scrotum, or when it has not descended, and is not even perceptible; or it may occur while the testicle is somewhere in the inguinal canal, or can be felt just at the abdominal ring. In these latter cases, the tunica vaginalis is elongated and extended from the place where the testicle is lodged down into the scrotum. These are circumstances very necessary to be remembered, because they influence the treatment. This must be manifest, because we cannot prudently attempt any thing for the cure of the hydrocele that would interfere with the descent of the testicle, or be likely to injure it.

The best mode of treating congenital hydrocele, when not complicated with a retarded descent of the testicle, is to apply a truss; for thus we at once remove the danger of a protrusion of the bowels, and promote the closure of the passage between the scrotum and the belly. No sooner has the obliteration of the opening been accomplished, than a further supply of fluid from the cavity of the peritoneum is cut off, and what is contained in the tunica vaginalis is absorbed. This practice is more advisable than the old method of cure by means of a stimulating lotion thrown into the tunica vaginalis, while an assistant made pressure at the ring, in order to keep a portion of the fluid from entering the cavity of the peritoneum. I deem the treatment by means of a truss more advisable; first, because unattended with any risk of bringing on peritonitis; and secondly, because it is adapted to expedite the closure of the communication between the scrotum and the belly,—a desideratum which is entirely out of view in the treatment with injections.

### HYDROCELE OF THE SPERMATIC CORD

Is much less frequently met with than hydrocele of the tunica vaginalis, and is commonly described as an accumulation of fluid in a thin membranous cyst within the sheath of the cord. Sir Benjamin Brodie, indeed, regards this encysted hydrocele as corresponding to a cyst filled with fluid, produced in any other organ of the body, and takes notice of its loose connection to the surrounding parts. While, however, Sir Astley Cooper admits this mode of formation, he conceives that, in certain examples, the production of the disease is owing to the adhesion between the peritoneal investments of the cord happening to be imperfect in one place, so as to leave a cavity between them. This is also Scarpa's explanation, who published, many years ago, an interesting memoir on the present complaint. The swelling is generally oblong, or globular; and, if it be so placed as to admit of being grasped and pushed forwards, it will often present a light blue colour, with a degree of transparency about it, and considerable tension. Few specimens of it attain much magnitude, its ordinary size not exceeding that of a pigeon's egg, and pain is not one of its characters. We now and then hear, or read, however, of a large one, including several ounces of fluid. When situated in that part of the

cord which is within the inguinal canal, the tumour is liable to be mistaken for hernia, though I may observe, that it is free from pain, as well as from the guggling sound or feel perceptible in intestinal herniæ, and that the functions of the alimentary canal are not in the least disturbed or interrupted. Though such a tumour may be forced a little way up the inguinal canal, we cannot bring about its perfect reduction. When the tumour is on the outside of the abdominal ring, we recognise its nature by various circumstances. We advert to its transparency, its fluctuation, its giving no sudden impulse to the finger when the patient coughs, and to its being unconnected with any of the organs in the abdomen, even though it may admit of being pushed into the ring. Under these or any other circumstances, it can never be put completely up into the belly, and, when left to itself, it soon descends into its usual place, above which the cord is free.

The fluid of a hydrocele of the spermatic cord is generally paler and more limpid, than that of a common hydrocele, and contains less albumen.

One of the best modes of treating this disease is, to make an incision in it, and then fill the cavity with lint. In the case of a lad in University College Hospital, I removed a slip of the front of the cyst, and the disease was soon cured. Another eligible plan of treatment consists in passing a seton of two or three threads or silks through the swelling. These may be introduced in the way recommended by Sir Astley Cooper, with a common curved needle. The latter method deserves the praise of mildness, and I believe is tolerably certain of answering, though, perhaps, less so than the treatment by incision. If we fill the cavity with lint, after laying it open, there will be no occasion for the removal of any portion of the cyst, in which proceeding there is some risk of doing injury to the vessels of the cord. The cavity will suppurate, granulate, and soon be obliterated.

Hydrocele of the spermatic cord, when small, produces little or no inconvenience; and, on this account, some practitioners scarcely consider it as a case requiring the performance of any operation. If, however, the patient's mind is rendered continually uneasy by the tumour, or the tumour should be in any way a source of inconvenience, or show a disposition to enlarge, it is right to attempt its cure. Injections have so often failed in the treatment of this form of hydrocele, that they are now abandoned in this metropolis.

Besides this kind of encysted hydrocele, there are other varieties, situated on the epidydimis, or the testicle. The former lies, as Sir Benjamin Brodie has explained, between the epidydimis and the inner layer of the tunica vaginalis; the latter between this membrane and the tunica albuginea.

### HÆMATOCELE,

Which, etymologically speaking, means simply a tumour composed of blood, at the present day always denotes a collection of blood in the tunica vaginalis. The swelling is of a pyriform shape, like hydrocele, from which it may be distinguished by its want of transparency, its greater weight, its obscure fluctuation, and the manner of its production; the cause being usually a blow on the scrotum, or a wound of an artery, or vein of the loose portion of the tunica vaginalis, or an injury of the testicle itself. Sometimes, I suspect, an enlarged or diseased vein gives way spontaneously, after the water has been discharged from the tunica vaginalis, and, continuing to bleed into the cavity of this membrane, leads

to the formation of hæmatocele. We know, however, in many instances, that a largish vessel has been wounded, for the fluid of the hydrocele, as it flows out, is more or less mixed and tinged with blood. If a lancet be used for this purpose, the risk of hæmatocele is increased. Some persons have become the subjects of hæmatocele in consequence of a blow on the testicle from the pummel of the saddle, in riding on horseback; and, in such cases, probably the bleeding is often from the vessels of the testicle itself.

Some time ago, I visited with Mr. B. Cooper a gentleman, who had a large hydrocele on each side of the scrotum, and one of these he had converted into a hæmatocele by a trial of his own ingenuity. Perceiving that all that a surgeon did, when he let out the fluid, was to make an opening in the swelling, he fancied that he could invent an instrument that would make the attendance of a surgeon unnecessary. After a little study, he contrived an instrument, very much like what is used by farriers for bleeding horses, only it was on a larger scale; the blade, which darted out on touching a spring, being something like a dagger. With this weapon he perforated the swelling, indeed, and let out the water, but wounded some of the blood-vessels, so that in a few hours the tumour was as large as ever, and a great deal more painful. In short, the cavity of the tunica vaginalis had become distended with blood. The blood soon began to putrefy, the parts inflamed, considerable fever ensued, and, partly from the constitutional disturbance and the approach of gangrenous mischief, the patient's life was in danger. If a prompt and free incision had not been made, I fully believe his condition would soon have been hopeless. By this operation a considerable quantity of putrid blood, matter, and a most offensive gas, sulphuretted hydrogen, having been discharged, the patient recovered very favourably.

One hydrocele was radically cured by this proceeding; but, notwithstanding the inflammation was considerable, it had not the effect of curing the other hydrocele.

Hæmatocele is only painful when complicated with inflammation, or with mechanical injury of the testicle. Some cases, therefore, are painful, and others not so. In certain examples, a hæmatocele is combined with hydrocele; this may take place when a person, who has a hydrocele, receives a severe contusion of the scrotum, and one or more blood-vessels of the tunica vaginalis are ruptured by the violence, and the blood, which flows from them, is added to the fluid already in the tumour. The state of the case may be known by the previous accident, the sudden increase of the swelling following the injury, and the dark opaque appearance of the tumour, which no longer exhibits its former transparency, when a lighted taper is placed behind it.

The treatment of hæmatocele varies according to circumstances. When the quantity of blood is inconsiderable, we should not interfere with it by any operation, but endeavour to promote its absorption by means of brisk purgatives and lotions containing vinegar, spirit, and hydrochlorate of ammonia. The absorption of a more copious effusion of blood in the tunica vaginalis is not likely to be accomplished; for we hear of cases in which the blood continued nearly twenty years unremoved, though changed in its appearance, and turned into a pale brown lamellated substance, very much like what is met with in an old aneurism. Sir Astley Cooper gives one instance, in which he cut into a hæmatocele that had existed seventeen years, and in which the blood, originally effused, still remained, though in an altered condition. When hæmatocele arises from a blow, antiphlo-

gistic treatment at first is the most prudent; we are to keep the patient quiet in the recumbent posture, and try what benefit can be obtained from purgatives, leeches, venesection, low regimen, and cold evaporating lotions. In a later stage, if the swelling should continue of any material size, or threaten to bring on suppuration, sloughing, and other troublesome or urgent consequences, we should of course make a free incision into the tunica vaginalis, discharge the blood collected in it, and then apply emollient poultices, unless there was a tendency to a renewal of bleeding, in which circumstance linen, wetted with cold water, or the Saturnine lotion, would be better than warm applications.

If the disease were combined with hydrocele, or to follow the puncture of the latter kind of swelling, I should lay open the tunica vaginalis, take out the blood, and then apply warm or cold applications, according as there might or might not be a disposition to a return of bleeding. In almost all cases of hæmatocele, requiring an operation, antiphlogistic means are indispensable at first; and I have seen several cases in which it has been necessary, on account of the inflammation and constitutional disturbance, to employ the lancet and other means of depletion very freely. In cases, where the effusion of blood follows the puncture of a hydrocele, that is, where there is a communication formed between the cavity of the tunica vaginalis and the external air, the blood soon putrefies, and becomes a source of considerable irritation; matter forms; a tendency to sloughing is produced; sulphuretted hydrogen gas is generated in the swelling; and the patient gets into an urgent state of danger, from which the formation of a free and immediate opening into the disease is the only means of extricating him.

### VARICOCELE, OR CIRCOCELE,

Consists of a varicous enlargement of the spermatic veins; the disease being more common on the left side than the right, in consequence, as Morgagni believed, of the termination of the left spermatic in the renal vein, the current of the blood in which is not in the direction of the left spermatic vein, as the course of the blood in the vena cava is, with reference to that of the right spermatic vein. In former days, the first of these terms was generally restricted to a mere varicous dilatation of the veins of the scrotum, an affection requiring no particular notice; while the expression *circocele* was used to denote more particularly a varix of the spermatic veins themselves, a case more deserving of consideration, because surgeons are often consulted for it, and it occasions a swelling that has frequently been mistaken for hernia. In the present day, these two terms are mostly employed synonymously; and when we hear of a modern surgeon speaking of varicocele, he is almost invariably alluding to a morbid enlargement of the spermatic veins, and not of those of the scrotum. When the veins of the cord are thus altered, they assume a tortuous course, their coats are considerably thickened, and the vessels have a knotty feel, attended with a greater fulness below the ring on the diseased side than the other, and with more or less uneasiness, sense of weight, and occasionally a severe pain in the testicle, inguinal canal, and loins. The swelling is sometimes large, and of a pyramidal shape, with the base just above the testicle. When we examine a varicocele with the hand, we feel the cluster of dilated veins, which are commonly described as communicating a sensation, as if we were taking hold of a bundle of earth worms. We may distinguish varicocele from a hernia, by placing the patient in the recumbent posture, and pressing the blood of the large

veins upwards, or returning the protruded viscera, so as to reduce the swelling; we then cover the abdominal ring with our fingers, and desire the patient to rise while we keep the fingers thus steadily over the ring. Now, if the case be a varicocele, the spermatic veins fill again, and assume their former distended condition directly the patient is in the erect position, notwithstanding the abdominal ring is covered and compressed; but if the case be a hernia, no protrusion can happen, while we keep our fingers on the ring, and consequently, so long as they are thus applied, there can be no return of the swelling, though the patient change his posture from the recumbent to the erect. The swelling of varicocele, when it returns, makes its appearance also in a more gradual manner than a protrusion of the abdominal viscera.

In the generality of cases, varicocele is not a very painful disease, and the patient finds any uneasiness from it relieved by supporting the testicle with a suspensory bandage or a silk net, by bathing the scrotum and groin with cooling lotions, and keeping his bowels regular. If there be greater annoyance, or any severe degree of pain, he should, in addition to the foregoing measures, observe the recumbent posture, and apply leeches. In a few rare instances, the sufferings produced by varicocele have been such as to induce the patient to submit to castration; but, in the present state of surgery, I am reluctant to believe that such proceeding is justifiable. Another experiment has consisted in putting a ligature round the largest of the varicous veins; but by this we should expose the patient to the risk of phlebitis; and one of the late Sir Everard Home's patients nearly lost his life after such an operation. Some practitioners have had recourse to another plan; after dividing the integuments, they have compressed the most distended veins between the blades of forceps constructed for the purpose, and thus obliterated their cavity. Fricke's method consists in passing a seton of three or four threads through the bundle of varicous veins. One of the most serious occasional consequences of the disease, and also of treatment of it with the forceps, is atrophy of the testicle.

## DISEASES OF THE SCROTUM.

The scrotum is liable to anasarca and ecchymosis, which, however, are here attended with no peculiarity, no circumstances different from those accompanying such affections in other common textures of the body. It is also occasionally the seat of phlegmonous erysipelas, and then, from its abundance of loose cellular tissue, which becomes distended with a serous fluid, is productive of a considerable degree of swelling, often extending to the very end of the prepuce, and causing there a phymosis. On first sight of such a case, where the swelling is equal in size to a child's head, the suspicion at first raised is, that the urethra has given way, and that the urine has been effused. Whether this has really happened or not, free incisions should be made; and, if any doubt exist about the state of the urethra, a catheter ought to be introduced, and kept in, as it can do no harm, even if the urethra should be sound, and, in the opposite case, will be of essential service in preventing the further escape of urine into the cellular tissue of the perinæum and scrotum. The scrotum is sometimes the situation of tumours; and I remember one case in St. Bartholomew's, where an excrescence in the shape of a horn, and of a horny consistence, was formed on it. In warm climates, the scrotum is often converted into an enormous mass of adventitious or hypertrophied cellular tissue, often amounting to half a hundred-weight or more, and

not only burying, as it were, the penis and testicles, but absolutely disqualifying the patient for exercise or any kind of employment requiring locomotion or muscular exertion. Now and then a similar distressing disease has been seen in Europeans; Delpech operated upon some remarkable cases of this kind, in one of which the swelling weighed seventy or eighty pounds. In Mr. Liston's collection is another tumour of this nature, which he removed, and the weight of which must be very great. It is generally, however, in warm climates that the disease is met with. Larrey relates the particulars of several cases which he saw in Egypt, and facts of the same kind abound in the records of surgery. The case of a native of China, who died under the operation attempted for his relief in Guy's Hospital, must be fresh in the memory of all surgeons in London. Many successful removals of the diseased mass, however, have been performed, especially by Clot Bey, in Egypt; and it is the only expedient that can afford relief, where the patient's life is rendered a burden by the magnitude of the adventitious formation. In practising these operations, there are three principal points to be attended to: first, we are to take care to secure every large artery as soon as divided, so that the patient may not die of hemorrhage before the operation is finished; secondly, we are to avoid injuring the testicles and urethra; thirdly, we are to give the patient a cordial draught, or a little brandy with a proportion of laudanum in it, before the operation, so that his nervous system may be better enabled to bear the long and unavoidable agony, or the shock, of the operation.

### CHIMNEY-SWEEPERS' CANCER

May be strictly denominated a disease of the scrotum; for the instances, in which it has been known to commence in other parts are very unusual. It seems to arise from the lodgment and irritation of soot in the rugæ of the scrotum; and, perhaps, if other parts of the integuments were as well adapted for the reception and detention of this substance, we should more frequently notice the disease in them. A few cases, in fact, are related, in which the disease occurred on the face and limbs, and this even in persons who were not chimney-sweepers; but then it is to be observed they were gardeners, or labourers in some other way, requiring them to handle soot. The disease commonly begins in the form of a smallish wart or induration upon the scrotum, such wart or induration soon presenting a broken surface, from which a particularly fœtid matter is poured out, but, drying, is converted into a kind of scab, or incrustation. From time to time this is rubbed off and followed by a more and more copious effusion of very offensive bloody ichor. At length, an ulcer of some extent is produced under the scab, with hardened, everted, or contorted margins. In time, the ulcer reaches the tunica vaginalis and the testicle, and the absorbent glands in the groin swell, burst, and sometimes change into similar malignant ulcers. I have known a chimney-sweeper's cancer commit such ravages that the artery in the groin was laid bare by it. In some cases, indeed, the patient dies of profuse bleeding; but more usually he dies hectic, exhausted by irritation, long suffering, profuse discharge, and extension of the disease to the lymphatic glands in the loins.

This is a malignant disease, over which internal medicines and external applications possess little or no control. If, therefore, we meet with the disease in its early stage, before the testicle, the spermatic cord, or the lymphatic glands are involved, we ought to lose no time in trying

useless medicines and dressings, but at once take away the disease with a knife. Even then the result will be uncertain; and, in the course of my time, I recollect more instances, in which the operation was followed by a relapse, than a permanent cure. I attended, at the Bloomsbury Dispensary, a chimney-sweeper afflicted with the disease in the state of ulceration, with one or two glands in the groin enlarged, which seemed to me a prohibition to the operation. He went into one of the hospitals, where the diseased portion of the scrotum was removed; but, I am informed, he soon died of a return of the disease higher up in the body. By these remarks, I would not wish it to be supposed, that the operation will never succeed when the inguinal glands are swollen. I am sure it will not answer, if those glands participate in the morbid action; but, if they be merely enlarged from irritation, then a cure may be the result, the glandular enlargement gradually subsiding after the disease has been removed. About two years ago, I operated under these circumstances on a chimney-sweeper in University College Hospital; and, though the inguinal glands afterwards suppurated, the man was perfectly cured in a few weeks. The same thing, it is well known, is occasionally noticed after the removal of a scirrhous breast.

One remarkable difference between chimney-sweeper's cancer and common cancer is this: in the former case, if the whole of the diseased parts be taken away, there will be no relapse; in the latter, the same practice will not secure the patient from a return of the disease in the same or other parts.

### CANCER OF THE PENIS

May commence on the glans, or the prepuce, and afterwards not only involve both these parts, but extend its ravages much further, so as to cause excessive induration even in the corpora cavernosa themselves, and sometimes to destroy the greater portion of the penis, by a process of malignant ulceration as high up as the pubes. In the museum of University College is a fine specimen of scirrhus of the penis, in which the corpora cavernosa and septum penis are involved; it was taken from an old man, who was under my care as a patient of the Bloomsbury Dispensary, and whose water I used to draw off daily for some time before he died. At certain times, he suffered acute pain in the organ, which was much enlarged, and the hardness of which was very remarkable. His great age, the state of his prostate gland, and the diseased condition of his bladder, prevented me from proposing the removal of the penis. He died, indeed, from a complication of diseases, and not exactly from scirrhus of the latter organ. In many instances, the disease originates in the form of a warty induration, either on the inner surface of the prepuce or on the glans, and it may continue in this state many years, without much change, though more generally it is soon followed by ulceration, the discharge of a thin peculiarly offensive ichor, and the formation of a malignant sore, with hard everted, or contorted, edges. In the case of the old man to which I have alluded, the disease had existed a very considerable time, without getting into the ulcerated stage. The late Mr. Hey, of Leeds, took particular notice, that, in many instances of cancer of the penis, the patients had a natural phymosis; for, in eight out of ten examples, which he attended, this was the case. The observation was corroborated by the reports of M. Roux, of Paris. Mr. Travers has never known a Jew to be the subject of cancer of the penis; but he operated on a man, who had been cut for phymosis ten years previously,

in whom a pimple on the side of the frænum ulcerated, and assumed the form of cauliflower fungus, completely surrounding the glans, while the latter continued sound. Perhaps, the following consideration may explain why many cases are combined with phymosis, which may not in every instance be natural, or congenital, or have preceded the other disease: when a cancerous affection begins on the inner surface of the prepuce, or when a cauliflower induration exists either there or on the glans, the irritation of the prepuce, arising from such a cause, may lead to a swelling, thickening, and enlargement of that part, just as we know that common warts, in the same situation, frequently do. Yet, I believe, that congenital phymosis does predispose to cancer of the penis, as Mr. Hey suspected; for, undoubtedly, those who have a long prepuce, and neglect cleanliness, are more liable to disease within that part than others, whose foreskin is short. Sooner or later, after scirrhus or cancer has begun in the penis, the glands in the groin enlarge, and the ravages of the disease may gradually extend from the extremity of the penis to the pubes, and have a fatal termination. Other ill-conditioned, or fungous diseases of the penis, however, must be carefully discriminated from cancer. I should say, with Mr. Travers, that whenever the disease begins as an irritable pimple of the glans, or prepuce, and this breaks into a spreading ulcer, with an indurated base, and a disposition to throw out a fungus, the case must be viewed with great suspicion, whether the glands in the groin be affected or not, particularly if the patient has passed the age of fifty.

The only chance of freeing a patient from a cancerous disease of the penis depends upon the timely removal of the affected portion of the organ with the knife. The earlier this is done, the greater the prospect of success; for, when the inguinal glands are involved, the operation is too late. Trivial sympathetic swellings of those glands, however, are not accounted by every surgeon a just prohibition of the operation, though the discrimination of such enlargement from one of a truly scirrhous kind is by no means easy. One thing has been fully proved by repeated experience, namely, that the patient is not certain of not having a return of the disease, though the operation be done at a period when no glandular enlargement exists. When the disease returns, it may either reappear upon the stump, or in the shape of cancerous buboes in the groin, which, after a time, often bleed profusely, so as to bring the patient very quickly to his doom.

### DISEASES OF THE PROSTATE GLAND.

A swelling of the prostate gland may be of different kinds, and depend upon a variety of causes: thus it may originate from *common inflammation of the part, abscesses, calculi within its substance, a varicous enlargement of the veins in its vicinity, or a chronic alteration of its texture*, by which its shape, size, and consistence are materially affected. This latter case, though attended with great induration of the part, and often termed *scirrhus*, is different from any cancerous affection, not betraying any disposition to affect the lymphatic glands, or to communicate a truly scirrhous form of disease to other textures and organs. The gland itself, when examined, does not present the texture of scirrhus, but is a dense, compact, nearly homogeneous substance. Whatever danger attends it (and great danger does frequently accompany it) proceeds from the difficulty of passing the urine, and its injurious effects on the bladder and kidneys, to which such state of the prostate gland, when far

advanced, inevitably leads. The prostate gland, besides being liable to the several affections which I have mentioned, is also subject to scrofulous disease and abscess; and perhaps, when a chronic enlargement of it takes place in a young person, — one under the age of thirty, for instance, — there is reason to suspect the affection to be scrofulous; for the other chronic enlargement, to which I have adverted, rarely happens in persons much under fifty.

With respect to *acute abscesses*, I believe they are generally formed around, or in the vicinity of, the prostate gland, and not in its substance. They may occur, however, in the cellular tissue, between its lobes. Most of the examples which I have seen, followed suddenly suppressed gonorrhœa, or were produced by the irritation of strictures in the urethra. They interfered seriously and urgently with the evacuation of the urine; and consequently required free and prompt incisions for the discharge of the matter. Sometimes they burst into the urethra, or make their way out in the perinæum. All inflammatory complaints about the neck of the bladder and the prostate gland generally cause more or less difficulty in passing the urine; and such is the ordinary effect of abscesses in this situation. In the early stage, we should employ every means in our power, calculated to prevent the inflammation from advancing to suppuration; and, for this purpose, we should apply leeches freely to the perinæum, bleed from the arm, administer calomel and brisk purgative draughts, and employ fomentations, or even the warm bath. But, directly matter has formed, the sooner an incision is made the better.

With regard to *prostatic calculi*, they are composed of phosphate of lime, their size varying from that of a pin's head to that of a nut. Sometimes they pass into the urethra, and are discharged. When they cause much annoyance, and can be felt from within the rectum on the finger being introduced into this bowel, they should be removed by making a suitable incision into the gland with the aid of a staff. When they project into the urethra, a similar operation will be required. If possible, they should always be extracted without actually cutting into the bladder itself.

The disease of the prostate gland, most interesting to the practical surgeon, is a *slow enlargement* of it, by which its bulk is sometimes enormously increased, from that of a chestnut, its natural size, to that of a large orange, or even a melon; for it has been known to attain the magnitude of fifteen times its natural size. The museum of University College is particularly rich in specimens of diseased prostate gland, bladder, and urethra. One preparation exhibits the bladder with the prostate gland, not only much enlarged, but torn or fissured by the repeated attempts of the surgeon to get the instrument into the bladder. Small calculi are lodged in the bladder in the depression behind the prostate; and we learn from the history of the case, that an abscess had formed between the bladder and rectum, which burst by an opening, which is still discernible, into the former of these organs.

Chronic enlargement of the prostate gland is most common in the decline of life, at which period there is a natural tendency to it, such that, in persons of advanced age, this part is always increased in size. The alteration of the prostate gland does not usually render the contiguous portion of the urethra narrower, in the manner of a stricture, but compresses the sides of that canal together, and either bends it more suddenly upwards, pushes it to one side, or turns it in spiral or other diversified modes. These facts enable us at once to understand why this

disease of the prostate gland should render the patient liable to retentions of urine, and why he should have symptoms and complaints very similar to those of stone.

The urethra has been known to be widened. Thus, Sir Benjamin Brodie has recorded a case of diseased prostate gland, where the urethra was dilated into a sinus, capable of holding two or three ounces of urine. The urethra, however, is generally more or less compressed and distorted, at the same time that it bends more suddenly up into the bladder. In consequence also of the prostate gland acquiring an increased magnitude, the prostatic portion of the urethra must necessarily be lengthened; and this may happen in such a degree, as to make the urethra two or three inches longer than natural. Frequently the gland is more enlarged on one side than the other; a circumstance that gives more or less obliquity to it. As the principal part of the prostate gland naturally lies below the urethra, the greatest part of the swelling occupies the same place. In many of these cases, there is a swelling of a portion of the gland just behind the vesical orifice of the urethra. Such a swelling may act like a valve at the neck of the bladder, and, in many preparations, it is actually seen constituting a large prominence in the bladder, attended with the effect of mechanically forcing the urethra forwards towards the pubes, and of obstructing the passage of instruments, or of preventing the surgeon from readily touching with a sound a calculus situated behind and below it. In one specimen in University College, the prostate gland is irregularly enlarged, and one part of it projects into the bladder, so that it was wounded in the attempts to introduce the catheter. Small calculi are also adherent to the inner surface of the bladder. In many of these cases of enlarged prostate, there are calculi in the bladder: in another preparation in the same museum, several calculi form a very serious complication of the other disease.

This chronic enlargement of the prostate gland comes on slowly and insidiously, not indeed exciting attention until the size of that organ generally, or of the third lobe in particular, begins to bring on first a frequent desire to make water, and occasional tenesmus, or uneasiness about the rectum, followed, after a time, by more or less difficulty of voiding the urine. There is not only pain in making water, but a desire and straining to discharge more, after the bladder has been emptied as far as it can be. The muscular coat of the bladder, being obliged to exert itself very frequently, and having a mechanical obstacle, as it were, to overcome, becomes of course considerably thickened. In fact, in an early stage of the disorder, the patient finds that he is obliged to make a greater effort than usual to get the urine to flow; he is compelled to strain a good deal ere it will begin to escape; but when once the first difficulty is surmounted, the contents of the bladder pass out tolerably well. However, in proportion as the diseased gland continues to increase in size, the difficulty of passing the water also increases; more straining is always required, and at times there is a complete or incomplete retention. No doubt, in a great number of instances, the projection of the third lobe, as it is sometimes termed, just behind the vesical orifice, has a mechanical effect in obstructing the discharge of urine; and probably it is when such prominence begins, that the inability to empty the bladder with perfect facility is first experienced. In one preparation in the museum of University College, the projection resembles a nipple in shape; in another it represents a complete ridge. Sometimes, when the third and one of the lateral lobes project considerably into the bladder, their surface has an irregular

ulcerated appearance, and on this account the patient suffers aggravated pain in expelling the last drops of urine, as well as distressing attacks of spasm at the neck of the bladder, symptoms also noticed in cases of stone. An ulcerated state of the projecting portion of the gland will also explain the great disposition to hemorrhage, exemplified in some of these cases on the introduction of a catheter.

In all advanced cases, the patient is annoyed with distressing irritation about the rectum, tenesmus, and flatulence; and a desire to go to stool often takes place so suddenly and irresistibly, that it is with great difficulty he can reach the proper place for relieving himself.

Generally, the patient voids large quantities of a viscid ropy mucus from the urethra, which was supposed by the late Sir Everard Home to be derived from the prostate gland itself. No doubt, a great deal of it is secreted by the inner coat of the bladder, which sometimes becomes the seat of inflammation.

In a considerable proportion of these cases, after a certain period, not only is the muscular coat of the bladder much thickened, but the inner coat protrudes between the muscular fasciculi in the form of cysts, or little sacs. A *sacculated bladder*, as it is termed, is a frequent complication of enlargement of the prostate gland. Now, these cysts may also include calculi, and instances have been known in which they were filled with pus. But this is not all the mischief resulting from disease of the prostate gland; for, amongst other bad consequences, the complaint, by deranging the functions of the urinary organs, may bring on, and frequently does bring on, a morbid enlargement of the ureters, and fatal disease of the kidneys.

Several of the symptoms of diseased prostate gland are like those of stone in the bladder; but, in the former case, the patient is able to bear exercise and the motion of a carriage much better than in the latter disorder. In a case of stone, there is also less tendency to retention of urine, but a greater disposition to paroxysms of violent pain in the hypogastric region, and to the discharge of blood with the urine after exercise. I occasionally visit an old gentleman, who has long had a considerable swelling of the prostate gland, yet, except at periods when he is laid up with retention of urine, he is able to walk into the city daily. In all doubtful cases, the state of the prostate gland should be examined from the rectum, and the patient sounded.

The museum of University College contains one specimen in which, besides the enlargement of this organ, a considerable thickening of the muscles of the ureters is seen, and likewise sacs formed by a protrusion of the inner coat between the fasciculi of the detrusor urinæ, from one of which sacs a calculus had been extracted. In another specimen, the prostate is very much increased in size, while the muscles of the ureters form a ridge adapted to give lodgment to calculi. Another preparation is the bladder of an old man, who died of retention of urine. The prostate is vastly enlarged, its lateral portions rising up, and its naturally posterior part projecting forwards; whereby the course of the urethra was so altered, that no instrument could have been introduced, unless it had been forced through the substance of the gland.

An enlarged prostate is an awkward complication of a case of stone, not only because it sometimes carries up the neck of the bladder almost above the pubes, and removes the cavity of that viscus very far from the perinæum, but because it may create impediment to the passage of a staff, and certainly will render the operation more difficult and protracted.

Another instructive preparation is a bladder with diseased prostate gland, and four calculi in the former viscus. The third lobe is enlarged. In trying to introduce the catheter, the surgeon forced it between the bladder and rectum; abscesses followed; and the patient died.

I do not know whether disease of the prostate usually produces a tendency to disease of the rectum; I suspect that it does, more especially hemorrhoids. In the above museum is a diseased prostate, complicated not only with a thickened sacculated bladder, but with stricture of the rectum.

One occasional effect of disease of the prostate is a vast dilatation of the ureters. In the above-mentioned collection is a tuberculated enlargement of the prostate gland, with the mouths of the ureters remarkably widened.

In another specimen of diseased prostate, taken from a patient who died of retention of urine, there is a fungous mass projecting from it into the bladder. The preparation also affords a specimen of the anatomical lusus of three ureters.

In the *treatment* of chronic enlargement of the prostate gland, occurring in persons above the middle period of life, we are to remember, that it is an organic disease, for the removal and complete cure of which no surgeon possesses any effectual means. Yet, notwithstanding this disagreeable truth, it is some consolation to know, that surgical assistance is often of essential service; and this not merely by obviating some consequences, which would be likely to abridge the patient's life, and even cut him off very abruptly, but by rendering the usual inconveniences of the complaint much more bearable than they would otherwise be. By the due regulation of the stomach and bowels with alterative and aperient medicines; by directing the patient to avoid sitting long at table after dinner, and not to expose himself to wet, cold weather, the stoppages of urine are rendered much less frequent, and the annoyance from tenesmus, flatulence, &c., ordinarily experienced by patients labouring under the disease, materially diminished. Setons and issues in the nearest part of the perinæum to the prostate gland have been tried; but I have never seen any good from them; and the same observation applies to various internal medicines, with respect to their power of reducing the swelling of the gland, especially iodine, mercury, and hemlock.

A retention of urine, arising from this disease of the prostate gland, will not often yield to the warm bath, opium, or hyoscyamus; and the reason of this fact seems to be explained by the consideration, that the obstruction is less of a spasmodic nature than of a mechanical description. Local bleeding is occasionally serviceable, and, as a degree of spasm may, and probably does contribute, with the mechanical effects of the disease on the urethra, to prevent the discharge of urine, I conceive that, when a catheter cannot be immediately introduced, the surgeon ought not entirely to neglect the trial of the warm bath and opium in the form of an enema, though he should not place much confidence in them, nor defer the use of the catheter. In fact, it is always best to resort to the catheter at once, because a prompt discharge of the urine is the only method of preventing the ill effects of a forcible distension of the bladder. The bladder itself rarely or never bursts in these cases, even if the water be not discharged; but the constitutional disturbance increases, the action of the kidneys is interrupted, the inner coat of the bladder inflames, and the patient dies comatose. I have seen examples, in which, when the water was drawn off, it had a completely purulent appearance, and no re-

covery followed; and Mr. Travers has seen two cases of long retention of urine from disease of the prostate gland, where the mucous membrane lay like a slough, loose in the bladder.

The catheter used in these cases ought generally to be of full size, greater length than common ones, and rather more bent upwards towards its beak. Some cases require the catheter to be thirteen or fourteen inches in length, as a shorter one will not reach the bladder. The late Sir Everard Home, who had considerable experience in the treatment of disease of the prostate gland, preferred elastic gum catheters, so constructed, that they retained a particular curve, even when the stilet or wire was withdrawn from them. These he sometimes left in the urethra several days; for they were calculated to bear warmth and moisture better than other common ones of the elastic kind. For the purpose of retaining them in the passage more surely and conveniently, a catheter bracelet was employed. A flexible catheter should be preferred to a silver one, when it is deemed most advantageous to keep the instrument any time in the passage; for it will remain there with much less annoyance than a metallic one. But, on the other hand, we are sometimes able to pass a silver catheter, when we cannot succeed with one made of elastic gum, which, unless the wire be of unusual thickness, has not always sufficient firmness to overcome the impediment arising from the compressed state of the urethra, or the alteration of its course. In these cases, whatever catheter be employed, it generally passes to the anterior portion of the prostate with perfect facility, and here its beak is stopped, sometimes partly by the compressed state of the urethra, but chiefly by the new curvature of the passage, which we cannot always get an instrument to follow. In fact, there are few instances of considerable enlargement of the prostate gland, without the urethra included in it being propelled forwards and upwards, or to one side, or twisted in various ways. Perhaps, where the passage is tortuous, an elastic catheter of moderate size is the most likely to find its way; and this instrument has one advantage over a silver one, deserving to be well remembered in practice, namely, by withdrawing the wire at the period when we are trying to make the instrument pass the obstruction, we are able suddenly to increase its curvature, and thus often succeed in getting it into the bladder when no silver catheter could be introduced.

Generally it is necessary either to leave the catheter in the urethra, or to draw off the water once or twice a day, according to circumstances, removing it directly after each evacuation. These plans are to be continued, until the patient regains the power of expelling the urine himself. When the case is such, that the introduction of the catheter is always difficult, the wisest plan, after getting the instrument into the bladder, is to keep it introduced for a few days, and, as soon as the patient can empty the bladder by his own power, it may be withdrawn. An elastic gum catheter, if it can be passed, should here be preferred. A surgeon should always be provided with catheters of various kinds, diameters, lengths, and curves; and one improvement, made by Sir Benjamin Brodie, I consider entitled to commendation, namely, that of having the handles of the wires of elastic catheters made large like the handle of a staff; for thus we acquire a greater command over the instrument, and can guide its beak with greater precision and delicacy. I approve also of the wires being thicker than those in common use, and of the plan of keeping some catheters prepared, so that they will retain their curvature after the wire is taken out of them.

The gum catheters which Sir Benjamin Brodie prefers, are mounted, not on small flexible wires, but on strong iron stilets, having the curve of a silver catheter. The stilets of the larger ones have flat iron handles resembling those of common sounds. Gum catheters should be kept thus prepared for a considerable time before they are used; they will then have the proper curvature. Sir Benjamin Brodie tries first to pass the gum catheter without the stilet; if he fails, he then tries the instrument with the stilet. In the present disease, large catheters are more easy of introduction than small ones; and the stilets of elastic catheters ought to be considerably curved. In passing them, it is now a common plan to keep the handle, at first, close to the left groin, introduce them as far as possible in this position, then bring the handle forwards nearly to a right angle with the pubes, and the handle is then to be depressed slowly and gently by placing one finger on it. When this is done, the point generally glides into the bladder, though sometimes this does not happen till the stilet is withdrawn. In particular examples, it is necessary to bend the point forward by means of a finger within the rectum, or on the perinæum.

If no catheter can be introduced, we must either puncture the bladder above the pubes, or form a passage through the diseased mass of the prostate. At the same time, I may observe, that we can almost always succeed with a catheter, and that puncturing the bladder is rarely called for.

### STRICTURES OF THE URETHRA.

A stricture of the urethra may be defined to be such a contraction or alteration of a part of the passage, that here it becomes considerably narrower than what it is by nature, or even entirely obstructed. With the subject of strictures, however, it is usual to consider several states of the urethra: as first, the *irritable urethra*, as it is termed; secondly, *spasmodic strictures;* and, thirdly, *permanent strictures.* Respecting the irritable urethra, I believe the term is rather employed for its convenience than its precision; and, generally, what is said upon this reputed irritability of the urethra, is vague and of little value. Frequent desire to make water, and more or less uneasiness in passing it, are commonly specified as symptoms of an irritable urethra: occasionally attended also with a discharge. Now, these effects may result from so many various causes, that really it is difficult to admit the propriety of taking them as proofs of an irritable urethra. Any inflammation in the urethra will cause the symptoms; so will an incipient stricture in certain constitutions.

Now, nothing shows more clearly the unsettled notions, attached to the subject of irritable urethra, than the widely opposite modes of treatment adopted for its relief by different practitioners. Thus, some surgeons treat it by prescribing, three times a day, one eighth of a grain of the bichloride of mercury, and ʒj. of nitrous spirit of æther; some, referring it to disorder of the digestive organs, prescribe the blue pill and sarsaparilla; some, viewing it as connected with the inflammatory state of the canal, employ leeches to the perinæum, and take blood from the loins by cupping; some, judging that it is the same thing as the alleged spasmodic stricture, give hyoscyamus or compound powder of ipecacuanha; while others, regarding it merely as too sensitive a state of the passage, endeavour to blunt its extraordinary tenderness by the occasional introduction of bougies.

The division of strictures into spasmodic and permanent is not satis-

factory to all surgeons, some of whom have a difficulty in believing, that the lining of the urethra is endued with muscularity. The observations of John Hunter maintain the latter doctrine, in favour of which several facts are usually adduced. Thus, a man, if otherwise healthy, voids his urine one day in a full stream ; on the following day, he exposes himself to damp and cold, or takes punch, or acidulous wine ; and next morning he cannot void his urine ; but is relieved by going to bed, taking a dose of compound powder of ipecacuanha, and, after having had the bowels emptied by medicine, he passes his water as well as usual. Then the effect of large bougies, or nitrate of silver, in enabling another patient to make water in a considerable stream, is also adduced as an argument on the same side of the question. The difficulty of passing water in such cases comes on suddenly, and ceases suddenly ; the cause is temporary —not a permanent disease. The canal of the urethra certainly varies in its diameter at different periods, and cold appears to have great effect in rendering it narrower. In practice, it has always appeared to me, that bougies and other instruments will enter the urethra much more easily in the same patient at some periods than others ; and that opium, hyoscyamus, and other narcotics, often facilitate the passage of such instruments. But then it is maintained that the resistance, when it occurs, is not anterior to that portion of the canal which may be conceived to be affected by the action of muscles in the perinæum. Abroad, the doctrine of the muscularity of the membrane of the urethra, and of spasmodic strictures, has gained, I believe, no advocates. There, the formation of strictures is invariably ascribed to the effect of inflammation in thickening parts of the canal ; and the same view is adopted by Sir C. Bell and many other practitioners in this country, who explain various circumstances, which have been referred to spasm of the urethra itself, by the action of muscles in its vicinity. A permanent stricture is attended with a conversion of the contracted part of the lining of the urethra into a substance of the consistence of ligament, but without its fibrous texture. The contracted part has, it must be confessed, no resemblance to muscular tissue.

One of the earliest symptoms of a stricture is the *retention of a few drops of urine in the urethra after the patient has made water,* which drops soon escape, and slightly wet the linen ; while another small quantity, collected between the neck of the bladder and the stricture, may be expelled by pressure below the urethra. The next thing noticed is, that the patient *cannot retain his water as long as usual,* but is obliged to empty the bladder once, twice, or oftener in the course of the night. As the disease increases the stream of urine becomes *forked, spiral,* or *scattered ;* and in a still more advanced stage, *the water is voided only by drops, or altogether stopped,* especially when the urethra is under the influence of cold, irritation, or the effects of intemperance. In addition to these symptoms, the patient has pain about the glans penis, and there is commonly a thin gleety discharge from the passage, a circumstance, which often leads to the serious mistake of treating the case as if it were merely a gonorrhœa or gleet.

In consequence of the natural sympathy between the urethra and testicles, one of the latter organs is liable to be attacked with inflammation, more especially, however, during the use of bougies. Whether a stricture be at first merely spasmodic, and capable of relaxation, as the Hunterian doctrines teach, is a disputed point ; but it is universally admitted that, after a time, the part of the urethra, which is the seat of stricture, is thickened, as well as contracted ; that the diminution of this portion of

the canal is not a temporary or periodical affection: in other words, that the stricture is permanent.

In old and aggravated cases of stricture, the bladder usually becomes considerably thickened, and does not admit of its usual degree of expansion. Frequently it inflames, and pours out a viscid kind of secretion like pus. And, when the obstruction in the urethra attains a certain stage, ulceration takes place between the bladder and the first and principal stricture; abscesses form on the outside of the canal, and, bursting, produce channels for the escape of the urine, called, on account of their situation and their usual indisposition to heal, so long as the obstruction in the urethra is not removed, *fistulæ in perinæo*.

Strictures in the urethra sometimes give rise to paroxysms of intermittent fever. I have seen many examples of this fact, and, in some of them, the ague had been treated without any suspicion having been entertained of its real cause.

A stricture, when examined in the dead subject, is often found not to occupy a great extent of the passage, the contraction being sometimes not broader, than what would originate from a piece of packthread drawn tight round the urethra. In some cases, however, a stricture does not correspond to this description; but the urethra is contracted along a considerable portion of its course, in which event its inner surface is exceedingly irregular, and sometimes as indurated and tough as cartilage. In particular instances, the contraction or diminution of the tube is only on one side of it; while, in others, it amounts to a complete circular constriction of the passage.

The most frequent place for a stricture is just behind the bulb of the urethra, or about six and a half or seven inches from the orifice, in the anterior part of the membranous portion of the canal. Perhaps the situation, next in order of frequency, is about four and a half inches from the extremity of the penis; then three and a half; and sometimes close to the opening in the glans. Strictures anterior to the bulb are less liable to be influenced by spasm, if they can be so affected at all, than other strictures placed more backward in the canal. It was the doctrine of Sir Everard Home, that, in the generality of cases, where only one stricture exists, it is just behind the bulb; and that if others are found more forward, we are almost sure of meeting with one in the former situation.

In the advanced stages of stricture, there is frequently a remarkable dilatation of the passage behind the stricture. In one case, under the care of Sir Benjamin Brodie, whenever the patient attempted to make water, a tumour, as large as an orange, was formed in the perinæum. When strictures have continued a long time, and increased to a certain degree, the bladder is required to make greater efforts than natural to expel the urine, and the result is a great thickening of its muscular coat. The same change is commonly seen likewise in persons, whose discharge of urine is not so free as it ought to be; and who suffer occasional retentions of it in consequence of the effects of disease of the prostate gland, or the portion of the urethra pervading this body. In cases of stricture, when the patient has repeatedly suffered from retention of urine, it is no uncommon thing to find, after death, the ureters themselves vastly dilated. I have known them to assume the appearance of two glass tubes, three quarters of an inch in diameter, distended with transparent urine.

Amongst the bad consequences of stricture, is the unfortunate and too

often fatal occurrence of a rupture of the bladder or urethra, arising from unrelieved retention of urine. The bladder itself sometimes gives way; but far more frequently a portion of the urethra behind the stricture ulcerates, or sloughs, and the urine becomes effused.

It is not an uncommon opinion, that strictures promote the origin and increase of disease of the prostate gland. They certainly do so, inasmuch as inflammation and abscesses about it are concerned; but I do not believe that they have any share in bringing on the indolent enlargement of that gland, so common in elderly persons. Bad strictures unquestionably keep up a disposition to chronic inflammation of the mucous coat of the bladder, and hence it may be thickened, as well as the muscular fasciculi of the detrusor.

An irritable bladder is a frequent complication or effect of strictures. Then another change, resulting from strictures, is the formation of sacs or cysts in the bladder; a sacculated state of this organ, which we know is also a frequent complication of diseased prostate gland.

If strictures are suffered to reach a certain stage, abscesses form about the neck of the bladder, the prostate gland, or in the perinæum. I have opened a good number of individuals, who died from the effects of very bad strictures; and, in a large proportion of these cases, I found not only extensive abscesses in the cellular membrane of the pelvis, but disease and suppuration in the kidneys.

In studying diseases in general, we should always make ourselves acquainted, if possible, with their causes. Now, with regard to strictures of the urethra, it is a common belief, that gonorrhœa is the most frequent cause of them; a view, however, that was rejected by John Hunter, on the ground that most of the ducts and passages in the human body, lined by mucous membrane, are subject to stricture. Then, another idea is, that though gonorrhœa may not have this effect, the astringent injections, employed for its cure, may bring on strictures. This is a point on which the highest authorities differ. A long residence in the East or West Indies, and the mode of life there pursued, give a disposition to strictures. At all events, in the better classes of society, strictures are particularly frequent among those individuals who have passed a considerable portion of their lives in a tropical climate.

The treatment of permanent strictures is conducted on various principles: —

1st. On the principle of mechanically dilating the contracted part of the urethra with common bougies, catgut bougies, elastic gum bougies, metallic instruments, or sounds, or elastic gum catheters retained in the passage.

2d. On the principle of producing a destruction of the stricture by making it ulcerate with the pressure of bougies or metallic instruments, or slough from the effect of escharotic applications to it.

3d. On the principal of perforating the obstruction with a conical sound; a plan, however, only sanctioned in bad cases, not yielding to milder methods.

4th. On the principle of piercing the stricture with a sharp instrument, introduced down to it through a tube.

5th. By cutting down to the stricture, removing the obstruction with a knife, and then introducing a catheter, and healing the wound over it.

*The Cure by Dilatation* may be regarded as that which, on the whole, retains the greatest share of approbation, though particular circumstances

may sometimes call for some of the other methods. The cure by dilatation is accomplished by common bougies, flexible metallic bougies, and sometimes by means of steel sounds and silver catheters of various sizes. They are all intended to act upon the principle of a wedge, and thus to dilate the contracted part of the canal. However, the action of such instruments is different from what it would be on inanimate matter; and the living parts, pressed upon and distended by them, undergo certain changes, which are the result of processes depending upon life. Thus, the parts either adapt themselves to the pressure, or recede by ulceration.

Strong as the symptoms of stricture may be, which have been enumerated, we require a more unequivocal proof of its existence; and we wish also to know what part of the urethra is contracted, and in what degree. For this purpose, we first carefully examine the urethra with a well-oiled bougie of nearly full size; for, if too small a one be employed, it may pass through a moderate stricture without any stoppage, or it may deceive us by its point becoming entangled in one of the lacunæ of the mucous membrane. All bougies above a certain size should be cylindrical, or not too conical, which shape would immoderately distend the orifice of the urethra. The stoppage of the instrument, together with well-marked symptoms of impediment to the free escape of the urine, may be regarded as a proof of stricture. If doubts exist, we should pass a metallic sound, or silver catheter warmed, and try whether more positive information can thus be obtained.

Supposing a stricture to be ascertained, the next object is to get as large a bougie through it as it will admit; but often only a small one will pass; and, if we can succeed thus far, we then know that the dilatation of such stricture is in our power; for, after leaving this small bougie in the passage a few minutes, we find the constricted part of the canal still more capable of receiving this bougie again, or even another bougie of rather larger size, on the next trial, which should be made in a day or two. This is next to be withdrawn, and one of still larger size introduced. In this manner, we proceed gradually from small to full-sized bougies, with which the cure is to be completed.

With respect to the questions — how often a bougie should be introduced, and how long kept in the stricture, there is no invariable rule to be followed; but much must depend upon the patient's capability of bearing the bougie without too much irritation. With this qualification, I may observe, that generally the bougie may be employed every other day, and be worn for twenty minutes, half an hour, or an hour, if the patient has favourable opportunities for it. The principle is to increase the size of the bougie, as fast as the yielding of the stricture will allow.

Of late years, metallic bougies and conical sounds of different sizes and curvatures, have been extensively employed. Sometimes they pass more readily along the passage, with their point directed to either side; an advantage which does not belong to common flexible bougies. The latter also, in consequence of their bending or cracking, are not so well calculated for those strictures, in which an instrument must be used with some degree of force. To common and flexible metallic bougies we can give any curvature deemed proper; but, with respect to steel and silver sounds and catheters, they are always constructed with determinate curves, adapted to the urethræ of different individuals.

The advantages of a waxen bougie are, that one of much smaller size, than any metallic instrument, can be safely employed; because metallic instruments, if constructed of similar slenderness, would be liable to break.

I scarcely need observe, that the minute diameter of some bougies is an important advantage, when the stricture is close, and will not admit a larger instrument.

Small sounds are usually made of silver; the large, of steel plated. I believe it is best to have them but slightly curved, and not more than eight or nine inches long. In using them, too much violence must not be exerted, which would make a false passage; and we shall more certainly avoid this risk, if we take care to make the beak glide along the upper surface of the urethra. After having passed one of the sounds, we may repeat the introduction of it again in two or three days. In many cases it is best to begin with small bougies, and then to go on with sounds, in the manner recommended by Sir Benjamin Brodie. The latter instruments are frequently advantageous for old gristly strictures, and cases complicated with a false passage.

It may be asked, to what size should we carry bougies, sounds, and other instruments used for the removal of strictures? In answer to this question I may remark, that some practitioners gradually proceed to bougies which are thicker than the little finger; but I never follow their example, finding that instruments of more moderate diameter answer every purpose. Bougies act, as Mr. Hunter has observed, on the living parts, constituting the obstruction or contraction: and these parts recede, or, in other words, are absorbed under the application of the instrument, so as not to require the passage to be distended in any extraordinary degree.

In common strictures, the most successful practice is conducted on the principles of gentleness and skill; and those surgeons, who employ great force and rough manual proceedings, not only put the patient to a great deal of unnecessary pain, but expose him to the danger of abscesses in the perinæum, profuse hemorrhages from the urethra, and the formation of a false passage.

It is well known to all men of experience, that strictures of the urethra are very liable to return: when, therefore, we have dilated the contracted part or parts of the passage, so far as is considered advisable, we should recommend the patient still to use a large bougie occasionally. In my opinion, it is much better for a man to pass the instrument himself once a fortnight, or once a month, for some considerable time after the end of the treatment, than to run the risk of having a relapse.

The method of curing strictures with elastic gum catheters has been preferred by several eminent surgeons abroad to all others as a general one. If we resort to this method, and succeed in getting the catheter through the stricture, it is a good rule to do what Sir Benjamin Brodie recommends; viz. to let the instrument be kept in the passage day and night, for three or four days; then taken out, and one of larger size passed, and allowed to remain. This mode of treatment is deemed by Sir Benjamin Brodie advantageous, 1. When the patient's time is of high value; because the stricture can thus be more quickly removed, than by any other means. 2. Where the stricture is dense and cartilaginous. 3. Where the urethra is irregular, or a false passage has been made. 4. Where rigors follow the use of the common bougies: for it is an observation made by Sir Benjamin Brodie, that such rigors are most disposed to take place when the urine first comes in contact with a part of the urethra that has just been dilated; which contact is prevented by the catheter, through which the bladder should always be emptied.

In very close strictures, we sometimes cannot succeed in getting any bougie immediately through them. In this circumstance, we must either

endeavour to make way through them by exciting ulceration, — that is to say, by pressing the end of the bougie with some force against the obstruction daily until the part ulcerates, — or try some of the other methods to which I have alluded. Now, it was the difficulty of getting through some strictures, which led to the employment of escharotics for their destruction. Another reason was also urged in favour of this practice, namely, that it produced a radical cure; whereas the treatment, on the principle of dilatation, was alleged only to relieve the patient temporarily, as the stricture generally returned some time after the discontinuance of the bougie. I believe that, in this respect, one method is not better than the other; and, whether we use common or caustic bougies, the patient will sometimes have a relapse.

So long ago as the time of Wiseman, red precipitate was conveyed on the end of a bougie down to strictures; but it was not till the period of John Hunter, that a more skilful way of applying caustic to them was suggested. This was by passing a piece of the nitrate of silver through a cannula, by means of a piece of wire down to the stricture. Afterwards a still better method was introduced by Sir Everard Home, who caused a portion of the nitrate of silver to be fixed within the extremity of a common bougie; which, thus completed, was called an *armed bougie*.

A full-sized common bougie is first introduced down to the stricture, and a mark made with the finger-nail on the instrument close to the orifice of the urethra. Thus we have the measure of the distance of the stricture from that orifice. We withdraw this first bougie, and taking the armed one, which should be of the same size as the common one previously introduced, we make a mark upon it precisely at the same distance from its point, as that already made on the bougie employed for the first measurement of the distance of the stricture from the orifice of the urethra. We then oil it, and pass it quickly along the urethra, until the arrival of the mark at the orifice of the urethra denotes that the caustic has reached the stricture. The caustic is then to be steadily applied for a minute or two against the stricture, and the bougie immediately afterwards withdrawn. This plan is followed up three or four times a week, and each stricture attacked in succession, until the urethra is free.*

By some judicious and experienced surgeons it is still maintained, that this treatment is advisable for spasmodic strictures, for old strictures with spasm, and for peculiarly irritable strictures. The following objections, however, are urged against the practice by others, viz. hemorrhage — severe constitutional disturbance — the risk of making a false passage — the bringing on of inflammation of the passage, and retention of urine — swelled testicle, or abscess in the perinæum.

The late Mr. Whately brought forward another mode of treating strictures with caustic. In short, he boasted of the wonderful effects of minute atoms of pure caustic potassa, weighing only one-seventeenth of a grain. They were taken out of a bottle at the moment when they were wanted, and pressed into a depression at the end of the bougie, and smeared over with cerate. No doubt Mr. Whately cured strictures, but he did not cure them in the way he supposed; his bougie, armed with this soapy mixture of fat and one-seventeenth of a grain of potash, would have no caustic effect, but operated merely on the principles of pressure and dilatation.

* A superior contrivance for the lateral application of the nitrate of silver to strictures was invented, a few years ago, by M. Ducamp: it can be procured of Weiss and Son's, Strand.

For my own part, I ascribe much of the action of other armed bougies to the same principles.

The employment of caustic has, for some time, been going gradually out of fashion in this country; and, in France, the practice was never adopted to any great extent. Ordinary cases do not require armed bougies; and bad cartilaginous strictures, attended with induration, and more or less extensive contraction and thickening of the mucous membrane, are manifestly examples, which the nitrate of silver would never relieve. At the same time, I believe, that where a stricture is peculiarly irritable, such irritability may sometimes be more quickly removed with the nitrate of silver bougie, than any other instrument.

Now, what is to be done where all common plans completely fail? Ought we to cut down to the stricture, after having passed an instrument into the urethra, as far as the commencement of the obstruction, endeavouring next to cut through the diseased portion of the passage, so as to find the continuation of it between the stricture and the bladder, and then to convey the catheter into that organ? I have seen this operation sometimes done with success; but more frequently the operator failed to find the continuation of the urethra. The difficulty proceeds from the great change and thickening of the urethra; and not only of that canal itself, but of the cellular membrane and more external parts. We have to cut into a mass likely to cause much perplexity. At the same time, the point of the staff, or catheter, is an important guide; and it is to be remembered, that, in the generality of these cases, the membranous portion of the urethra behind the stricture is considerably dilated; a circumstance that ought to facilitate the detection of it. I believe the danger of the operation is overrated, though not its occasional difficulty and frequent failure.

Then another method consists in perforating the stricture with a stilet, adapted to a kind of catheter, or tube, out of which it is made to project after the instrument has been passed down to the stricture; an old practice, revived in modern times. In 1795 it was introduced again by Dr. Physic, of the United States, who found it very successful. Of late years it has been practised in England by Mr. Stafford and others. The objections, commonly urged against this method, are the risk of hemorrhage, and the chance of not making the perforation in the right direction. But, in obstinate cases, some risks must, I believe, be encountered; and this will happen whether we cut down to a cartilaginous stricture, perforate it through a cannula, or force a conical sound through it. Mr. Stafford's cases, many of which he has published, seem to prove, that the danger of bleeding has been exaggerated. With regard to the forcible passage of a conical sound through the stricture under urgent circumstances, I entertain an unfavourable opinion of the practice, and should be exceedingly reluctant to adopt so uncouth and unscientific a method, which must always be attended with great danger of producing a false passage.

*A false passage,* as it is termed, is one caused by the laceration of the mucous membrane of the urethra by the forcible and unskilful introduction of a bougie, sound, or catheter in a wrong direction. One consequence of such an injury is, that when an instrument is afterwards introduced, the end of it goes into the new passage, and cannot be made to act upon the stricture, or find its way into the bladder. It scarcely admits of a doubt, I think, that a false passage is sometimes made, and heals up without any inconvenience, except a degree of hemorrhage at the time of the accident. Indeed, if we were to suspect the occurrence directly

after it had happened, we should, perhaps, give the patient the best chance of the laceration healing up without trouble, by directing him to retain his water a few hours, and then to pass a catheter of larger size, and more curved, than that which produced the false passage, so that its beak might be kept close against the upper surface of the urethra. I suspect, with Sir Benjamin Brodie, that a false passage is generally made by letting the end of the instrument press too much against the lower surface of the membranous portion of the urethra; though the forcible propulsion of this part of the canal to one side or the other may lead to similar mischief. However, by endeavouring to make the beak of the catheter glide along the upper surface of the passage, we elude the lacuna magna, the sinus of the bulb, the orifices of the prostatic ducts and the sinus pocularis; all points in which the end of the instrument may be entangled, and all situated on the lower surface of the canal.

When a false passage had been produced in the treatment of a stricture, Mr. Hunter used to introduce a staff as far as it would go, which he calculated would generally be to the bottom of the new passage, and of course beyond the stricture. The end of the instrument was then felt for outwardly, and cut upon. The new passage was next slit open to its junction with the urethra, at a point beyond the stricture; a probe or director was now passed in the direction towards the glans penis, and necessarily towards the stricture. On its further introduction being impeded by the stricture itself, this was cut through; and the operation was finished by withdrawing the probe, and introducing two cannulæ, one through the wound, and the other through the urethra, until they came together, when they were held securely, a perforatar pushed through them, so as to divide the obstruction, and then a bougie, after which the tubes were removed. The operation is now simplified by passing a catheter directly the stricture is divided, which part of the operation can also be now more conveniently done with Mr. Stafford's instrument.

Sometimes *profuse hemorrhage follows the introduction of bougies or catheters;* in such cases, the effect of cold lotions on the perinæum, or, what is still better, the cold bath itself, may be tried. If the patient be a strong, robust subject, we may also have recourse to venesection. In one instance, under the care of Sir Astley Cooper, the hemorrhage was so profuse, that it was judged necessary to divide the artery of the bulb; a measure which had the desired effect.

*Fistulæ in Perinæo* are ulcerated openings in the perinæum, which are not unfrequently formed in examples of bad strictures, as outlets for the urine, the urethra ulcerating behind the obstruction. When they are about to form, the patient generally experiences an increased difficulty of making water; perhaps he is attacked with shivering, followed by other febrile indisposition, and then considerable tenderness begins to be felt in the perinæum, — a hard tumour, with some degree of œdema, presenting itself in that part, or its vicinity. The skin next inflames, and a fluctuation is felt. The abscess bursts, or is opened, and fetid pus discharged, sometimes blended with urine from the first, and, in other instances, no urine coming out of the aperture till two or three days have elapsed. The discharge of pus then diminishes; but the urine flows out of the new passage in larger quantities, and whenever the patient makes water, a part of it escapes through the natural channel, and the rest through the orifice of the abscess. Sometimes instead of one, there are several external openings produced.

In consequence of the urine continuing to flow through the cavity of

the abscess, the track of the purulent matter becomes lined with a texture closely resembling that of mucous membrane, and the adjoining parts assume a hard and callous consistence. Fistulæ of the same nature may form in the scrotum, in the groin, or even on the penis near the pubes. When fistulæ in perinæo are established, the patient is no longer liable to attacks of retention of urine. Some time ago, I had a patient in the Queen's Bench Infirmary who was in a curious state; for, in consequence of the whole of his urine having passed for several years through fistulæ in the perinæum, all the urethra anterior to their communication with it appeared to have been completely obliterated.

In a few cases, urinary fistulæ form a communication between the rectum and the portion of the urethra behind the stricture; a complication, the possibility of which ought to be recollected. I may lay it down as a general principle, that abcesses in the perinæum, or near the prostate and neck of the bladder, should be opened early. The cure of fistulæ in perinæo must obviously depend upon that of the strictures themselves; for, in proportion as these give way, the urine resumes its natural course, and the fistulous openings heal. If they should not do so, however, we may pass a gum catheter into the bladder, and confine the patient for a few days to bed. Sometimes, however, when the communication with the urethra is unusually large; or when the urine flows too freely by the side of the urethra; or when the catheter excites a great deal of suppuration in the passage; the foregoing plan will not answer. Under these circumstances, let the patient be taught to pass the catheter himself, and let him for some time never make water without having first introduced it, as advised by Sir Benjamin Brodie. We should also do another thing which he particularly recommends, namely, stimulate the bottom of the fistula with nitrate of silver, while we retard the healing of its orifice by touching it once a week, or once a fortnight, with the potassa fusa.

### RETENTION OF URINE

Should not be confounded with *suppression*, which properly means an interruption of the secretion of that fluid, none being discharged, because little or none is formed by the kidneys. Examples of the latter disorder were commonly noticed in the late epidemic cholera.

In *retention*, the urine is poured into the bladder by the ureters, but, either owing to the want of power in the bladder, or to an obstruction in the urethra, it is not properly discharged. Of course, there is a distension of the bladder — very perceptible in the hypogastric region, — the swelling, indeed, often reaching as high as the navel; attended with a distinct fluctuation that can be felt through the parietes of the abdomen, as well as within the rectum. The patient suffers great torture; there is a hot, dry skin; thirst; an accelerated pulse; and other marks of febrile disturbance.

The bladder often continues distended with urine, notwithstanding, the patient may void it at periods in a stream, and even pass, in the twenty-four hours, the quantity usually discharged by a person in health. But, then, he discharges merely the overflowings of the bladder, as it were; and though the water may dribble away, or even occasionally flow out in a stream, that receptacle is never truly emptied, but remains with an acmulation of urine. This is the *retention par regorgement*, as it is termed by French surgeons. In cases of this description, serious mistakes are apt to be made in practice. A certain quantity of urine is discharged from

time to time; a retention is not suspected; and the patient, of course, does not receive the benefit of proper treatment. All surgeons, therefore, should remember well these retentions *par regorgement*, and, in doubtful cases, examine the hypogastric region, and introduce a catheter. This last proceeding can never do harm; it is fraught with no peril, not even with severity; and I can affirm, from repeated observation, that it will often be the means, and the only means, of saving the patient's life.

The division of retentions of urine into *complete* and *incomplete*, or *total* and *partial*, appears to me truly practical — a valuable and well-founded distinction, well calculated to put us upon our guard against taking a wrong view of particular cases. I believe, that if we examine the hypogastric region, and connect the fulness perceptible in that situation with other symptoms, we shall rarely be deceived, whether the patient discharge a part of his urine or not. If corpulency should conceal the hard circumscribed swelling of the bladder, so manifest in thinner persons, we ought of course to follow the manifestly prudent rule, which I have laid down for doubtful cases, and immediately pass a catheter. In fat subjects, I would also recommend the introduction of a finger into the rectum, where we may plainly feel the prominence of the distended bladder, and also a fluctuation, if, while the finger is applied to the prominence within the rectum, we tap briskly on the hypogastric region with the fingers of the other hand. This method, I should say, is particularly useful when the bladder is so thickened and contracted, that it does not rise above the pubes.

I constantly inculcate the maxim of letting the treatment of diseases be always guided, as much as possible, by the consideration of their particular causes, the removal of which must of course be a principal object in view. Now, retention of urine may depend upon a variety of causes, the nature of which entirely influences the prognosis and treatment; nor is it possible to form any just opinions, with regard to the treatment of this urgent disorder, without a constant recollection of the different circumstances concerned in its production.

The general indications are, first, to bring about, if possible, the discharge of urine through the natural passage; which object is sometimes accomplished by means of the warm bath, fomentations applied to the hypogastric region and perinæum, bleeding, opium, hyoscyamus, &c., and sometimes by the removal of mechanical obstacles to the flow of urine; but still more frequently by the skilful use of catheters. 2dly, When all these means fail, it becomes necessary to have recourse to some operation by which an outlet is made for the urine.

### CATHETERS.

Some are of course designed for the male urethra, and others for the meatus urinarius. Another general division of them is into *flexible* and *inflexible* ones. The former, or *elastic gum catheters*, as they are usually named, are now brought to great perfection, being made of many different sizes, to each of which a number is assigned. Some of them are of such a construction, that they will retain their curvature permanently; while another advantage is their being composed of materials calculated to resist, for a long while, the warmth and moisture of the urethra. It is only the best sorts, however, that are superior in this respect. They are provided with stilets and wires, which give them the requisite degree of firmness, and the particular curvature needed at the period when they

are about to be introduced into the urethra. Those employed by Sir Benjamin Brodie are furnished with firm iron stilets, and flat, broad handles like those of common sounds, by which means the surgeon acquires a greater command over the direction and management of the beak. Elastic gum catheters are frequently the only means by which the lives of patients, labouring under retention of urine from different causes, can be saved; and they render this important service by accommodating themselves to the displaced and contracted state of the urethra, and admitting of being passed through a very small channel. While those of diminutive diameter are frequently the most advantageous for strictures, the larger ones answer best for the retention of urine arising from disease of the prostate gland. Generally speaking, when other circumstances are not opposed to it, a large catheter is preferable to one of small size, as it distends the parietes of the urethra, and is much less likely to be obstructed by any of the irregularities, which the internal surface of the canal presents at different points of it.* Elastic gum catheters may be introduced either with or without the stilet, or, when partly introduced, their curvature may be suddenly increased by withdrawing the stilet at the same time that they are pushed further into the passage. All instruments about to be introduced into the urethra, should be smeared with sweet oil or lard.

*Inflexible* or *silver catheters* are introduced in the same way as a sound or staff, either with the convexity at first towards the pubes, succeeded by the *tour de maître*, or with the concavity of the instrument always upwards, that is to say, towards the pubes, or else with the handle kept in the first instance inclined towards the patient's left groin; a plan which Sir Benjamin Brodie follows, and which I often find advantageous. Whichever mode is followed, the catheter gets into the same position after its beak has reached the perinæum, and the *tour de maître* has been practised in the first manner of proceeding. We have now to direct its beak through that point of the urethra encircled by the margin of the opening in the deep perineal fascia; and, as soon as this is cleared, we should bring the handle of the catheter gently forwards and downwards, by which manœuvre the beak will be made to ascend through the membranous and prostatic portions of the urethra into the bladder. In this part of the operation, we should particularly aim at keeping the beak of the catheter against the upper surface of the urethra, so as to avoid the risk of making a false passage. If the instrument were forcibly and rudely pushed towards the bladder, without its handle being depressed at the proper moment, the canal would certainly be ruptured.

Sometimes the catheter is passed while the patient is standing with his back against a bedpost or the wall. If he be in bed, he should lie evenly, with his knees somewhat raised and separated. Mr. Morton's description of the mode of introducing the catheter is perfectly correct. "The operator, standing upon the left side of the bed, takes hold of the penis with the thumb and fore finger of the left hand, and raises it gently, so as to efface the curve, or angle, which the penis forms, where it bends down in front of the scrotum. Holding the catheter in his right hand, lightly poised between the thumb and two first fingers, the surgeon introduces its point into the orifice of the urethra, and continues to pass the instrument onwards, until the point reaches the bulb, which is about an inch below the arch of the pubes. During this time, the concavity of

* See Th. Morton, on the Surgical Anatomy of the Perinæum, p. 62. 8vo. Lond. 1828.

the catheter is directed towards the symphysis pubis, while the straight portion is held parallel with the front of the abdomen. The point of the catheter having reached the bulb, the position of its handle is now to be changed from the horizontal direction, in which it has hitherto been held, until it has been brought into a perpendicular position, and thus forms a right angle with the axis of the patient's body. This movement of the handle of the catheter will cause its point to rise out of the sinus of the bulb, after which it may be safely pushed onwards through the opening in the triangular ligament, and thus enter the membranous portion of the canal. By gradually depressing at this time the handle of the catheter, a little more between the thighs of the patient, it will glide smoothly onwards through the remaining portion of the urethra into the bladder." *

The same well-informed surgeon delivers the following valuable remarks on this subject: — " The natural obstacles, which most frequently oppose themselves to the passage of the catheter are, first, the lacunæ of the urethra, and the sinus of the bulb; after which comes the opening in the triangular ligament. When these are passed, the anterior border of the prostate gland, the orifices of its ducts, and the sinus pocularis, may all serve to obstruct the introduction of a small catheter by entangling its point; and, lastly, the elevated ridge, which marks the commencement of the neck of the bladder. It will be observed, that all these natural obstacles to the easy introduction of a catheter are situated upon the inferior surface of the urethra, and therefore they will be best avoided by keeping the point of the catheter gently directed against its superior wall. The margins of the opening in the triangular ligament will not give any trouble, if the situation of the circular aperture that transmits the urethra is accurately understood: it is nearly one inch below the arch of the pubes, and equidistant from the descending branches of the same bones. When the point of the catheter is arrested in either the membranous or the prostatic portions of the urethra, it will be found of considerable advantage to introduce the left forefinger into the rectum, which will frequently enable the operator to distinguish the situation, as likewise the cause of the difficulty, and also to direct the instrument with greater certainty into the bladder." Mr. Morton very properly cautions surgeons against grasping the catheter too firmly, instead of holding it lightly, like a pen; and explains, that if the end of the catheter be kept *too strictly* against the upper side of the urethra, it will be stopped by the superior margin of the opening in the triangular ligament, or, if it pass that, by the edge of the prostate gland.

Women are much less subject than the male sex to retention of urine, the meatus urinarius being short and capacious; not liable to stricture; nor to those consequences, which originate in the other sex from disease of the prostate gland, and from abscesses situated near, and pressing upon, the urethra.† Neither does the inflammation, accompanying severe gonorrhœa in females, lead, as it frequently does in men, to retention of urine. Yet women are now and then afflicted with retention of urine, from causes very different from those which bring it on in the male sex. Polypi of the uterus, or vagina, ovarial dropsy, cancer uteri, displacements of the womb, especially that termed retroversion, and inflammation about the neck of the bladder after parturition, are the usual causes of the disorder in women.

* See Morton's Surgical Anatomy of the Perinæum, p. 62.

† I have known, however, great difficulty of voiding the urine, and severe pain, arise from an abscess of one of the lacunæ of the meatus urinarius.

The catheter for females is shorter than that for the male subject, and has but a slight curve. It should be passed without subjecting the patient to exposure: we should hold the catheter in the right hand, and pass the left forefinger between the nymphæ, and on the smooth surface between them, about three quarters of an inch below the clitoris, we shall readily feel the papilla denoting the orifice of the meatus urinarius, into which we are to direct the instrument upwards with its concavity kept forwards. Here we have none of the difficulties which are met with in the male sex from the length and curvature of the passage, the resistance of the deep perineal fascia, the yielding of the membranous part of the urethra, the impediment formed by the prostate gland, the hitching of the end of a small catheter in the orifice of an enlarged prostatic duct, or in the sinus pocularis of the verumontanum, the stoppage of the beak of the instrument in the sinus of the bulb, or by spasm of muscles in the perinæum.

*Men advanced in years are particularly liable to retention of urine.* This is partly explained by their being remarkably subject to disease of the prostate gland, and partly by the bladder, after a certain period of life, losing some of its irritability and contractile power, so that it no longer retains the capability of lessening its cavity beyond a certain point. Hence the expulsion of urine in old persons is never complete, a portion of it always remaining in the bladder after each evacuation. At length, the infirmity increasing, the quantity of urine voided each time lessens; the desire to empty the bladder becomes more and more frequent; and, in the end, the urine only comes away by drops, or in a dribbling stream.

In this state, the sufferings are not very great; the tumour, formed by the bladder above the pubes, is indolent, and, if compressed, a certain quantity of urine will sometimes flow out of the urethra. In short, this is a case of *incomplete* retention; frequently as much urine being discharged in the twenty-four hours as is natural, but the bladder is never emptied. However, the symptoms are generally less urgent than in other examples; because this form of the complaint does not, like others, lead to a positive interruption or total suppression of the urinary secretion, nor to a rupture of the bladder.

The weakened state of the bladder from age can never be removed; but when there is a greater tendency than usual to an accumulation of water, the use of the catheter should never be omitted, as it will afford immediate relief to the patient's uneasiness, and also prevent that degree of distension, which would terminate in incurable disease and total paralysis of the bladder, if not in a rupture of it, and fatal effusion of urine.

*Retention of urine often proceeds from injuries and diseases of the spine and pelvis,* by which the bladder is rendered paralytic; cases remarkable, on account of the strongly ammoniacal quality of the urine soon produced under such circumstances, and the propensity in the coats of the bladder to become softened and ulcerated. In such cases, the treatment should consist in the regular use of the catheter, in cupping the injured part of the back, or bleeding the patient in the early stage of the case, followed up by purgatives and counter-irritation, as blisters, the moxa, or an issue. Fractures of the spine or pelvis, however, would call for particular treatment, one essential thing in which would be to keep the injured bones as quiet as possible.

Another *retention of urine, accompanied also by a paralytic state of the*

*bladder*, does not depend upon any injury of the spine or pelvis, but altogether upon the detrusor urinæ muscle having suffered long and immoderate distension, in consequence of a previous accumulation of urine in the bladder from some other cause. Here, whatever benefit can be rendered, must be derived from the catheter, tonics, cold bathing, the exhibition of the tincture of cantharides, or the tinctura ferri sesquichloridi, and the application of blisters to the region of the sacrum.

*Retention of urine from inflammation in or near the urethra* is often exemplified in severe gonorrhœa, and in acute inflammations about the prostate gland and lower portion of the rectum. In all probability, when some practitioners describe a retention of urine, as arising from spasm or irritation, they would be speaking more correctly if they were to refer the disorder principally to the effect of inflammation somewhere about the urethra or the neck of the bladder.

When retention of urine proceeds from inflammation in the urethra or neighbouring parts, we should first try the effect of soothing antiphlogistic treatment, antimonial purgative medicines, bleeding, leeches to the perinæum, the warm bath, fomentations on the hypogastric region, and the effect of hyosciamus or acetate of morphia. If these means prove unavailing, the use of the catheter is not to be deferred.

*Retention of urine is sometimes caused by the pressure of collections of matter on the urethra.* Here the first indication is to discharge the abscess, and draw off the urine. Afterwards, with the assistance of antiphlogistic treatment, hyoscyamus, or opium, and the warm bath, or fomentations, the patient will soon begin to be able to discharge his water himself. I once visited a case with Mr. Holt, which was attended with a complete and obstinate retention of urine, arising from the pressure of an extraordinary mass of coagulable lymph effused in the corpus spongiosum, about two inches from the orifice of the urethra. The original complaint was a virulent gonorrhœa, accompanied by chordee. Here bleeding, the warm bath, narcotics, the tinctura ferri sesqui-chloridi, and leeches to the perinæum, did not supersede the necessity for the catheter.

Another *retention* arises from *fungous* and *carcinomatous diseases of the bladder.* Cancer is sometimes propagated to the bladder from the rectum or uterus. Here the treatment can only be palliative, and the catheter is not to be neglected.

Amongst the varieties of *retention* is that *depending upon foreign bodies in the bladder*, whether hydatids, coagulated blood, worms, or calculi, which may obstruct the passage of urine from the bladder into the urethra, or through the latter tube. Here the cure depends upon the removal of the substances causing the obstruction. Worms, hydatids, and coagulated blood would require the bladder to be washed out with a syringe and catheter of the largest size. In cases of worms in the bladder, turpentine has great power in promoting their discharge; and, what is remarkable, gets into the bladder, in a few seconds after it is swallowed.* Calculi, either in the urethra or bladder, not above a certain

* Mr. Law, of Penrith, Cumberland, was kind enough to send me some specimens of what were supposed to be tæniæ, voided from the bladder of a young woman under his care; but, if Mr. Owen's report be correct, the patient must be guilty of deception, as the specimens, which I presented to the College of Surgeons, were found by him only to be imitations of tæniæ, made from the intestines of some small bird. From a kind of monomania, she seems to have introduced some thousands of pieces of these sham tæniæ into her bladder.

size, may be removed with the urethral forceps, sometimes without an incision in this canal, sometimes with it.

In children, one kind of *retention* is *produced by the diminutive size of the orifice of the prepuce, or a congenital phymosis*, as it is termed. In such a case, the prepuce is sometimes distended by the urine into a large pouch, from which it escapes slowly and difficultly. Instances of urgent danger from such a cause are given by Petit.

*In retention of urine from stricture in the urethra*, a difference of opinion exists about the right principle of treatment. Many surgeons begin with an antiphlogistic soothing plan, and try the effect of the warm bath, bleeding, leeches, aperient medicines, or opium, given by the mouth or in clysters. This plan may be the best, if the retention is quite recent, and the patient is not in much agony. In the opposite case, it is proper to resort to the catheter at once. Thus, instead of the method adverted to, Sir Benjamin Brodie takes one of the smallest gum catheters, which has been kept for a considerable time on a curved iron wire, and which consequently will retain its curved form after the wire is withdrawn. He introduces it without the wire, and keeps the concavity of the catheter towards the pubes, elongating the penis at the same time. The instrument will then be likely to pass the stricture and enter the bladder, the urine to flow out in a fine stream, and the patient to be instantly relieved.

If this plan fail, we may try a small catgut bougie. We are to introduce it as far as we can, and then elongate the urethra by drawing the penis forwards, when the bougie will often pass. Certainly, as Sir Benjamin Brodie has justly observed, it is not always necessary that it should pass into the bladder; if it enter the stricture, that is sufficient, — we should then let it remain there, until a violent effort to make water occurs, when it is to be taken out, and the urine will frequently follow it.

If this expedient should not answer, we may take another small catgut bougie, and bend its point upwards before it is introduced, by which means we shall be enabled to keep its point against the upper surface of the urethra, and to avoid the lower, where the obstruction is mostly, if not always, the greatest.

When a catgut bougie will not succeed, a *silver* or an *elastic gum catheter*, mounted on a firm iron stilet, will sometimes pass. When the stricture is recent, the catheter should be of nearly the full size of the urethra; but, if the stricture is of long standing, the instrument should be considerably smaller. Sir Benjamin Brodie prefers one that is shorter and less curved than usual; and if it is made of silver, he advises the tube to be fixed in a wooden handle, which will enable us to direct its point more delicately and with greater effect. If we use an elastic gum catheter, the iron stilet should have a handle, like that of a common sound. The rules and advice, given by Sir Benjamin Brodie on these matters, appear to me particularly valuable. We are to pass the instrument as far as the obstruction, and then, having withdrawn it for about half an inch, we are to pass it on again towards the bladder, keeping the point against the upper part of the urethra. No violence is to be employed; for, if we tear the urethra, we cannot succeed. I recommend steady and moderate pressure against the stricture, to be maintained for a little while, and then perhaps the obstruction will begin to relax or yield, and the instrument enter it. If a gum catheter has been used, we should leave it in the urethra for a day or two, which will have a great effect in curing the stricture. Even if we do not succeed in getting an

instrument into the bladder, the pressure employed may still do good, by bringing about a relaxation or yielding of the stricture, and on the instrument being withdrawn, a stream of urine may follow it. Experience confirms the frequency of such occurrences, and, if they can be brought about, the patient is extricated from an urgent state of danger, as well as from the torture to which a retention of urine from this cause necessarily subjects him.

Now, supposing we were not able, in a case of complete retention of urine, to relieve the patient by the catheter, and he were strong and full of blood, he may, in the first instance, be bled, and put into the warm bath, and then the catheter tried again; or, what is still more applicable to all cases, an enema should be injected, composed of ʒj. of tincture of opium, and ʒij. of mucilage of starch, or gruel — not more, as it would not be retained. As soon as the influence of the opium begins to be felt, if the hypogastric region be kept well fomented, sometimes the urine will begin to flow, and, at all events, there will now be a greater chance of success with the catheter.

If all the measures specified were to fail, and the bladder were to continue distended beyond a certain time, either that organ, or a portion of the urethra behind the obstruction in it would give way, and the urine be extravasated in the cellular tissue of the perinæum and scrotum. Thus either a rapid and fatal inflammation, involving the peritoneum, would be excited, or more or less extensive abscesses and gangrene of the cellular tissue of the scrotum, perinæum, and interior of the pelvis be the consequences. In such unfortunate cases, the urine does not gravitate to the thigh or nates, but spreads over the scrotum, penis, the groins, and even higher up towards the navel and loins. The reason why it does not pass towards the nates is, that it is stopped by the connection of the deep perineal fascia, with the superficial, and the rami of the ischium and ossa pubis. When the urethra gives way, there is generally at first a small induration in the perinæum, which is sometimes rapidly converted into a dark, livid, extensive, and quickly spreading tumour of the scrotum, groins, and parts in the perinæum. Nay, sometimes the effusion of urine ascends, as I have said, far above Poupart's ligament. Now, wherever the urine passes, it is sure to produce suppuration or gangrene, and sometimes the whole scrotum sloughs away, leaving the testes hanging by the spermatic cords, totally destitute of their natural coverings. The only way of preventing such evils, — I mean those of effusion of urine, — is to procure, in some way or another, an outlet for the urine from the bladder previous to its rupture, or that of the urethra.

In stricture, this may frequently be accomplished by making an incision in the membranous portion of the urethra behind the stricture, which part of the canal is generally dilated into a sort of tumour, by being distended with the urine, forced thus far by the bladder.

In diseases of the prostate gland, attended with urgent circumstances, we must either convey the catheter into the bladder, through the tumour, by a combination of skill and well-directed force, or puncture the bladder above the pubes; which last proceeding, however, is rarely necessary. I had occasion, however, to adopt it in one instance in University College Hospital, as will be mentioned more particularly when the methods of puncturing the bladder are described.

But, if urine be already effused, the surgeon must never forget to make free and deep incisions for its escape; and, if possible, a catheter should

be introduced, so that the urine may have a ready outlet, and no more of it pass into the cellular tissue.

## INCONTINENCE OF URINE.

An inability to retain the urine in the bladder is of three kinds: in one, the water continually dribbles away, without any inclination to void it, or any sensation of its being voided. In other instances, the patient can hold his urine in a certain degree; but the propensity to evacuate it comes on so frequently, suddenly, and irresistibly, that he is compelled to discharge it. The third kind of incontinence only occurs when the patient is asleep.

The first case depends on a weakness, or total paralysis, of the sphincter muscle of the bladder. As the neck of this organ is constantly open, every drop of urine escapes into the urethra, immediately it has descended from the ureters, and does not lodge in the bladder at all. Sometimes the weakness, or paralysis, of the sphincter is quite a local disorder; but, most frequently, it is symptomatic of some other affection. In the first case, it is often the consequence of a difficult labour, in which the neck of the bladder has been a long while compressed; or of the formation of fistulous communications between the vagina and the bladder. Sometimes, incontinence of urine depends on a malformation of the urinary passages, and exists from the time of birth. The complaint is often an effect of apoplexy, injuries and diseases of the spine, &c.

It is not dangerous, though exceedingly annoying, in consequence of its continually wetting the clothes, causing a disagreeable smell, and even excoriating the parts over which the urine flows.

When the complaint is local, tonics and astringents are indicated; and the principal remedies are, cold bathing, bark, blistering the sacrum or perinæum, the tinctura cantharidum, the shower-bath, electricity, and rubbing the spine and sacrum with stimulating liniments.

When incontinence of urine is merely the effect of another disorder, the latter claims the principal attention.

The second species of incontinence of urine is of a spasmodic nature, and commonly depends on some irritation operating on the bladder. Hence, the indication is to find out the irritation, and if possible to remove it. Hemorrhoidal complaints, suppressed menses, a stone in the bladder, a fistula in ano, &c., may cause the affection. When the particular irritation cannot be discovered, general soothing and antispasmodic remedies, such as bleeding, opium, the warm bath, fomentations, &c., should be prescribed. The uva ursi is sometimes useful, of which a scruple, or half a drachm, may be given three times a day.

This kind of incontinence of urine is frequently only a symptom of epilepsy, or hysteria. Sometimes it originates from pressure made upon the bladder; and hence, it may be a symptom of polypi of the uterus, a prolapsus of this viscus, or difficult parturition.*

* Retention of urine, from paralysis of the bladder, is a case attended with an involuntary dribbling away of this fluid, if the catheter be not properly employed, and is a disorder that has frequently been mistaken for an incontinence of urine. As soon as the bladder is distended to a certain degree, the urethra being unobstructed, the continued secretion from the kidneys, instead of causing the bladder to give way, passes off through the natural channel. The discharge of urine leads the unwary surgeon never to suspect the real nature of the disease; but if a catheter chance to be introduced, the quantity of urine drawn off immediately throws light upon the true character of the disorder.

The last case is that, in which the urine is involuntarily discharged in the night-time, when the patient is asleep. The infirmity is mostly met with in young boys and girls; and, for the most part, spontaneously goes off as they approach the adult state. They should avoid drinking any fluid just before going to bed, and empty the bladder before they go to sleep.

When, in adult persons, the complaint does not yield to the above precautions, one fourth of a grain of the powder of cantharides, given with milk of almonds, every evening, has been known to be of service. The effect of exhibiting a grain of opium, or two grains of ipecacuanha, every night, a little before bedtime, may also be tried. The best apparatus for catching the urine, where no cure can be accomplished, which I have ever seen, consists of a long tube, made of elastic gum, or other flexible waterproof material, and capable of holding about a pint and a half of fluid. It causes little inconvenience, and, as it is so narrow as to be concealed by the trowsers, it occasions no disfigurement.

There is a particular incontinence of urine, arising from the formation of a preternatural communication between the bladder and vagina. It is usually the consequence of a slough, and sometimes follows difficult labours. The continual dribbling of the urine through the opening, generally prevents it from healing; but by making the patient lie a good deal on her abdomen, the water is hindered from constantly escaping, and the aperture will sometimes heal. The fistulous opening may occasionally be made to heal up, by scarifying its edges, and keeping them afterwards in contact with the twisted suture; the patient being made to lie on her abdomen, as much as possible, for two or three days. In the worst cases which admit of any chance of relief, perhaps, the actual cautery, applied with great caution and moderation, is what ought to be employed. Many cases on record attest its frequent efficacy.

### GONORRHŒA,

Or *Clap*, may be defined to be an inflammation of the mucous membrane of the urethra, attended with a discharge of puriform matter, which is frequently believed to be of a specific quality, and which is well known to possess infectious properties. In women, the discharge takes place from the mucous membrane of the vagina, labia, nymphæ, and clitoris, as well as from the lining of the meatus urinarius, and, according to M. Ricord, sometimes also from the lining of the uterus itself.

A gonorrhœa is found to begin at an earlier period after infection than a chancre, generally within a week or ten days. However, some individuals are attacked in two or three days; and others experience no inconvenience, perhaps, for two or three weeks. The earliest symptom is an itching at the orifice of the urethra, sometimes extending over the whole of the glans penis, which, with the mouth of that canal, has a fuller and redder appearance than usual. The glans being reddened and smoothed by distention, is sometimes compared to a ripe cherry. The natural secretion of the mucous membrane of the urethra first loses its viscid quality, and becomes thinner, but soon assumes a thicker consistence, turning white, yellow, or greenish, so as to have the common appearances of pus.

About the period when the discharge begins, heat and pain are experienced in the passage, more especially at the time of making water. The urine passes with a scalding sensation, and sometimes with considerable difficulty, either in a very diminished, broken stream, or merely by drops. Occasionally, the irritation is such, that a complete retention is brought

on. In ordinary cases, the inflammation does not extend further along the urethra than an inch and a half, or two inches, from the orifice—the *specific extent*, as it was termed by Mr. Hunter; but, in severe examples, the inflammation passes through the whole course of the urethra, and even affects the mucous membrane of the bladder. When this happens, the patient's sufferings are considerably aggravated, the pain about the hypogastric region, perinæum, and hips, being particularly distressing. In such cases, small indurations, consisting of enlarged glands, may often be felt in the course of the urethra, and sometimes these, and Cowper's glands inflame and suppurate.

In general a common clap increases, or, at all events, maintains itself in an unabated degree, for ten days or a fortnight: the discharge then frequently begins to lessen; the pain and scalding sensation in making water to subside; and in a month or six weeks, none of the symptoms may remain. In this manner, gonorrhœa may undergo a spontaneous cure. Sometimes, however, the acute symptoms go off, especially the pain and heat in making water; the quantity of discharge is also reduced; but the urethra, instead of resuming its natural healthy mucous secretion, pours out a thin, colourless, or light green matter, which may continue for a long time to ooze from the passage, constituting what is called a *gleet*.

It was one of the opinions of John Hunter, that a gleet is essentially different from a gonorrhœa, in not being infectious, and in consisting of a discharge composed of globules, blended with the mucous secretion of the part; while the matter of gonorrhœa is made up of globules blended with a serous fluid. Gonorrhœa in its worst forms is truly a distressing disorder. Not only may the inflammation run along the urethra to the bladder itself, as already described, but fibrine may be effused in the corpus spongiosum urethræ, so that, when an erection takes place, one side of the penis being less yielding than the others, the part assumes a distorted or bent appearance, termed *chordee*, and attended with great suffering. The irritation, accompanying gonorrhœa, gives a tendency to erections; which are perhaps a source of far greater suffering, especially when combined with chordee, than the ardor urinæ, or even the irritable state of the bladder itself.

Frequently, the inflammation extends to the prepuce, which becomes thickened, swollen, and œdematous, so that the glans cannot be uncovered; a state termed *phimosis*.

Sometimes other parts are affected, as the glands in the groin, and the testicle, which are attacked by acute inflammation. Hence *sympathetic buboes*, and the inflammatory painful enlargement of the testicle, absurdly called *hernia humoralis*. I may say, that tenderness of the glands in the groin, and of the testicles, is an ordinary attendant on clap, so that even when one of the latter organs does not actually inflame, it is often in a state in which the use of a suspensory bandage affords much comfort.

Several curious and interesting questions necessarily present themselves to our notice in the consideration of gonorrhœa.

The first is, whether a clap depends upon a specific virus? All surgeons know that simple irritation of the mucous membrane of the urethra will increase the quantity, and alter the quality, of its natural secretion, or will change the mucous secretion into one of pus, so as to bring on a discharge. Some practitioners denominate a case of this description a *simple* or *benign gonorrhœa*, reserving the epithet *virulent* or *venereal* for the case which is conceived to depend upon a specific poiso

A discharge of matter from the urethra may result from any kind of irritation affecting it, as that of the employment of bougies, or of the application of various acrid and unhealthy secretions to its orifice in the act of coition. Such altered secretions may be formed from the mucous surfaces of the female parts of generation, totally unconnected with the poison of syphilis. What experienced surgeon does not know, that when female children are violated, a discharge generally follows, in consequence of the injury done to the parts, even though there may be no actual laceration of them? And hence the offender is frequently alleged to have been in a state of disease when he perpetrated the crime, though this inference is far from being warranted, merely because the female is attacked with a discharge.

But, besides these gonorrhœas from simple irritation, it is contended that there are others, arising from the influence of a specific poison, and, as some surgeons maintain, from the identical poison that is concerned in producing the venereal disease.

As we know not what the poison of gonorrhœa is, nor what the syphilitic poison itself is in a separate state; nor even whether there may not be, as Mr. Carmichael conceives, several varieties of venereal poison, the determination of this question is particularly difficult. If we were to judge of the nature of the venereal and gonorrhœal poisons by their general effects, and consequences of each of them, we should be led to the inference that they are certainly not identical. We see in gonorrhœa, generally speaking, only a discharge from the mucous membrane of the urethra without ulceration, going through a certain course, and usually terminating of itself in three, or four, or five weeks, without any eruption, sore throat, or affections of the bones. In syphilis we see a disease that begins with ulceration of another texture, generally lasts considerably longer than a clap, and is disposed to bring on a train of secondary symptoms, denoting its influence over the constitution at large, and often lasting for several months.

*The arguments, in support of the identity of the two poisons, are of the following kind: —*

1st. The supposed conveyance of the venereal disease from a country where it was known to be prevalent, to a very distant one, in which it then commenced for the first time. Now, Mr. Hunter supposed that it could only have been conveyed, during a voyage of several months, in the form of gonorrhœa, as he thought that a chancre on the penis would in this time have destroyed the organ.

2d. The occurrence of secondary symptoms after gonorrhœa. Mr. Hunter mentions a gentleman who had gonorrhœa three times, which was treated without mercury: about two months after each infection, he had secondary symptoms, which consisted of ulcers in the throat, and blotches on the skin.

3d. The result of an inoculation with gonorrhœal matter, as performed by Mr. Hunter himself; followed by bubo, ulcer on the tonsils, and blotches on the skin; all ultimately cured by mercury.

If the particulars of this case be closely attended to, it will be perceived that Mr. Hunter deviates from some of his common doctrines about the venereal disease. In the first place, the primary sores, resulting from the inoculations, he says, *healed up without mercury;* then the sore throat, after having been made to heal by mercury, *broke out afresh*, and required this medicine again. Now, if Mr. Hunter had not been intent on proving the identity of the gonorrhœal and syphilitic poisons, he probably would

not have admitted, that a primary sore *could have healed without mercury*, or that a secondary one, after being healed, *could have broken out again*, without a new stock of infection; for these are the principles which he insists upon in other parts of his work, though, inasmuch as they are not correct, they do not really affect the inference deduced from the present case by Mr. Hunter, except by proving that this great man had no settled rules for deciding whether a complaint was venereal or not.

4th. The frequent production of secondary symptoms, when gonorrhœa leads to ulceration at the orifice of, or within, the urethra. According to the researches of M. Ricord with the speculum vaginæ, and his experiments with inoculation, ulceration or a true chancre in the vagina, or other concealed situation, is a much more common accompaniment of gonorrhœa in women than usually supposed; and he declares that syphilis is only inoculable with the discharge, and secondary symptoms liable to follow gonorrhœa, when such ulceration exists. As this is asserted by him to be the fact, with respect to women, he deems the inference warrantable, that the same combination of a discharge from the male urethra with a true chancre in that passage, is also not uncommon, and will serve to account for the very opposite doctrines frequently entertained respecting the dependence of gonorrhœa and syphilis upon the same poison. The fossa navicularis in men is found by M. Ricord to be the part of the urethra in which a primary venereal ulcer is oftener found, than any other portion of the urethra. Every experienced surgeon must have seen chancres occupying the very mouth of this canal.

If these facts be admitted, the plain inference from them is, not that the poisons of gonorrhœa and syphilis are identical, but that the former is a decidedly different disease, and that, unless a chancre exist in the urethra, no discharge from this passage, no mere gonorrhœa, can be the source of secondary symptoms.

While some surgeons observe no particular differences between these comparatively rare secondary symptoms of gonorrhœa and the more frequent ones of syphilis, other practitioners have attempted minutely to define such differences, more especially Mr. Carmichael, who, as we know, attributes to gonorrhœa papular eruptions, soreness of the fauces, pains in the larger joints, iritis, and inflammatory swellings over the superficial bones.

Sometimes, though the doctrine of gonorrhœa originating from any specific poison is rejected, it is conceived, that the disease may arise from the operation of any mechanical or chemical stimulus, and that, in this way, infectious matter may be generated, which will even propagate, under certain circumstances, syphilitic as well as gonorrhœal complaints. This view seems to combine two things, namely, a denial of the existence of a specific gonorrhœal virus, and the admission that gonorrhœa may, if it lead to ulceration, give rise to syphilis itself. It is sometimes imagined that this hypothesis rather coincides with many of the anomalies in the history of the venereal disease, especially the probability of the infinite multiplicity of its origin in every country where promiscuous sexual intercourse prevails to a great extent; and that it tends to reconcile some of those extraordinary relations, in which soldiers, having intercourse with the same woman in quick succession, severally contract gonorrhœa, chancre, or primary sores of various characters, all from the same source of infection, a subject already discussed in the observations on syphilis. For my own part, I feel less difficulty in adopting the conclusions to

which M. Ricord has been brought by his experiments with inoculation and the speculum.

*The arguments against the identity of the gonorrhœal and venereal poisons are : —*

1st. The rarity of secondary symptoms after gonorrhœa, and the frequency of them after a primary venereal sore.

2d. The differences between the secondary symptoms of each disease, when such symptoms do occur.

3d. If the poison were the same in each case, why should the matter of gonorrhœa not commonly produce chancres on the glans and prepuce, with which parts it is so much and so long in contact?

4th. Why should it be a disease completely beyond the control and influence of mercury?

5th. If the application of the poison to a secreting or mucous surface be specified in explanation of the difference of effect, why does the syphilitic poison frequently produce chancres on the secreting surface of the corona glandis, and, occasionally, notwithstanding all assertion to the contrary, within the urethra itself? and why should women ever have chancre at all, as the poison in them must generally be applied to a mucous surface?

It is not an uncommon belief, that the various degrees of severity, which a gonorrhœa assumes, indicate only the stage and extent of the inflammation, which, wherever the natural susceptibility exists, is excited by the introduction of any irritating secretion.

It may here be remarked, that all this is true: yet, we find that persons have chancres secreting pus close to the orifice of the urethra, without gonorrhœa being brought on by it. This is certainly another fact, and what does it tend to prove? Not, that the two diseases depend upon the same virus, but, merely that the matter of chancre will not commonly irritate the urethra of the individual having such a sore upon the penis. Neither does it generally cause ulceration and chancre on the neighbouring part of the penis. So far as the fact proves any thing on this question, it is, I think, decidedly against the conclusion, that these two diseases depend upon the same kind of virus.

### TREATMENT OF GONORRHŒA.

Notwithstanding our ample experience in the treatment of clap, we are quite ignorant of any specific remedy for it. The disease, however, though characterised by a disposition to go on for three or four weeks (whatever be done), is capable of being rendered much milder by proper treatment, and also of being prevented from continuing for many weeks, and even months, in the form of gleet. The benefit, therefore, which a patient with gonorrhœa may derive from surgery is not unimportant.

Gonorrhœa is manifestly attended with inflammation of the mucous membrane of the urethra, as indicated by the heat, pain, and swelling, and often by the effusion of fibrine in the corpus spongiosum, and other effects. Its first stage should, therefore, be treated on antiphlogistic principles; the penis should be covered with linen wet with cold water or the lead lotion; — or, as preferred by M. Ricord, the penis, scrotum, and perinæum may be fomented with a decoction of poppy-heads, to which, when the pain is severe, laudanum may be added. Or the same parts may be fomented with a decoction of the leaves of belladonna. The patient should abstain from violent exercise, wine, full diet, and high-seasoned dishes, and take purgative medicine every second or third day.

When the discharge is quite incipient, M. Ricord finds the application of from twenty to forty leeches on the perinæum, according to the strength of the patient, and the exhibition of copaiba, or cubebs, the most successful mode of checking the complaint. But, he considers the latter medicines, after a gonorrhœa is completely developed, as inefficient, and calculated to render the digestive organs averse to their exhibition in a later stage, when they may become necessary.* The urine is to be rendered less stimulant, by giving mucilaginous diluent drink, as barley water, linseed tea, or a solution of gum arabic, with a proportion of nitrate of potash and a little syrup of poppies in it. The liquor potassæ may be given in doses of ten drops, repeated eight or ten times in the course of the day; for it has the effect of rendering the urine less irritating. Medicines, calculated to promote the secretions in general, to keep the bowels open and the skin moist, are generally approved of in the early stage; as mixtures containing the liquor ammon. acet. and nitrate of potash, or powders composed of the nitrate of potash, and a small proportion of pulv. ipec. comp. The decoct. hordei comp., with nitrate of potash, and tinct. hyosciami, is a medicine very commonly prescribed.

When, from the violence of the pain about the bladder and perinæum, there is reason to believe, that the inflammation extends further than usual, or when the urine cannot be voided without the utmost difficulty, or is even retained altogether, the treatment must be still more active: leeches should then invariably be applied to the perinæum, venesection practised, the slipper-bath employed, the bowels freely and repeatedly opened, and the patient kept under the moderate influence of opium, or hyosciamus, with the view of lessening the spasm at the neck of the bladder. If complete retention come on, a clyster, made with two or three ounces of the mucilage of starch and from forty to sixty minims of laudanum, should follow bleeding and the warm bath.

After the inflammatory stage is over, and the discharge and some uneasiness about the passage are the chief inconveniences left, the indication is to employ means calculated to bring the secretion of the mucous membrane into its natural state again. For this purpose, we may direct the patient to take certain medicines, which act upon the membrane of the urethra by altering the qualities of the urine, as the balsam of copaiba, or cubebs: twenty drops of the copaiba balsam may be taken three times a day, in a glass of milk or peppermint-water, or it may be made into draughts with the mucilage of gum arabic and a little of the aqua pimento. The cubebs, or Java pepper, is to be given in doses of ʒj. or ʒij. twice or thrice a day; or we may employ injections, which may either be of an astringent or stimulating kind. The former generally consist of a solution of the sulphate of zinc, or of the acetate of lead in water, or rose-water, in the proportion of ten or twelve grains to six ounces of the fluid. The stimulating injections usually contain the bichloride of mercury, or nitrate of silver. Two grains of the bichloride in six ounces of distilled water make a strong injection, and about five grains of the nitrate of silver; though this has been of late sometimes used in the proportion of ten grains to an ounce for the stoppage of the discharge in the chronic stage. When the first periods of a gonorrhœa are attended with pain, I think with M. Ricord, that, though astringent, stimulating, or other injections sometimes stop the discharge, they mostly fail, and do more harm than good. But, should the discharge commence without pain, or other sign of inflammation, the

* Ph. Ricord, Maladies Vénér. p. 707—712.

balsam of copaiba, or the powder of cubebs, might be tried, with the view of putting a sudden stop to the complaint; but all bleeding is unnecessary. With the same object, M. Ricord has a good opinion of the efficacy of drastic purges; and joins many other surgeons in commending the trial of nitrate of silver injections; but, instead of beginning with one composed of ten grains to each ounce of water, as recommended by some modern surgeons, he prefers commencing with only a quarter of a grain to that quantity of water, and augmenting the strength of the injection by degrees.* I believe with M. Ricord, and many others, that, so long as there is a good deal of inflammation, it is best not to employ any kind of injection.

The erections, which occur in the acute stage of gonorrhœa, are the cause of great suffering. The best means for their prevention, or relief, consist in not letting the patient have too many blankets on his bed, or be in too warm a chamber; in applying cold water, or evaporating lotions to the parts; and in prescribing the tinct. hyosciami, vinum colchici, or, what M. Ricord joins in the praise of, camphor combined with opium, and given either in the form of pills, or that of an enema.

For the stoppage of profuse bleeding from the urethra, caused by laceration of the urethra during an erection, the following plans are recommended: — ice-cold water to the penis, inner side of the thighs, perinæum, and hypogastric region; acidulated beverages, not however taken too freely; an elevated position of the pelvis; not heating the patient with too many coverings on his bed; a towel rolled up, and kept firmly pressed on the perinæum with a T bandage; or circular compression of the corpus spongiosum. If these means prove unavailing, M. Ricord introduces a catheter, so as to compress the urethra from within outwards for a day or two, combining with it sometimes very moderate external pressure.† When gonorrhœa is productive of dysury, leeches should be put on the perinæum, blood taken from the arm, the warm bath used, and, as M. Ricord directs, the extract of belladonna rubbed on the perinæum. But, when urgent retention of urine prevails, a catheter is to be introduced, No. 8. or 10., which will pass more readily than a smaller. In France, the instrument is sometimes smeared with an ointment containing a proportion of the extract of belladonna‡; a method which may be more deserving of attention than it has yet been deemed in this country.

### TREATMENT OF GLEET.

We may try injections of bichloride of mercury, or nitrate of silver, or the internal exhibition of balsamum copaibæ, cubebs, the tinct. ferri sesqui-chloridi, or tinct. of cantharides, in doses of ten or fifteen drops thrice a day; and in particularly obstinate cases, the cold bath, sea-bathing, rough horse exercise, a blister under the urethra, bark, sulphate of quinine, and steel medicines.

Many gleets cannot be cured by any of the preceding measures, because the disease may not be simply a wrong action of the secreting vessels of the urethra, but dependent upon other diseases of that canal, or parts connected with it, as is exemplified in stricture and disease of the prostate gland. Hence, when a person applies to me for a gleet, and says that he has had it a long time, I generally make it a rule to pass a bougie, in order to ascertain whether there is any other disease of the passage.

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* Op. cit. p. 711.

† Op. cit. p. 716.

‡ Ricord, Mal. Vénér. p. 718

### CHORDEE

Takes place when the inflammation is not confined merely to the surface of the urethra and its glands, but affects the corpus spongiosum: in this circumstance, an extravasation of fibrine occurs in that texture, which becomes incapable of yielding in the same degree as the corpora cavernosa. Hence, during erections, there is a curvature of the penis — it is bent, as it were, with the concavity mostly at the lower side of that organ. The patient may suffer severely from erections, conjoined with the state of the penis termed chordee; for the irritation of gonorrhœa keeps up a determination of blood to the part, and it is difficult altogether to prevent them.

When much inflammation is present, we may bleed the patient from the arm, and, in all cases, apply leeches, cold lotions, or use cold bread-and-water poultices, with which may be blended the extract of belladonna.

The bowels are to be kept open, and the tincture of hyosciamus, or what is still more efficient, the vinum colchici, the acetate of morphia, or some other preparation of opium, administered, with the view of lessening the disposition to erections.

After the inflammation has subsided, the remaining hardness may be dispersed by frictions with ointment of hydriodate of potassium, or camphorated mercurial ointment.

### SYMPATHETIC BUBO,

One of the occasional consequences of gonorrhœa, arises from mere irritation, and not from the absorption of any virulent matter. It is a simple inflammation of one or more of the inguinal glands, much less frequently advancing to suppuration than a venereal bubo.

*Treatment.* — Antiphlogistic, with cold evaporating lotions, or fomentations and poultices, leeches, aperient medicines, and quietude.

### INFLAMMATION EXTENDING TO THE MUCOUS MEMBRANE OF THE BLADDER

Is another occasional effect of severe claps; it is attended with extreme suffering and annoyance. In this state, the bladder is so irritable, that it cannot contain the smallest quantity of urine, without the patient being put to intolerable pain; and when this affection is joined, as it frequently is, with a difficulty of discharging that fluid, and even with retention, the patient's agony may well be conceived. This state of the bladder demands prompt and vigorous measures: venesection, brisk purgatives, leeches to the hypogastric region and perinæum, the warm slipper-bath, fomentations, and draughts of the camphor mixture, with ten minims of the tinct. of opium and fifteen of that of henbane, every three or four hours; or an injection of the mucilage of starch with forty drops of opium into the rectum. The uva ursi is another medicine frequently prescribed in these cases, in the quantity of ℈j. or ʒss. every six hours.

### PHIMOSIS

Is either a congenital smalness of the opening of the prepuce; or else an accidental narrowness of the same orifice preventing the glans from being uncovered, and arising from any circumstance that produces a swelling of the prepuce, whether inflammation, or an infiltration of the cellular tissue of the part with urine, or a serous fluid. It may arise from

simple excoriations caused by the confinement and acrid quality of the sebaceous matter secreted round the corona glandis; primary venereal sores, particularly those which are formed on the inner surface of the prepuce, or which take place in clusters near its orifice. Phimosis is also sometimes induced by sores on the glans, especially such as are on or near the corona glandis, or on one side of the frænum. Occasionally, the pressure of warts against the prepuce will bring on phimosis. Sometimes the inflammation of the prepuce partakes of the erysipelatous character, and, whether it be of this kind or of the phlegmonous, the part frequently has an œdematous or anasarcous appearance behind the glans. When chancres occur, phimosis sometimes leads to serious evils; for the glans, being then situated between the sores and the orifice of the prepuce, the pus may be prevented from escaping. The result is an accumulation of matter round the corona glandis: ulceration begins within the prepuce; makes its way through it; and the glans protruding through the new opening, the whole prepuce seems thrown in the opposite direction. In certain instances, the swelling and thickening of the prepuce cause such compression of ulcers on the glans, that unless a timely division of the prepuce be made, the whole of the glans is destroyed by sloughing.

Sometimes, phimosis produces obstruction of the passage of the urine through the orifice of the prepuce, and this fluid may then insinuate itself into the cellular tissue of the part; while in other examples, the retention may lead to ulceration of the urethra, and extravasation of urine around it.

Phimosis is not then itself essentially a venereal complaint: for it may arise from any kind of irritation producing inflammation of the prepuce, whether a gonorrhœa, a chancre, simple excoriations, the pressure and irritation of warts, or an accidental injury of the part. When it arises from a true venereal sore, it is itself only an example of the common inflammation usually produced in the vicinity of the specific disease.

The phimosis, from simple excoriation, and from the irritation of acrid secretions lodged under the prepuce, requires that tepid water, or the diluted liquor plumbi acetatis, should be frequently injected between the prepuce and the glans, so as to keep the parts clean. The penis may also be covered with linen wet with the lotion, the patient be kept in bed, or, at all events, from walking about, and purgative medicines and a low diet prescribed. When the inflammation is more severe, leeches or scarifications will be useful, and the bleeding should be promoted by bathing the penis in warm water.

The phimosis, originating from severe gonorrhœas, chancres, or other sores, may require, in addition to local and even general bleeding, warm emollient poultices, or the steam of hot water. The sores are to be kept clean by freely throwing between the glans and the prepuce a weak solution of the sulphate of zinc, the black wash, or a lotion composed of two grains of the bichloride of mercury, ℈j. of the extract of opium, and six ounces of distilled water; or, when the inflammation is considerable, we may simply inject under the prepuce a tepid solution of gum arabic, with which the extract of opium is blended, in the proportion of ten grains to six ounces.

When a chancre is complicated with violent inflammation of the prepuce and phimosis, I believe, that the best practice is to suspend the use of mercury, and direct our endeavours to the reduction of the swelling and inflammation of the part. When these effects subside, mercury may be more advantageously continued.

The following are the circumstances, which, in cases of phimosis, sometimes render the division of the prepuce necessary: —

1st. An accummulation of matter under the prepuce, secreted by sores in that situation, and not admitting of being readily washed out by means of a syringe. Here, if we neglect to divide the prepuce, an ulcerative process takes place upon its inner surface, and forms an opening through which the glans will protrude with a very great degree of deformity. But this is not the only evil; for the chancres, under these circumstances, always continue to enlarge, and sometimes the glans and prepuce both become involved in gangrenous mischief.

If the glans had already protruded through an ulcerated opening in the side of the prepuce, the best plan would be to put a director from the natural opening through the new one, and divide the intervening portion of skin. In order to stop the progress of ulceration from within, and to prevent the protrusion of the glans, Mr. Hunter did not divide the prepuce completely, but merely punctured it, so as to let out the matter, as he would have done in any other common abscess.

In cases of permanent phimosis, combined with chancre, M. Ricord concurs with such practitioners as recommend the operation to be deferred, unless there is an urgency for it, until the chancres are healed, and thus all risk of the wound becoming inoculated will be avoided. If circumcision, which he prefers, be performed, while a chancre is present, he advises the sore to be taken away if possible, together with the portion of the prepuce; a method, which I have sometimes followed. But, if the chancre be left, M. Ricord immediately rubs it with caustic.

2d. Sometimes we meet with cases in which the compression of the swollen prepuce acts injuriously upon sores of the glans; and when there is reason to suppose that this cause is likely seriously to retard their cure, and even bring on sloughing, we are justified in dividing the prepuce.

3d. Phimosis, arising from the puckered and contracted state of the orifice of the prepuce after chancres are healed.

4th. Phimosis from the pressure and irritation of large warty excrescences.

5th. Examples of congenital phimosis producing impediments to the discharge of urine in infants, or even leading to the formation of calculous substances under the foreskin; and, in adults, creating an obstacle to sexual intercourse, and, in old persons, causing a predisposition to cancer of the organ.

There are several methods of operating. One consists in passing a director under the middle of the upper part of the prepuce as far as the corona glandis, and then, with a pointed curved bistoury, slitting the prepuce up to the point to which the director extends. We push the bistoury with its back in the groove of the director gently along this instrument, until the point reaches nearly to the corona glandis, when by raising the point and bringing the edge towards us, the division is made in an instant.

2d. Instead of this mode of dividing the prepuce, Cloquet and Wallace prefer making an incision, parallel to the frænum, at the under part of the prepuce; because the line of the incision, thus formed, is found to be, as soon as the prepuce is drawn backwards, transverse in place of oblique, or parallel to the axis of the penis, and those angular flaps of skin are avoided, which cause great deformity when the operation is performed at

the upper part of the prepuce. This plan I sometimes adopt. M. Ricord objects to it, as leaving a deformity very similar to that of hypospadias.

3d. A third method consists in the performance of circumcision: the prepuce is drawn forward, and taken hold of with a pair of forceps; as much of the extremity of it being left out of their grasp as needs removal: with one stroke of a common scalpel, guided along the forceps, as a pencil is along a ruler, a complete circle of the prepuce is cut away. In applying the forceps, as the upper part of the prepuce is quite unconnected to the glans, and longer than the lower portion, which is also united to the frænum, of course, a more considerable piece of the prepuce above should be left in front of the blades of the instrument than below.

After circumcision has been performed, the inner membrane of the prepuce and the outer skin are seen with their edges more or less separated from one another. If the inner membrane should still seem tight, it is to be slit up, or cut with scissors. Then, in order to keep the edges of the outer and inner skin of the prepuce together, a small suture may be passed through them. If the artery of the frænum bleed copiously, it must be tied, or twisted. For the prevention of inflammation and erection, cold water is to be applied, and camphor and opium, or the acetic extract, or the tincture, of colchicum prescribed.

### PARAPHIMOSIS

Is the case, in which the prepuce is drawn behind the glans penis, and cannot be brought forward again. If the opening in the prepuce be narrow, as is often the case when the part is in an inflamed state, it will, when drawn behind the glans, produce such a constriction of the penis, as is not only followed by considerable swelling of the glans, but by the greatest difficulty, or even impossibility, of getting the glans back again through the narrow part of the prepuce. The glans is uncovered and of a livid colour, its corona being overlapped by a tumid ring, formed by the œdematous lining of the prepuce. Behind this tumid circle is the seat of stricture or compression, produced by the contracted orifice of the prepuce. The extent of the swelling backwards is various in different instances. Neglected cases sometimes terminate in sloughing either of the glans, or the prepuce, or both parts together.

From what has been said, we may readily understand why a phimosis should frequently change into a paraphimosis, when the prepuce is imprudently drawn too far back.

In the treatment, if the case be recent, the inflammation considerable, and the patient a strong subject, venesection should be practised. The indication is to reduce the glans to as small a size as we can, by the application of cold lotions, or snow, or ice-water, and then compressing it equally, and unremittingly, for a few minutes, between the ends of the fingers and thumbs of both hands; and when we have pressed as much blood out of it as is practicable, and reduced it to the smallest size, we are then to press it back with the thumbs through the constriction of the prepuce, while the fingers are used at the same time for bringing the prepuce forwards over the glans.

When the attempt does not succeed, we may have recourse to leeches, purgatives, punctures in the anasarcous part of the swelling, and cold applications; but if we cannot succeed, notwithstanding these means and the manual proceedings which I have described, and the constriction be such as to threaten to produce sloughing, the portion of the prepuce forming the constriction must be divided with a sharp-pointed narrow

bistoury. The operator will always find the stricture behind the corona glandis, and separated from it by a tumid ring, consisting of the œdematous lining of the prepuce. It is therefore in a kind of depression, or groove. Into this, the point of the knife is to be passed, deeply enough to go under the stricture, which may then be divided by cutting upwards. No preliminary incision is necessary.

Even when the stricture has been cut, the adhesive inflammation may prevent us from immediately bringing the prepuce forwards; but as the constriction has been removed, no sooner does the inflammation abate, than the parts resume their natural state.

## DISEASES OF THE ANUS AND RECTUM.

### ABSCESSES. — FISTULA IN ANO.

This last term is applied to almost every abscess which breaks in the vicinity of the anus; but very improperly; for, the idea of there being a fistula naturally leads to the adoption of measures totally different from those usually required for the cure of abscesses in general. Sometimes, the complaint makes its attack in the form of phlegmonous inflammation, attended with a frequent, full pulse, and heat and dryness of the skin. The formation of matter is often preceded by a fit of shivering. A part of the buttock near the anus is considerably swelled, and presents a large circumscribed hardness, the middle of which soon becomes very red, and matter forms in its centre. On other occasions, suppuration is preceded by erysipelatous inflammation, without any of the circumscribed hardness which characterises the foregoing tumour. The redness spreads more extensively; the disease is more superficial; the quantity of matter small; and the cellular tissue sloughy to a considerable extent. Sometimes the complaint begins somewhat like a carbuncle. The skin is of a dusky red, or purple colour, and, although harder than in the natural state, not nearly so tense as in phlegmonous or erysipelatous inflammation. At first, the pulse is full and hard; but, if no relief be obtained, it soon becomes unequal, low, and faltering; and the strength and spirits are greatly dejected. The matter, formed under the skin, is small in quantity, and bad in quality, and the cellular tissue is deeply gangrenous. This species of the disease affects persons, whose habit is either naturally bad, or has been rendered so by intemperance.

These different affections often influence parts in the neighbourhood of the disease. Hence retention of urine, strangury, prolapsus ani, tenesmus, piles, diarrhœa, or obstinate costiveness.

Sometimes the abscess begins as an induration of the skin near the anus; but without pain, and alteration of colour; the hardness gradually softening and suppurating.

The matter may either point in the nates, at a distance from the anus; or near the latter part; or in the perinæum. The matter may escape from one opening, or from several. Sometimes there is not only an external aperture, but another internal one, communicating with the cavity of the intestine. In other instances, there is only one external or internal opening.

The matter may be formed at a considerable distance from the rectum, which is not even laid bare by it; in other cases it is laid bare, but not perforated; sometimes it is both denuded and pierced.

Many abscesses about the anus are connected with a bad state of the health. When quite local diseases, they generally arise from obstinate costiveness, and the irritation of the mucous membrane and cellular tissue of the rectum by the passage of indurated fæces. Individuals, who have long suffered from piles, are particularly liable to abscesses near the extremity of the rectum. Severe diarrhœa, accompanied with tenesmus and great determination of blood to the rectum, has also been known to bring on the complaint. Sir Astley Cooper is of opinion, that the most common cause is disease of the liver, which, preventing the free return of blood from the intestines, and influencing their secretions, leads to inflammation near the rectum.* In a few instances, abscesses at the side of the rectum appear to have arisen from the penetration of the mucous membrane, and sphincter muscles, by fishbones, or other irritating extraneous substances in the bowel, one or two interesting examples of which are recorded by Sir Benjamin Brodie.

When the inflammation is phlegmonous, Pott advocates the doctrine, that the thinner the skin is suffered to become, before the abscess is opened, the better; but the generality of modern surgeons make it a rule to open every abscess near the rectum as soon as a fluctuation can be felt. This affords the best chance of preventing a fistula and sinuses extending far up. If the patient be of a full, sanguine habit, venesection, leeches, and mild purgatives, are proper in the early stage. The confectio sennæ with sulphur is one of the most eligible aperient medicines. An emollient poultice is the best application; and if the pain be severe, leeches and fomentations should be employed.

When the attack is of an erysipelatous kind, and there is a sloughy state of the cellular tissue, the sooner the part is opened the better. If we wait for the matter to point, we shall wait for what will not happen, at least not till after a considerable length of time, during which the disease will extend itself, and the cavity of the abscess be greatly increased.

When the fistula in ano commences with that kind of inflammation which a carbuncle exhibits, calomel, with opium, and mild aperient medicines, may be prescribed in the early stage; but the patient will not bear much depletion; and very soon tonics, with ammonia, or wine, will be required. The part should be opened early by a very free incision.

All suppurations in the vicinity of the anus do not necessarily interest the rectum; sometimes the matter is so distant from the intestine, that the surgeon has no more to do with this part than if it did not exist, and the abscess is to be treated upon general principles. Under simple treatment, the necessity of meddling with the rectum will often be removed. But it more frequently happens, that the intestine, although not pierced by the matter, has yet been so denuded, that the fistula will not heal, without laying the cavity of the abscess and that of the intestine into one. The difficulty of healing many abscesses near the rectum depends upon their being influenced by the action of the sphincter and levator ani muscles, which have a constant tendency to prevent the union of the granulations and coalescence of the sinus.

The operation consists in dividing the rectum, from the top of the hollow, in which the matter is lodged, down to the anus. Thus the fistula is converted into an open wound. The course and extent of the fistula is to be first ascertained. The patient may kneel on his bed, and at the same time lean forwards on his elbows, while the knees are kept

* Lectures, vol. ii. pp. 327, 328.

close together; or he may get up, lean forwards on the back of a chair, and place his knees together. The forefinger of the most convenient hand, according to the side on which the fistula is situated, having been oiled and passed into the rectum, the surgeon introduces a narrow curved probe-pointed bistoury into the fistula, with its edge turned towards the rectum, until it has traversed the fistula, and the probe-point is felt pressing against the extremity of the finger within the bowel. Then, by making a little pressure with the knife, held in a particular manner, the rectum will be pierced, and the probe-point having come in contact with the end of the finger, the latter is steadily withdrawn; and as the knife rests upon and is made to follow it, the edge divides all the parts intervening between it and the anus, including the external sphincter. When a silver director is bent, it will sometimes pass through the whole track of the fistula into the rectum: then the division of all the parts, interposed between it and the anus, should be performed under the guidance of this instrument. Or the director may be employed when the course of the fistula is tortuous. Then the director, if used, is to be withdrawn, and the operation is to be completed, by bringing the knife out, with its point applied to the finger, within the intestine. In this manner, all that is between the edge of the knife and the anus must obviously be divided. The sphincter muscle being included in the cut, not only is there a free and ready escape of the matter, but the action of the muscle, which creates such a disturbance of the part, and prevents its healing, is for a time suspended.

Immediately after the operation, a soft dossil of fine lint should be introduced, from the rectum, between the lips of the incision. This first dressing should remain till loosened by suppuration. Afterwards, lint dipped in sweet oil or tepid water, is one of the best applications. A T bandage is usually employed.

We have now to consider fistulæ in ano, in the state, in which they are after having spontaneously burst.

When the matter has made its escape only through an external opening, the case is termed a *blind external fistula*. Sir Astley Cooper has several times known a fistula form on each side of the anus, and communicate round the rectum. He examined the body of a man, who died of a discharge from a fistulous opening in the groin, and who had a fistula in ano: the fistula passed under Poupart's ligament, took the course of the vas deferens, and descended into the fistula in ano. Sometimes the fistula only just reaches the sphincter, and is extremely small, appearing at first merely as a suppuration of one of the follicles of the anus. Sometimes it reaches four inches up the side of the rectum.* When there is an opening in the intestine, and none in the skin, the fistula is called a *blind internal fistula*. Fistulæ, having an opening both in the skin and gut, are termed *complete*. The first and last cases are the most common. A probe is to be introduced to ascertain their nature, and the operation, already described, is the proper one for obtaining a cure. When there are several openings, and corresponding sinuses, they are all to be divided with a curved bistoury, so as to make one cavity of the whole.

In cases of *blind internal fistulæ*, if the bursting and discharge of the matter should not produce a cure, which they sometimes do, though very seldom, an external opening is to be made, and then the same operation, as has been already described for other cases, is to be put in exe-

* Sir Astley Cooper's Lectures, vol. ii. pp. 326, 327.

cution. The place for the opening is always sufficiently denoted by the induration.

Sometimes the health will require to be improved before a cure can be accomplished, and many patients, who cannot recover in hospitals, do so on removing into a better air. The medical treatment of fistula in ano, connected with disease, consists in restoring the secretions of the liver, and intestinal tube, by giving the chloride of mercury, or the pil. hydrargyri at night, and the compound infusion of gentian, with soda and rhubarb, twice in the day,*

If any organic or visceral disease exist; such as disease of the liver or lungs, or carcinoma or stricture of the rectum, the operation ought not to be performed; for, under these circumstances, the fistula, though laid open, will not heal, or, if it should, the viscereal disease will advance with a quicker pace.†

Besides the foregoing kinds of abscess near the anus, piles sometimes suppurate, and matter forms in their centre, as will be presently explained. Occasionally, also, abscesses form in the front of the vertebræ, descend into the pelvis behind the peritonæum, and bursting somewhere near the terminaton of the rectum, become fistulous. The operation in such a case would be entirely useless.

### PILES, OR HEMORRHOIDS.

In their texture, piles are subject to a great deal of variety. Sometimes they are merely dilated veins, or *varices*, situated near the anus, or lower portion of the rectum, forming prominences covered by its mucous membrane, or the delicate skin near the anus, and from which a bleeding takes place, whenever there is a great determination of blood to the parts.

In other still more frequent cases, the texture of hemorrhoidal tumours is more complicated; many of them being characterised by an areolar, soft, spongy structure, filled with blood. At periods, when these are in a quiet state, free from irritation, and without any particular determination of blood to them, they are small and shrivelled; but in the contrary circumstances, they swell, become firmer, undergo, as it were, a kind of erection, and blood is voided from their surface. Hence, their texture is compared by French pathologists to the erectile tissues. Numerous arterial branches are distributed to them. Chaussier found, that if an incision be made in them, and a coloured fluid thrown into the hemorrhoidal arteries, it will issue from numberless small apertures within the swellings.

Other hemorrhoidal tumours consist of one or more cysts, or cells, smooth internally, more or less vascular, retaining the blood for variable periods, but every now and then bursting, and occasioning hemorrhage.

Lastly, some hemorrhoids, originally having cavities, or cells, are gradually converted into solid swellings by the effects of repeated attacks of inflammation, and the effusion and organization of fibrine.

Hemorrhoids are divided into *internal* and *external*, according to their situation, either above the sphincter muscle, and in the inferior part of the rectum, or below the sphincter, near the verge of the anus, under the delicate thin integuments by which this part is covered. But, as an *internal* pile may protrude below the external sphincter, the best criterion

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* Vol. cit. p. 328.

† Sir B. C. Brodie, Lond. Med. Gaz. Oct. 1835. p. 29.

is its texture; for it is always covered by the mucous membrane of the bowel; while an external pile is invested by the delicate skin near the anus. Those internal ones, which resemble *varices*, lie under the mucous membrane, which is often adherent to their surface, and so thin, that their bluish colour can be plainly distinguished through it. Varicous piles make their appearance, chiefly when the parts are in a state of congestion, in the form of dark blue, elastic knobby swellings, not attended with much pain, yielding to pressure, but returning immediately it is discontinued. These venous dilatations under the skin, or under the mucous membrane of the rectum, are generally only a small part of those which exist around the bowel. M. Bégin has sometimes found the lower portion of the rectum involved in a plexus of enlarged veins, composing a thick vascular zone around it, and so gorged with blood, that if it had been cut in the living subject, a very dangerous hemorrhage must have been the consequence.

Internal hemorrhoids of the spongy and cellular kinds are always situated between the fleshy fibres and the mucous coat of the bowel, under which they project. They are of different sizes, from that of a pea to that of a nut, walnut, or even a small egg. Their number is equally various; sometimes only one or two; but occasionally so many, that the affected part of the bowel is filled and distended with them. Sometimes only a small portion of them projects into the bowel, the greater part of their mass being lodged in its cellular tissue; but, in other instances, the whole or greater portion of the swelling directs itself towards the interior of the bowel, and being gradually detached by the repeated passage of the feces from its original connection, at length hangs by a kind of pedicle into the cavity of the rectum.

External hemorrhoids of this kind also sometimes form slight prominences under the thin delicate skin near the anus; but in other examples, considerable and permanent tumours, which were often termed *mariscæ* by the old surgeons, from their shape and appearance.

Various circumstances may tend to bring on a determination of blood to the rectum, followed by hemorrhage from the mucous membrane, and, in many instances, by the tumours called piles. Plethoric individuals, and others in whom the circulation in the branches of the vena portæ is obstructed, are particularly liable to them. They are seldom met with in very young persons, being scarcely ever produced till the body is completely developed in breadth as well as height. An age between thirty and forty is the most common period for them to begin; and if in a full habit, they mostly continue during life. In the male subject, the occasional bleeding from piles is frequently regarded, and not without reason, as a salutary evacuation.

In the other sex, menstruation seems to render this other spontaneous kind of depletion unnecessary; but, on the natural discontinuance of the menses, piles are disposed to form, and, in full plethoric women, the bleeding from them may then become a substitute for the uterine evacuation. Also during pregnancy and after delivery, many women are troubled with piles. In these cases the enlargement of the hemorrhoidal vessels depends upon the suspension of the menstrual discharge, the compression of the veins by the gravid uterus, and the efforts and local irritation accompanying parturition.

Whatever tends to bring on plethora creates a disposition to hemorrhoids; as taking more food than nature can properly dispose of, eating high-seasoned dishes, and drinking too much wine and other fermented

liquors. Such excesses, combined with an indolent or sedentary life, will be still more likely to induce the disease. A similar effect may also proceed from any other circumstances occasioning a great determination of blood to the rectum; as the abuse of aloetic purgatives, and stimulating glysters; habitual constipation; the irritation of the bowel by the passage of indurated feces; and excesses in venery, whereby a larger quantity of blood is made to pass into the vessels of the lower part of the rectum, as well as into those of the genital organs.

By the expression *hemorrhoids*, some of the old writers signified bleedings from the rectum, whether attended with piles or not. In fact, a congestion of the hemorrhoidal vessels is sometimes terminated by a copious discharge of blood from the mucous membrane; but repeated congestions will not always end in this way, but often in inflammation, and the change in the size of the veins, or the formation of the tumours already described.

Few diseases are more painful than piles in the state of inflammation. About the fundament, there is an excessively painful feeling of tension, burning heat, and weight, extending from the anus, through the pelvis, and to the neck of the bladder in the male, and to the womb in the female. The pulse is hard, quick, and contracted. The patient is continually wanting to go to stool, and the efforts made for this purpose generally have no other effect than that of subjecting him to severe torture. Sometimes the evacuation of the urine is attended with difficulty. The anus and surrounding parts are red, gorged with blood, and the seat of prominent, tense, elastic swellings, which are of a purple or deep brown colour, and extremely painful on being touched. The sufferings are still greater, when the inflamed mucous coat of the rectum is propelled down, so as to form a circular projection, which is strangulated by the sphincter muscle. A corresponding increase of suffering results from a similar constriction of inflamed hemorrhoids by the fibres of the same organ, the action of which not only prevents the reduction of the protruded swellings into the bowel, but interferes with the return of the blood from them, and thus their tension and size become still further increased. Under these circumstances, it may be impossible for the patient to empty the bowel, and he may be attacked with the same symptoms as are noticed in cases of strangulated hernia.

When the irritation of the rectum, resulting from piles, is less intense, but protracted, a frequent consequence is a morbid secretion of mucus from its interior. In other instances, the effects are a thickening of its coats, a contracted state of the anus, and great induration of the adjoining cellular tissue. Piles, which have been repeatedly inflamed, sometimes occasion a permanent spasmodic action of the sphincter, or numerous deep fissures at the margin of the anus, rendering the evacuation of the feces exceedingly painful. Lastly, abscesses and fistulæ may become complications of hemorrhoidal swellings. Inflamed piles occasionally suppurate in their centre; and the matter, which forms within them, may long continue to be imperfectly discharged from them through a fistulous opening on their surface.

When persons experience little inconvenience from the tumours, or the hemorrhoidal flux, as it is termed, takes place from time to time in a plethoric subject, there is in the first case no real occasion for the removal of such piles; and in the second, the stoppage of the periodical bleeding may create a risk of bringing on some other more serious disease like apoplexy, which the discharges of blood from the rectum tend to keep off.

It is on this account, that piles are sometimes regarded as safety-valves for the constitution. The prevention of constipation by the mildest laxatives is here the chief indication. The lenitive electuary, with sulphur, or small doses of castor oil, are commonly preferred. Even when the evacuation of blood from the anus is rather profuse, it is not always proper to check it. So long as the pulse is strong, the colour of the face natural, the muscular system vigorous, and the patient feels relief from the depletion, it is best not to interrupt it. But, if the countenance be pale, the debility considerable, and the pulse much reduced, the patient should be kept in the recumbent posture, cold acidulous injections be thrown up the rectum, cold lotions applied to the anus, and all his beverages be of a low temperature, and acidulated with citric or sulphuric acid. If there were pain about the rectum, and the pulse not too much reduced, venesection might also be proper, as calculated at once to relieve the irritation of the part, and to stop the determination of blood to it.

When the hemorrhage recurs very frequently from an internal pile, or the tumour often descends, and inflames from constriction by the external sphincter, the tumour should be extirpated. By the patient sitting over a pan of warm water, and making efforts as if at stool, the tumour may almost always be made to present itself at the anus, and then can be easily taken hold of with a tenaculum forceps, and tied. On account of the profuse hemorrhage, liable to follow the excision of internal piles, the removal of them by ligature is now almost constantly preferred by the London surgeons. If the pile cannot be made to descend in this way, a pint or two of warm water may be thrown up the rectum, and on its discharge taking place, the tumour will often present itself.

When an internal pile is above a certain size, it should be transfixed with a needle and strong double ligature, one half of which is to be firmly tied over each side of the neck of the tumour. The surgeon, after having secured each pile in this way, may cut off its convex portion, and snip off both ends of each ligature close to the knot, returning the remains of the pile and rest of the ligatures into the rectum. On the day before the operation, the bowels should be emptied by means of a dose of rhubarb, so that there may be no necessity for another evacuation for two or three days. After the ligatures have been detached, which usually happens in a week, and a little time has been afforded for the healing of the sores left after their separation, the patient should take some lenitive electuary and sulphur every night, and use a *lavement* of cold water every morning. Thus he will prevent a recurrence of the disease.* External piles may be safely removed with a cutting instrument.

### INFLAMMATION AND STRANGULATION OF PILES.

Another inconvenience from piles, and, in some cases, not less serious than that resulting from their magnitude, or the bleeding from them, is their inflammation, which, in its very beginning, is usually conjoined with a protrusion, either of the hemorrhoidal swellings, or of a circular prominence of the mucous membrane of the rectum, in a state of great turgescence. Nothing can exceed the sensibility which these parts acquire from distension, and the pressure made on their base by the sphincter muscle. Violent nervous symptoms, extreme restlessness, severe febrile

* Sir B. Brodie, Lond. Med. Gaz. 1834–35, p. 844.

disturbance, and even subsultus tendinum, may arise from the inflamed and strangulated state of hemorrhoidal swellings.

Here the first indication is to push up the tumours completely beyond the grasp of the sphincter muscle. The patient is directed to rest on his knees and elbows, and the swellings, having been smeared with a little spemaceti ointment, are to be gradually pushed up by one of the surgeon's fingers, with the intervention of a fine napkin. Then, in order to prevent the protrusion from taking place again, a thick compress is to be applied to the anus, supported by the T bandage. At the same time, the patient is to be kept strictly quiet in bed, lying on his back, and restricted to a very low diet. Cold water is now and then to be thrown up the rectum, and, in the greater number of cases, local and general bleeding is indicated. When inflamed and strangulated piles cannot be returned into the rectum, antiphlogistic treatment is to be employed, especially venesection, leeches, and either cold or warm emollient applications. Frequently I have at once relieved the patient by cutting off inflamed piles, which did not admit of immediate reduction. In other examples, where the anus is surrounded by a circular prominence of protruded, turgid, inflamed mucous membrane, attended with excessive pain, a few deep incisions made in it will frequently give prompt relief, and bring about such a diminution of the part, that it may be returned.

What happens when the foregoing methods fail to accomplish the reduction of constricted hemorrhoids? If the inflammation has not risen above a certain pitch, the irritation generally begins to abate in the course of four or five days, or a week, accompanied by a discharge of blood, mucus, or pus from the surface of the tumours, which, becoming diminished, gradually return into the rectum. These desirable changes are to be promoted with emollient applications, leeches, and other means already specified.

In a worse description of cases, hemorrhoids, whether in the shape of tumours, or a prominent thick ring of the mucous coat, are so forcibly strangulated that they mortify. I have seen several instances, in which this has terminated in a cure. Gangrene of strangulated piles, however, may extend beyond the tumours, thus involving the lower part of the rectum in the mischief, and bringing on likewise phlegmonous erysipelas and gangrene of the cellular tissue, not only around that bowel, but in the parts external to the anus.

External piles, inflamed, but not strangulated, may often be rendered less painful by anointing them with a cerate containing powder of galls and a little of the extract of opium, or belladonna; then applying a cold lotion to them, and, if requisite, leeches; care being taken to keep the patient in the recumbent posture, and on a strict antiphlogistic regimen.

### MUCOUS AND PURULENT DISCHARGES FROM THE RECTUM,

Arising from piles, require different modes of treatment according to circumstances. Thus, when piles suppurate in their centre, and become fistulous, the extirpation of the hemorrhoidal tumours accomplishes likewise the cure of the abscess. When, however, piles are attended with a chronic mucous discharge, this may be checked, or even completely cured, by cold astringent injections, the balsam of copaiba mixture, the sesquioxide of iron, a blister kept open over the sacrum, the cold bath, sea bathing, and exercise in the pure open air.

## PROLAPSUS ANI,

Though generally described as a descent either of the mucous membrane alone, or of the mucous and muscular coats together, seems to Sir Benjamin Brodie to be always of the latter description, the other case being merely internal piles, which we know are only covered by the mucous membrane. He admits, however, that protrusions of elongated portions of mucous membrane take place, but they are arranged by him under the head of excrescences and polypi. On the other hand, Mr. Salmon* represents prolapsus of the rectum to be *always* a descent of the mucous membrane, which is detached from the external coat; so that he differs from Sir B. Brodie in even a greater degree than the generality of other writers, who describe two forms of prolapsus, one with descent of the mucous coat alone, the other with prolapsus of both.

Prolapsus ani is more common in infancy and old age, than any other period of life. It is particularly frequent in children with large tumid bellies, and confined bowels, where the whole mass of intestines becomes too large for the abdominal cavity. In children also the prostate gland, urethra, and vesiculæ seminales are not so much developed, and the attachment of the rectum to the surrounding parts does not extend so high up as in the adult. In grown-up persons, prolapsus ani sometimes occurs as a consequence of piles. In this case, the piles are seen at the upper part of the prolapsus, close to the anus, forming a zone round the gut; and the colour and appearance of the mucous membrane, covering the protruded piles, is altogether different from that of the membrane investing the rest of the bowel.†

*Treatment.*—Except when prolapsus ani takes place in a child from the irritation of calculus in the bladder, when of course the cure will depend on the removal of the stone, relief may generally be derived from Sir Benjamin Brodie's plan: it consists in prescribing occasionally calomel and rhubarb, directing that the child may not eat much vegetable food, and injecting into the rectum every morning two or three ounces of a lotion composed of tinct. ferri chloridi ʒj., aq. puræ ℔j. When, in an adult, prolapsus ani is a consequence of piles, the first indication is to extirpate the latter.

The prolapsus consists, as I have stated, in a descent of the mucous and muscular tunics of the rectum, the upper portion of which passes down in the manner of an intus-susception, within the lower as far as the anus, or even further, so as to protrude to the extent of from one to several inches. In general, the prolapsus occurs whenever the patient goes to stool; but, in some individuals, whenever they continue long in the standing position.

This state of the rectum is often combined with hemorrhoidal complaints, and a feeble, relaxed constitution. In certain chronic cases, where the prolapsus has existed a long while, the mucous coat becomes thickened and almost insensible; but, in most instances, the part is liable to attacks of inflammation, followed by ulceration. The disease is frequently attended with discharge of blood, mucus, or even pus. In the treatment of other examples, presenting themselves in the adult, the reduction of the bowel is the first thing to which the surgeon naturally directs his attention. In some cases, this is easily accomplished; but in others

* F. Salmon, on Prolapsus of the Rectum, p. 6, &c.
† Sir B. Brodie, Lond. Med. Gaz. 1834–35, p. 845.

difficulty is experienced, in consequence of the swelling of the parts, and the sphincter strangulating the bowel. In fact, the protruded portion of bowel may be twice or thrice its natural size, of a deep purple red colour, marked with ecchymosis, and sometimes in great danger of mortifying.

Under these circumstances, the immediate reduction of the bowel is urgently indicated. The patient may lie on his face, as Dupuytren directs, with a pillow placed under the pelvis; or he may support himself on his knees and elbows in bed, with the nates towards the surgeon. The protruded part having been covered with wet linen, and a compress laid over its extremity, pressure is to be gently made on its base, so as to diminish its bulk, while the same part is gradually pushed within the sphincter muscle. Thus the reduction commences with the return of the portion of bowel last protruded. If this plan should not succeed, the effect of scarifications and leeches on the part is sometimes tried, though such practice is condemned by Dupuytren. Followed up by cold applications, however, it answers in a few examples.

Even when the reduction is accomplished, the condition of the parts producing the tendency to prolapsus yet remains, and, consequently, the relief is only temporary.

Cold astringent lotions and the cold bath are frequently employed, for the purpose of giving strength and tone to the sphincter, which may then make greater resistance to the descent of the bowel. This practice occasionally proves effectual, but not till it has been persevered in for a great length of time. Where the disease has begun in early life, and continued to the adult age, the horizontal posture, the use of a bed-pan, an astringent injection daily, and a course of Ward's paste, are the means recommended by Sir Benjamin Brodie, though he acknowledges that they will not always succeed. Astringent lotions, and compression, made with a piece of sponge, covered with fine linen, and supported with a T bandage, sometimes answer in children, but mostly fail in adults and old persons.

Under such circumstances, the excision of the whole circle of the protrusion, or of a part of it, or of any hemorrhoids on the mucous membrane, is advised. The risk of dangerous, and even fatal, hemorrhage is the objection urged against these proceedings by Dupuytren. If, says he, the cautery be used to stop the hemorrhage, the agony, and chance of a perilous degree of inflammation being extended to the upper part of the rectum and neck of the bladder, will yet form a prohibition to the practice. The extirpation of the protruded part, either with the knife or the ligature, must always be out of the question, so long as the bowel admits of being reduced.

Instead of these measures, I should prefer the less severe expedient, originally suggested and practised by Hey, and adopted by Dupuytren; it consists in raising up two, three, or more of the radiating folds of skin close to the anus with a pair of forceps, furnished with broadish extremities, and removing them with curved scissors. Afterwards, on cicatrisation taking place, the anus becomes lessened in diameter, and the relaxed state of the skin removed. The excision should extend up close to the anus, and even half an inch within it, if the relaxation be considerable. The number of folds to be taken away is also to be greater in proportion to the degree of looseness of the skin near the anus. Notwithstanding the remark made by M. Velpeau *, that the description of

* Nouveaux Elém. de Méd. Opératoire, t. iii. p. 1002.

Hey's practice, in the Dictionary of Practical Surgery, is so imperfect, that this improvement in surgery would have fallen into oblivion, even in England, if it had not been for Dupuytren; the fact is, that there are few British surgeons, of any experience, who have not been in the habit of performing Hey's operation for the last thirty years. I have practised it in several instances with complete success. Besides, if the Dictionary were not in existence, English surgeons possess Hey's Practical Observations in Surgery, containing his own explanations. At the same time, I fully admit the merit of Dupuytren's more particular account of the subject. Mr. Salmon's plan of removing a triangular portion of the sphincter seems to be a modification of Hey's or Dupuytren's method. Many years ago, I performed this operation on a Jew, carrying on the trade of a furrier in Holborn; and last year (1838), I adopted it in University College Hospital, for a little boy, about four years old, who had suffered from a prolapsus ani almost from birth, and for which the plan advised by Sir Benjamin Brodie, after a long and strict trial, was found unavailing. The removal of two slips of integument was followed by a complete cure.

### PRETERNATURAL CONTRACTION OF THE SPHINCTER ANI.

When the sphincter has been long in a state of spasmodic contraction, it undergoes considerable enlargement, and acts with a proportionable increase of power. The disease is chiefly met with in women, especially those who are disposed to hysteria; but sometimes also in men. In emptying the rectum, the patient is obliged to strain very much, particularly when the feces are hard, or even solid. Mr. Salmon even conceives, that this condition sometimes leads to prolapsus of the rectum; though a close state of the sphincter appears, I think, more likely to be an obstacle to any descent of that bowel. There is pain not only while the feces are passing, but for a long time afterwards. Frequently the disease is complicated with a small, but exceedingly sensitive, ulcer of the mucous membrane, or with irregular cracks or fissures, which M. Velpeau suspects may often be the cause of the spasmodic affection of the sphincter.

*Treatment.* — Relief may be derived from aperients, which will keep the feces from being of a hard or solid consistence. A suppository of extract of belladonna has been tried by Sir Benjamin Brodie; but as it is apt to produce deleterious effects on the brain, he does not at present frequently resort to it. Another plan adverted to by him, and also by Mr. Salmon, is that of always dilating the anus with a bougie before the patient goes to the water-closet; a plan that must be attended with extreme annoyance. In obstinate cases, it is necessary to divide one side of the sphincter muscle. The pressure of the finger, or a plug of lint, will command the hemorrhage. An active purgative should be given the day before the operation, and opium afterwards to keep the bowels constipated for two or three days, so that the wound may not be disturbed. It is to be dressed with lint, and generally heals in about three weeks. If the surgeon avoid dividing the sphincter muscle in the female forwards, no inconvenience results from the operation, the patient retaining the feces after it as well as ever.

### ULCER WITHIN THE RECTUM.

The ulcer, which sometimes accompanies a spasmodic contraction of the sphincter, may take place independently of it, on the posterior part

of the rectum, opposite to the point of the os coccygis. It occurs principally in costive individuals, is difficult to heal, disposed to enlarge, and creates a great deal of pain during and after each passage of the feces. In some instances, it bleeds copiously.

*Treatment.*— Mr. Copeland's practice is to divide the mucous membrane longitudinally, so as to comprise the ulcer in the incision. According to Sir Benjamin Brodie, a cure may always be accomplished by dividing the sphincter muscle, and very often without an operation of any kind, if the confect. pip. comp., or Ward's paste, be given internally, and the bowels kept gently open with lenitive electuary and sulphur. Ward's paste, blended with soap, he has also introduced into the rectum, as a suppository, twice a day, with advantage.

### STRICTURE OF THE RECTUM

Consists in a thickening and induration of the mucous and muscular textures, and no doubt also in similar changes of the intervening cellular tissue.* Sometimes the contraction extends three or four inches up the bowel; but, in other instances, the constriction is limited to a very narrow circle. Very often the gut is of its natural diameter close to the anus; but, about an inch and a half, or two inches above it, there is a circular contraction, while higher up the bowel is again of its natural diameter. Now, although the stricture is thus confined to a certain extent of the rectum, the mucous membrane is in an unhealthy state both above and below the contraction.*

The disease occurs in both sexes, but in adults more frequently than children, and comes on very gradually. At first, the patient experiences some slight difficulty in emptying the bowel, and is obliged to strain a good deal, especially if the feces be hard, which, when discharged, are found to be of small diameter. At length, the constricted portion of the bowel inflames, and the pain then becomes much more severe, attended with a discharge, not only of mucus, but of blood and purulent matter. If the disease proceed further, inflammation takes place in the cellular tissue round the rectum, and putrid abscesses form, which burst in various places near the anus, and occasionally into the urethra in men, or vagina in women. I lately attended a gentleman, from whom nearly a pint of matter issued from the rectum daily for some time before he died, and there was pus under the glutæi muscles. In some instances, the patient dies with symptoms like those of strangulated hernia, in consequence of the stricture becoming completely blocked up by indurated feces. Great pain in the abdomen, vomiting, and a tympanitic distension of the belly, are here amongst the most prominent symptoms. As Sir B. Brodie has explained, the bougie and injections may remove this kind of obstruction, once or twice, and thus save the patient; but another attack coming on, the treatment may not be equally successful. In the advanced stage of the disease, patients generally become completely hectic, but often linger many years.

Most of the strictures of the rectum met with by Mr. Salmon, he says, were situated between five and six inches from the anus; but many other surgeons, amongst whom is Sir Benjamin Brodie, represent the lower part of the rectum as their common situation. At all events, they occur high up, in a certain proportion of cases, and even in the sigmoid flexure of the colon.

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* Sir B. Brodie, in Lond. Med. Gaz 1834-35, p. 28.

The treatment consists in the occasional employment of mild aperient medicines and injections; sometimes in the introduction of a suppository of opium, or hyosciamus, and in dilating the stricture with bougies. The exact place and degree of the stricture should first be ascertained, if possible, with the finger; and if the disease be not in too irritable a state, the use of the bougie may commence at once. The instrument should be kept in ten minutes, a quarter of an hour, or longer, every day, or every other day, according as the patient may be able to bear it without too much inconvenience. Mr. Salmon considers that it is better to pass the bougie less frequently than usually recommended, and at intervals of from three to five days. In some cases, Sir B. Brodie divides the stricture in two or three places with a *bistoire caché*, so adjusted that the blade may be opened to about one sixth or one fourth of an inch. The incisions having been made, the larger bougie can be at once introduced.

Frequently this disease is attended with such irritation of the bowel, that bougies cannot be resorted to, unless this condition be first obviated by other means. A suppository of opium, or hyosciamus, at night, followed by a mild aperient in the morning, will sometimes enable the patient to bear the use of the bougie. In other instances, a draught, composed of half a drachm of balsam of copaiba, fifteen minims of liquor potassæ, three drachms of mucilage of gum arabic, and nine drachms of carraway water, taken thrice a day, has answered the purpose.* When the feces accumulate above the stricture, and cause considerable irritation by distending the bowel, an elastic gum catheter should be introduced through the stricture, and tepid soap and water injected, followed by warm water. By persevering in this plan every day, or every other day, the whole collection will soon be cleared away.

If the disease be much advanced, the mucous membrane ulcerated, and abscesses have formed, the case will rarely admit of complete cure.

I fully concur with Sir Benjamin Brodie, that bougies are scarcely ever, perhaps never, safe for strictures of the rectum, except when the obstruction is within reach of the finger.

### MALIGNANT DISEASES OF THE RECTUM

Rarely occur till after the middle period of life. At first, the patient experiences some slight uneasiness about the bowel, followed after a time by difficulty of expelling the feces, which gradually increases, and becomes attended with acute lancinating pains, extending through the pelvis to the back, nates, hips, and thighs. Frequently, these pains are followed by a sudden gush of a fetid bloody discharge from the bowel, in consequence of ulceration having taken place. At length, the stomach gets out of order, and the general health declines. The patient has a sallow look, denoting the existence of a severe organic disease; and frequently the scirrhous or medullary affection of the rectum is accompanied by other visceral disease. Sometimes, but not commonly, in the advanced stage, there is copious hemorrhage from the bowel; and abscesses form around the part, and burst externally. In females, they burst into the vagina; and the ulcerated communication between this tube and the gut may be so free, that a large quantity of feces may be discharged through the former passage. In the male sex, the ulceration frequently makes a communication between the rectum and bladder, or the rectum

* Sir B. Brodie, Op. cit. p. 29.

and the urethra, and then the patient expels not only air, but feces, with the urine. Retention of urine is another frequent complication of the present disease. The patient, after lingering a considerable time in severe agony, is at last exhausted. In some instances, the diseased mass completely obstructs the passage of the feces, and symptoms, resembling those of strangulated hernia, come on; or the bowel ulcerates immediately above the obstruction, and the feces, escaping into the cavity of the peritoneum, excite a fatal attack of peritonitis.*

Whether the disease partake of the character of carcinoma, or of medullary disease, it consists in the growth of a new substance, whose pressure seems to produce an absorption of the mucous and muscular coats of the bowel.† The cases, in which the mass projects into the bladder, or vagina, are, no doubt, examples of medullary cancer, or fungus hæmatodes. In some examples, the texture of the morbid parts is such, that it appears like a combination of scirrhus and fungus hæmatodes, some portions of it being of a soft medullary consistence, and others hard.

Attempts have been made to remove malignant disease of the lower part of the rectum with the knife. If ever such an operation be justifiable, as Sir Benjamin Brodie observes, it must be where the disease is very low down, and quite in its earliest stage. Under other circumstances, there would be no probability of the whole of the diseased textures being taken away.

Bougies render the disease worse. Opiate clysters, and injections of linseed oil, with or without lime water, sometimes allay the pain and irritation. Sir Benjamin Brodie speaks favourably of the liquor potassæ and balsam of copaiba, as internal medicines. The sufferings of the patient always make the exhibition of anodynes indispensable, and the best are the acetate and muriate of morphia.

## PARTICULAR FRACTURES.

### FRACTURES OF THE OSSA NASI

Are by no means unfrequent, a circumstance accounted for by the prominence which these bones form, and their being so little protected by the soft parts. The injury can only happen from direct external violence, as blows, or falls on the face. Besides being accompanied by evident marks of contusion, there is bleeding from the nose; and in consequence of the moveable state of the pieces of bone, a crepitus can be felt. In some instances, the fragments are not at all displaced; but in others, where the force applied has been greater, the ossa nasi are driven inwards towards the nasal fossæ, and, if there has been time for much swelling of the soft parts to come on, the injury and depression of the bone is to be ascertained by manual examination; for the tumefaction will conceal from the eye the nature of the accident. Sometimes, the fracture extends through the nasal process of the upper jaw-bone ‡, and across the nasal

* Sir B. Brodie, in Lond. Med. Gaz. 1834–35, p. 238.

† F. Salmon, on Stricture of the Rectum, p. 63.

‡ Such a case was under the care of my friend, Mr. Hooper, about three years ago. The injury was produced by a scrubbing-brush being thrown in the patient's face with immense force. There was likewise injury of the brain. The case soon ended fatally.

duct, attended with a great deal of ecchymosis, a regurgitation of blood from the lachrymal puncta, and an impediment to the passage of the tears into the nose. Lastly, the violence may be transmitted through the perpendicular plate of the ethmoid bone to its cribriform plate, which may also break, and symptoms of pressure, or injury of the brain, be excited. In other instances, there may be no fracture of the cribriform plate, yet the brain suffer concussion.

When a fracture of the nasal bones is not attended with displacement, all that is requisite to be done is to apply the cold evaporating lotion; but, if the fragments are beaten inwards, they should be restored to their proper situation, by introducing a director up the nostril, and adjusting the pieces of bone with the aid of the fingers applied externally.

Generally, when the fragments are replaced, they have no disposition to quit their situation again; but, cases are mentioned, in which it was judged necessary to afford them some support, by means of lint passed up the nostril. When the soft parts are much swollen, bleeding, leeches, and other antiphlogistic means are indicated.

### FRACTURES OF THE MALAR AND SUPERIOR MAXILLARY BONES

Are rarely met with, except as the effect of gunshot violence, or other great mechanical force applied directly to the face. Thus, the cheek-bone is sometimes fractured by the kick of a horse, or the blow of a hammer; under these circumstances, there must be more or less splintering of the bone, and contusion, or even laceration of the soft parts.

Individuals sometimes attempt suicide by firing a pistol into the mouth. In such cases, the alveolary processes, with the teeth, are often forced away, together with the palatine processes of the upper maxillary bones, the palate bones, the lower turbinated bones, the vomer, and lateral portions of the ethmoid bone. The antrum is of course laid open. In one case, recorded by Dupuytren, the patient lived till the fortieth day; and after death, the cribriform plate of the ethmoid bone was found fractured, and a bullet lodged in one of the anterior lobes of the brain.

All action of the muscles about the throat is to be suspended, and only liquid nourishment given with a spoon, or injected through an elastic gum catheter, passed from the right nostril into the pharynx. Displaced portions of the palate are to be reduced; splinters of bone removed; and any injurious effects on the brain counteracted according to the rules, delivered in the observations on Injuries of the Head. The soft parts are to be rectified as well as possible. Antiphlogistic remedies, inclusive of bleeding, will be indispensable.

### FRACTURES OF THE LOWER JAW-BONE

May take place in its *body*, its *rami*, the *coronoid process*, or the *neck* of one of its *condyles*. A fracture sometimes occurs near the chin, though rarely in the precise situation of the symphysis, generally at some point between the symphysis of the bone and the insertion of the masseter muscle. From this insertion, as far back as the angle of the jaw, or root of the coronoid process, the bone is covered externally by the masseter, and inwardly by the internal pterygoid muscle, a circumstance explaining the diminished frequency of fractures in this particular portion of the bone. It explains also another fact, which is, that when fractures do happen in this situation, they are not very liable to displacement, because the foregoing muscles antagonise one another.

The lower jaw-bone may be broken in two places at once, namely, on each side of the symphysis, and, in this case, it is difficult to keep the middle piece in its right situation, because several muscles, concerned in depressing the jaw, are attached to that part of it, and draw it downwards and backwards.

Fractures of the lower jaw may be *perpendicular*, *oblique*, or *transverse*, that is, parallel to the base of the bone. These last are less common than perpendicular and oblique fractures; but, they are occasionally met with, detaching a portion of the alveolary process, with the teeth in it, from the rest of the bone.

Fractures of the lower jaw are sometimes *comminuted*, the bone being broken in several, or even many, pieces. When the *fracture* is *near the chin*, whether the bone be broken on one side or both, the fragment comprehending the symphysis is drawn downwards and backwards towards the os hyoides by the action of the digastricus, mylo-hyoideus, genio-hyoideus, and genio-hyoglossus.

*Fractures of the ramus* are not very common, because this part is protected by the zygoma and masseter. *Fractures of the neck of the condyle* are more frequent than those of the *coronoid process;* and the condyle itself may then be drawn forwards and displaced by the action of the external pterygoid muscle. When the ramus is fractured, the fibres of the masseter and internal pterygoid, being attached to both pieces, prevent any considerable displacement.

When a fracture of the lower jaw is accompanied by displacement, the nature of the accident is readily detected by the inequality in the line of the base of the jaw; by an irregularity in the arch of the teeth; by the inclination of the mouth more to one side than the other; and by the crepitus, plainly distinguishable by manual examination. When the gums are lacerated, or the injured portion of the bone is exposed by a wound, as is often the case, forming a *compound fracture*, the nature of the accident is still more obvious.

When the ramus, or the neck of one of the condyles, is broken, the patient will complain of severe pain in the ear; and when the jaw is moved, a crepitus is perceptible.

The reduction of a fracture of the lower jaw is easily accomplished by means of the thumbs introduced within the mouth, and the fingers applied externally to the base of the bone. The surgeon is to draw the displaced fragment upwards, and a little forwards, so as to bring it on a level with that fragment which retains its proper situation. By attending to the line which the base of the jaw ought to form, and the regularity or irregularity of the arch of the teeth, he may always judge of the correctness of the reduction.

Easy as the reduction is, the maintenance of it is sometimes troublesome, requiring that the arch of the teeth in the broken bone should be kept steadily applied to that of the teeth in the upper jaw. Hence, when the teeth are naturally irregular, or accidentally deficient, certain practitioners consider it advisable to introduce a piece of cork between such teeth as may be present, in order that there may be a smooth even surface, against which the lower jaw may be confined. Others inclose the fractured part of the jaw with pasteboard, which on its first application is to be softened with warm water, so that it may adapt itself to the shape of the part. Whether pasteboard is used or not, the broken jaw is to be well supported, and kept steady with a roller, or, what is much better, the four-tailed string bandage, the centre of which is to be

put on the chin, and the front tails fastened over the occiput, and the posterior ones over the forehead. The assistance of a compress under the part that has a tendency to be drawn downwards and backwards, is frequently required. Mastication and conversation are to be avoided, as causing disturbance of the fracture. Hence only spoon victuals should be allowed. In bad compound cases, the administration of food and medicines through an elastic catheter is sometimes deemed advisable.

Fractures near the symphysis are very difficult to keep right, on account of the incessant disturbance of this part of the bone by the muscles attached to it and the os hyoides; viz. the digastricus, mylo-hyoideus, genio-hyoideus, and genio-hyoglossus, all of which are put in action in deglutition. For this case, Mr. Lonsdale has invented a simple, but ingenious instrument, which grasps the base of the jaw and the arch of the teeth, so as very effectually to maintain the reduction. Instruments, acting on a similar principle, have also been suggested by various surgeons both in France and Germany. They are not applicable to fractures of the ramus, coronoid process, or condyle.

When the neck of the condyle is broken, the condyle itself is drawn inwards and forwards by the action of the external pterygoid muscle; and, as it cannot be replaced, we should keep the neck of the bone inclined towards it, by making the bandage act, particularly on the angle of the jaw, with the aid of a compress.

Cases are on record, in which the detached condyle, instead of uniting, was discharged from a subsequent abscess of the part.

Sanson asserts, that when the coronoid process is broken, the fracture never unites; but that mastication is performed very well, the masseter and pterygoid muscles then fulfilling the office of the temporal.

### COMPOUND FRACTURES OF THE LOWER JAW

Are by no means uncommon; and, when it is remembered that this bone can only be broken by blows, kicks, gunshot injury, and other species of direct external violence, the fact is sufficiently accounted for. The same explanation enables us to understand why the fracture is also, in many instances, *comminuted*, and several of the teeth knocked out, or loosened.

The treatment of a compound fracture consists in removing all loose splinters of bone; reducing the fracture, if attended with displacement; dressing the wound with simple unirritating applications; applying the four-tailed sling bandage for the jaw; giving all food with a spoon in a liquid form, or, in very bad cases, through an elastic gum catheter, passed through the nostril into the pharynx; enjoining perfect quietude of the part; and adopting strict antiphlogistic treatment.

If abscesses form, an early opening should be made in them, and the mouth kept clean with a common gargle, or one containing the chloride of sodium. When necrosis takes place, the dead portions of bone should be removed, as soon as exfoliation has advanced far enough.

Fractures of the lower jaw are sometimes *complicated* with laceration of the artery, or nerve, in the canalis mentalis. I have never seen an instance, however, in which the bleeding did not soon stop, after the reduction of the fracture.

As the lower jaw is a particularly vascular bone, the repair of its accidental injuries is generally accomplished with surprising quickness. Hence, even the worst fractures of it, *compound* and *comminuted* ones, generally have a favourable termination.

I have seen two or three horrible cases, in which nearly the whole of the lower jaw, and the integuments, and the muscles connected with it, and more or less of the tongue, were shot away; yet, the patients recovered, and in a more expeditious manner than might have been expected.

Instances are recorded, where fractures of the lower jaw continued ununited. In one case of this description, Dr. Physic, of New York, succeeded in bringing about the union of the bone, by passing a seton between the fragments.

### FRACTURES OF THE SPINE.

If we except the atlas, the tooth-like process of the dentata, and the spinous processes of the vertebræ in general, one of which may be fractured without any other injury of the spine, it is not usual for a vertebra to be broken singly. Generally, the body of one vertebra, and the articular or transverse processes, either of the vertebra above or below that of which the body is fractured, are likewise implicated.

Fractures of the spine, like those of the cranium, are important and dangerous, not by reason of the injury of the bones themselves abstractedly considered, but on account of the effects produced on the very essential part of the nervous system, which the vertebræ contain and protect.

Fractures of the spinous processes may not be accompanied by any injury of the spinal marrow; but those extending through one of the bodies of the vertebræ, and the neighbouring articular and transverse processes, cannot happen, without a degree of violence, that never leaves the spinal cord entirely free from injury; and hence, the accident brings on a train of dangerous symptoms, which, sooner or later, generally have a fatal termination.

When the fracture is situated in the lower portion of the vertebral column, it mostly produces loss both of sensibility and of motion in the lower extremities, and paralysis of the bladder. When the injury is higher up, in addition to these symptoms, the abdomen becomes prodigiously distended with air collected in the bowels; when it is still higher, the intercostal and abdominal muscles are paralysed, and the breathing difficult, because only carried on by the diaphragm.

When the lower cervical vertebræ are broken, and the medulla hurt, the upper extremities, as well as the lower, are both paralyzed. If the injury be situated above the fourth cervical vertebra, or the origin of the phrenic nerve, and, especially, if there be any displacement of the fragments, or compression or injury of the spinal cord, respiration cannot go on, and immediate death is produced.

Amongst the symptoms of fractures of the spine, priapism, and even emission of the semen, are by no means uncommon. Both of them were noticed in a young man under my care, who died from a fracture of the cervical vertebræ in University College Hospital, in October, 1835.

Such are the consequences usually induced, when a fracture of the spine is accompanied by displacement of the fragments, and with more or less compression, or injury, of the corresponding portion of the spinal cord.

On dissection, the spinous process of the displaced vertebra is found depressed; the body of the bone broken through; and a part of it thrown more or less forwards or to one side. A displacement from laceration of the intervertebral substance is very rare. Sometimes blood is extrava-

sated between the vertebral canal and the sheath of the spinal cord, and sometimes on the latter part itself. In slight displacements, the medulla is compressed and bruised; in more considerable ones, it is generally torn through; but the dura mater usually remains entire.

With respect to the symptoms of a fracture of the vertebral column, many of them, and indeed the most dangerous of them, may be brought on by a violent concussion of the spinal cord. Hence, the diagnosis is sometimes obscure. An inequality in the line of the spinous processes, a crepitus, and even deformity, are occasionally perceptible; and these circumstances, joined with the extent of the paralytic disorder, according to the situation of the injury, as already explained, will leave no doubt about the nature of the accident.

In consequence of the paralysis of the bladder and sphincter ani, the patient cannot void his urine, and the feces come away involuntarily. The qualities of the urine, also, undergo a remarkable change; for it becomes strongly impregnated with ammonia. It is likewise found, that when the patient continues to live a considerable time, with the urine in this state, the bladder itself becomes thickened, softened, and even ulcerated. The evacuations from the bowels are often remarkably dark and fetid.

Patients, who lie for weeks and months in a paralytic state from injury of the spine, are much exposed to the risk of sloughing of the nates. Sir Astley Cooper mentions a case of fracture of the lumbar vertebræ, where the patient lived two years, and then died of such sloughing.

A fracture of the spine is capable of union, just like fractures of other bones. If the patient get over the danger, arising from the injury of the spinal cord, the fracture itself is certainly capable of reparation.

The chances of recovery and the length of time the patient may live after the accident, when a final recovery does not ensue, depend materially upon the situation of the fracture, and its degree of displacement; or, in other words, upon whether the fracture affects the cervical, dorsal, or lumbar vertebræ, and whether the spinal cord is contused, crushed, or otherwise wounded. The higher the fracture, the sooner does it generally prove fatal.

When the dorsal vertebræ are broken and displaced, the patient seldom lives beyond two or three weeks; but Sir Astley Cooper knew of one instance in which the patient lived nine months.

When the lumbar vertebræ are fractured, the patient often lives a month or six weeks; but he may live a considerable time, and ultimately perish of sloughing of the nates, or mortification of the lower extremities, as happened in one of the cases recorded by Soemmerring.

When the fracture is in the lower cervical vertebræ, and attended with displacement of the fragments, and consequent injury of the medulla, the patient rarely lives beyond the tenth day, death taking place sooner the higher the fracture is situated.

Fractures of the cervical vertebræ, involving one of the transverse processes, are attended with one danger not occurring in fractures of other vertebræ, viz. laceration of the vertebral arteries. It is the simultaneous injury of the spinal cord that is the principal source of danger, and a fracture of any part of the spine, if it were not for this circumstance, would be repaired like other fractures, and the patient recover. This is proved by many recoveries, known to have followed even fractures of the upper cervical vertebræ, where no material contusion or compression of the medulla had taken place.

Sir Astley Cooper mentions a case that occurred in Mr. Cline's prac-

tice, where the first vertebra of the neck was broken across, without occasioning death till a twelvemonth afterwards, when the fatal event arose from the dentiform process losing its support and becoming displaced.

In the museum of the College of Surgeons is a remarkable preparation, proving the possibility of a person living a twelvemonth after a fracture of the last dorsal vertebra, during which time nature had made the greatest efforts to bring about a cure. The patient was kept perfectly at rest, and the urine at first regularly drawn off with a catheter; but, by degrees, a power of emptying the bladder by the action of the abdominal muscles was regained, and the patient even became well enough to sit up and to creep slowly down stairs, notwithstanding the lower extremities were completely deprived of all power of voluntary motion. After death, the fracture was found completely united by bone. The greatest curiosity about the case is, that a fragment of the body of the vertebra had been forced at the time of the accident completely across the vertebral canal, so as to divide the medulla spinalis, the ends of which, as exhibited in the preparation, are an inch asunder.

Soemmerring relates an instance, in which the patient lived six months after a fracture of the body of the first lumbar vertebra, and of the oblique and transverse processes of the last dorsal one. After death, the fracture was found perfectly united by osseous matter.

In one of Cruveilhier's engravings, is the representation of a fracture of the second lumbar vertebra, attended with displacement. The patient recovered from paralysis of the lower limbs, and all other ill consequences of the accident, but died of another disease four years afterwards. The greater part of the broken vertebra was pushed towards the left side and backwards; but the rest of it, comprehending the right articular and transverse processes, and the portion of the body connected with them, remained in its natural situation. The left oblique and transverse processes were fractured; bony matter had been thrown out for the repair of the injury — not from the fragments themselves, but, as Cruveilhier states, rather from the vessels of the surrounding parts, the cellular and fibrous tissues, and the muscles.

In the case recorded by Mr. Barlow (vol. xvii. Med. Chir. Trans.), consisting of a fracture of the first lumbar vertebra, sensation began to return in the legs and thighs after eight months, and the patient could raise himself in bed, and in twelve months could bear to be drawn out in a small chaise. After an attack of fever, sphacelation of the heel took place, pus was voided with the urine, and gangrene commenced over the sacrum, of which the patient died. The upper portion of the spine was found to be thrown forwards, and connected to the fore and upper part of the inferior fragment by callus. The articular processes of the first lumbar and last dorsal vertebræ were dislocated, the vertebral canal was lessened in diameter to one half of its natural extent, pus was found in the pelvis of each kidney, and the bladder was diseased.

Mr. Lawrence mentions a case of fractured spine, where the patient lived a considerable time after the accident, and at length died, when the fracture was found soldered together by bone; but the osseous matter had so nearly filled up the vertebral canal, that there was only just room enough in it for the end of a blowpipe. The spinal cord had been completely divided.

With respect to the *treatment*, we are first to consider what ought to be done when there is no displacement. Here the indications would be to draw off the urine once or twice a day with a catheter, and to keep off

inflammation of the spinal cord and its sheath by antiphlogistic treatment, especially by bleeding, active aperient medicines, and perfect quietude in the recumbent position.

In a case of fracture with displacement, where the patient is not quickly destroyed by the extension of the paralysis to the diaphragm, and other important organs, or by the case being complicated with rupture of the kidneys, spleen, and internal hemorrhage, ought we to attempt to reduce the fractured vertebræ, as the only chance of removing the pressure from the spinal cord? Now, experience has little to adduce in favour of such attempts, which have been made from time to time, but generally in vain. In a patient, from whom a specimen in the museum of University College was taken, the attempt was made, but to no purpose. In the case recorded by Mr. Barlow, of Writtle, it was also made; not with any bad consequences, indeed, but without success, as on dissection the fracture was found united, but in a state of displacement. The reduction had not in reality been accomplished, or, if accomplished, had not been maintained. In making the experiment, there must be some risk of rendering things worse, so imperfectly must we always be acquainted with the exact position of the fragments. But, even if the reduction were accomplished, and could be maintained, the injury, which the spinal cord has received, will yet remain, and all the bad consequences of it continue.

The notion of removing pressure from the spinal cord, as is done from the brain, by means of the trephine, led to the scheme of cutting away the spinous processes and adjoining bony arches in the situation of the injury with Hey's saws; an operation which, I believe, with Sir Charles Bell, would generally of itself destroy all possibility of the patient's recovery.

Neither would the removal of such portion of the vertebral column make any difference in the injury of the medulla already existing, unless, indeed, it were an augmentation of it; nor could it alter the position of the fragments of the body of the broken bone.

My views would therefore restrict the treatment to means calculated to lessen the risk of inflammation and suppuration of the medulla, especially common antiphlogistic treatment, including rest in the recumbent posture. The urine should be drawn off once or twice a day with a catheter, which in these cases should not be left in the bladder, as the beak of it is apt to produce inflammation and ulceration of that organ, followed by effusion of urine and peritonitis. The bowels are to be regulated with castor or croton oil. If possible, the convenience and comfort of a fracture-bed should be afforded; and when there is a tendency to sloughing of the nates, the hydrostatic bed should be employed.

Should life continue long enough to justify the inference that the fracture is united, though some of the paralytic effects of the accident still remain, we might try the effect of iodine liniments, blisters, the moxa, or issues. The internal and external use of strychnine has been suggested; but I know of no facts in its favour.

Very curious effects are sometimes exemplified in injuries and diseases of the spine, which are referrible to the double roots of the spinal nerves; the anterior of which are for voluntary motion, the posterior for sensation. Thus, a few years ago, I attended a man in Black-Horse Yard, Rathbone Place, who was paralytic in both lower extremities, in consequence of a blow on the spine, received in a fall from the mast of a ship; one limb having lost all feeling, the other all sensation. In fractures of the cervical vertebræ, below the fourth, the arms are paralytic, but one may be more

so than the other; and lately in University College Hospital, I had a patient with fracture of the fifth cervical vertebra, with displacement, and of the arch of the fourth without it, who had no power of action in any of the muscles of the upper extremities, yet he possessed feeling in these limbs down to the elbow.

### FRACTURES OF THE STERNUM

Are less frequent than might be expected, considering its exposed situation in front of the chest. For this fact, there seem to be two reasons; the first is, that the sternum is a spongy bone, less brittle than many others; the second is, that it rests on the cartilages of the ribs, which form so elastic a support for it, that it is enabled to elude any common violence by the yielding of those parts. However, notwithstanding these circumstances, it is sometimes broken. In the course of the last five years, we have had in University College Hospital several examples of fracture of the sternum. It may be fractured by gun-shot violence, or by the passage of a heavy carriage over the trunk, or by any other considerable force applied directly to the sternum. But the fracture may occur in another manner, which would not be expected. M. David, in his Mémoire sur les Contrecoups, relates a case, which took place in the following way: a bricklayer fell from the top of a house, and as he was falling, the middle of his back struck against a piece of timber, and the consequence of this blow was a fracture of the sternum. Now, the explanation given by M. David of the mode in which the sternum happened to suffer injury, is, that it was broken by the violent action of the abdominal muscles, diaphragm, and muscles of the neck, connected with this bone, whereby it was powerfully drawn at once in different directions. The truth of this account is confirmed by the curious fact, that the sternum is sometimes fractured during parturition by the violent efforts of the muscles attached to it; for cases of this kind are upon record.

A fracture of the sternum is not in itself dangerous; but it may be followed by severe and even fatal consequences, on account of the thoracic viscera happening to be injured at the same time: thus, the lungs or the heart may be penetrated by a fragment of a broken sternum. In the Museum of University College, is a preparation, exhibiting a laceration of the right ventricle of the heart by a portion of fractured sternum. M. Sanson met with a similar case, in which the heart was torn by a sharp spicula of a broken sternum. Blood may also be copiously effused in the cellular tissue of the anterior mediastinum; and sometimes considerable inflammation of this texture will ensue, leading to the formation of abscesses, and to various degrees of necrosis in the injured bone. One occasional complication of a fracture of the sternum is *emphysema*, or an inflation of a great part, or of the whole, of the cellular tissue of the body, which can only take place, however, when a spicula of bone happens to wound the lungs.

As the sternum is a superficial bone, its fractures are readily detected if there be displacement, the lower portion is generally situated in front of the upper one, and sometimes overlaps it. In most instances, a crepitus is perceptible, produced by the motion of the fragments on one another in respiration, and particularly obvious when the patient coughs, if the surgeon's hand be applied to the front of the chest. The patient, indeed, is usually teased with a frequent dry cough, and when the lungs have been pierced by a spicula of bone, there is a spitting of blood, which

may be followed by emphysema. The cough is particularly annoying, from the motion and disturbance it causes of the injured part.

If there be no displacement of the fracture, no complication, the principal indication is to keep the fragments as quietly as possible in their present position, which is most effectually accomplished by applying a broad roller round the chest, and making it press on the broken bone and ribs, so as to limit and diminish their motion. The bandage should be rather tight, and kept from slipping down by passing a piece of tape over each shoulder, from the centre of the roller behind to a point in front of the chest. If the tapes were fastened too near the axillæ, they would slip off the shoulder, and not answer the purpose of their application. In order to keep the fragments as quiet as possible, the trunk should be inclined forwards, and the pelvis raised, so as to relax the abdominal muscles. Whenever the sternum is broken, another indication is to bleed the patient freely, because the risk of inflammation in the chest must be guarded against. Bleeding is also one of the most effectual means of relieving the cough, which always occasions severe pain, and a great deal of disturbance of the injured part. The lancet, antiphlogistic measures in general, especially quietude, the application of a broad bandage round the thorax, the relaxation of the recti abdominis, and the administration of an emulsion with a little opium, for the palliation of the cough, may be said to constitute the principal means of treatment.

But, supposing the fracture were attended with displacement, some practitioners advise us to relax the abdominal muscles, asserting that we shall then more easily succeed in reducing the fracture by pressure; while others say it is best to extend the spine by putting a bolster under the loins, as they assure us, that, in this position of the patient, the fragments can be more readily reduced. Now, if we were unable to effect a reduction by these or other plans, then the question would present itself, whether we ought to perform an operation for the purpose of bringing about a coaptation of the bone? Whether we should be justified in making an incision down to the fracture, and trying to raise the depressed portion of bone to its proper level, by means of an elevator? Without pronouncing an unqualified condemnation of this scheme, I may safely remark, that before we think of putting it in execution, we should be sure that the existing bad symptoms are really produced by compression of the thoracic viscera, and that they are of a sufficiently urgent nature. A moderate depression of a portion of the sternum would not be likely to create any dangerous symptoms, inasmuch as that bone lies over the anterior mediastinum, which merely contains cellular substance, pressure on which would certainly occasion no perilous consequences. But, we are also to recollect that the thoracic viscera may be injured, and that such injury may be the true cause of the urgent symptoms. In this case, merely elevating a moderately depressed portion of the sternum would promise little relief. However, what I wish to be well considered is, whether the bad symptoms are produced by mere compression of the thoracic viscera, or by any other description of mischief. A case is recorded by Petit, in which the patient recovered from an unreduced fracture of the sternum, but experienced severe oppression in his chest, and great difficulty of breathing during the rest of his life. It seems, therefore, that, if the fragments are left displaced beyond a certain degree, the patient may suffer from the sternum being united in this deformed state. The cases, in which we might be called upon to trephine the sternum (another proceeding fortunately oftener spoken of than done),

are, first, those in which purulent matter is confined in the anterior mediastinum in considerable quantity, so as to occasion dangerous oppression of the lungs; and, secondly, others in which it might be deemed right to adopt the practice to expedite the removal of a portion of dead bone. But even circumstances of this kind, truly requiring the operation, are exceedingly rare, for abscesses make their way outward, and dead bone will in time separate by the process of exfoliation. The formal application of the trephine to the sternum, for the purpose of raising a depressed portion of it, I think, would hardly be deemed justifiable in the present state of surgery.

### FRACTURES OF THE RIBS.

The ribs are broken almost as frequently as any bones which can be mentioned, except the clavicle and radius; the middle ones being those which are most exposed to the accident, and especially the part of them near what is termed their angle. The upper ribs are rarely fractured, because they are protected in front by the clavicle, and covered by the pectoral muscles; while behind they are shielded, as it were, by the scapula and the thick muscles of the back. As for the lower ribs, they generally escape, in consequence of their being so short and moveable. The displacement of the fracture can only take place either inwards or outwards. On account of the connection of those ribs, which are usually broken, to the sternum in front, and to the vertebræ behind, there can evidently be no displacement in the direction either backwards or forwards. Neither can the ends of the fractured rib be thrown upwards or downwards, because the intercostal muscles, which are attached equally to both fragments, resist such an occurrence. However, the ends of the fracture may be forced inwards, or they may incline outwards; but, in by far the greater number of instances, it is in the direction inwards that the displacement happens. The detection of a fracture of the ribs is not generally attended with difficulty; for if we merely place our hand on the part that has been struck, and desire the patient to cough, we can mostly perceive a crepitus; or the natural movements of respiration will render the same symptom manifest, if we merely press our hand upon the injured part of the chest. However, when the ribs are broken towards their posterior ends, under the thick muscles of the back, we may experience a great deal more difficulty in detecting a crepitus. When one or more of the ribs are broken, the patient is annoyed with a sharp pricking pain in the situation of the injury, and has a frequent dry cough, which, by the disturbance it occasions of the fracture, gives considerable pain. Now, supposing we were not able to feel the crepitus, and the diagnosis were obscure, we should then act according to the wise maxim laid down by all the best writers on surgery; namely, adopt precisely the same treatment as if the occurrence of fracture were a matter of certainty.

A simple fracture of one of the ribs, unattended with any particular complication, such as a wound of the lungs, emphysema, or effusion of blood in the chest, is not productive of any serious danger, and generally has a favourable termination. But when several ribs are broken, and blood is extravasated in the chest, or the lungs are wounded, the accident often has a fatal result. We hear almost every day of cases, in which several ribs are broken by the passage of carriages over the chest, and the fracture complicated with injury of the thoracic viscera, effusion of blood in the thorax, or an extensive inflation of the cellular tissue, constituting what is termed *emphysema*.

When the accident is free from the complications which have been specified, the right treatment is obvious. It is a rule when a surgeon is called to a strong young person, who has broken one or more of the ribs, to practise venesection. This is done with the view of diminishing the risk of inflammation within the chest, and the chance of internal hemorrhage. Then, another indication is to keep the rib as free from motion as possible. We are to endeavour, therefore, to prevent the intercostal muscles from taking part in the performance of the function of respiration, and try to make the patient breathe principally by means of the diaphragm and abdominal muscles. For this purpose, a broad roller is firmly applied to the chest; or a strong napkin, the two ends of which must be brought from behind forwards, and then laced over the sternum. The patient is thus enabled conveniently to regulate the tightness of the bandage himself, and, for the sake of his own comfort, he will be sure to maintain the requisite degree of pressure; for, when the roller becomes too slack, he begins immediately to experience the pricking pain again, and his cough is more troublesome. It is evident, that whether we employ a broad roller, or a napkin, it would slip down towards the loins, if the precaution were not taken to attach two pieces of tape to the central part of it near the spine, each of which is to be carried over the nearest shoulder, and sewed to a point of the bandage or napkin below the clavicle. The French apply another tape under the perinæum, to prevent the roller from slipping upwards, but this would only be necessary in very corpulent subjects, and is rarely or never made use of in this country.

Fractured ribs, not attended with the complications already noticed, are generally treated with great success; and, in four or five weeks, a firm union takes place. If the patient be left entirely to himself, without any kind of surgical assistance, a broken rib will also, for the most part, unite; but in the museum of University College, is a specimen of a fracture of six ribs, where the fragments are only connected by a fibrous or ligamentous substance. Without speaking positively, I should presume, that, in this example, no effectual means had been adopted to keep the ribs motionless during the treatment.

In old persons, the cartilages of the ribs and the ensiform cartilage are frequently ossified; and when they are in this state, they are liable to be broken. The ensiform cartilage has been known not merely to be fractured, but to be depressed, or beaten inwards, so as to lacerate the diaphragm, and tear the liver. The cartilages in their natural state may also be ruptured; and, when this happens, they do not unite by cartilage, but by osseous matter, a bony clasp being formed, by which the fragments are bound together. The treatment of the latter injuries is the same as that ordinarily adopted for fractures of the ribs.

### FRACTURES OF THE CLAVICLE.

The *clavicle* is perhaps more frequently broken than any other bone in the body; and for this there are several reasons. The accident is of frequent occurrence, in consequence of the bone serving two offices, which expose it to the effects of violence applied either to the shoulder or arm; namely, it keeps the scapula at a proper distance from the sternum, and is, at the same time, a point of support for the humerus, every impulse communicated to which bone is transmitted to it. In addition to these considerations, it is to be recollected, that the superficial situation of the clavicle in front of the shoulder, across the upper part of

the chest, must expose it to injuries from blows, the fall of brickbats, or other violence applied directly to it.

Its middle portion, or greatest convexity, is more frequently broken than any other part of it, unless the fracture happen from a direct blow; in which case the injury may occur where the violence is applied. In such a case, the soft parts are always contused, and sometimes lacerated. In this manner, a *comminuted* fracture may be produced; and, if the violence be great, the subclavian vessels and some of the nerves converging to form the axillary plexus, may be injured. But, although the middle of the clavicle is more frequently broken than any other part of it; yet, in cases of direct violence, it usually breaks precisely in that situation on which the force has fallen: thus, if the blow has taken place towards that end of the bone which is nearest the acromion, then the fracture will be there; if towards the sternal extremity of the bone, then that portion of it will be broken. But fractures of the middle third of the bone are commonly produced in another manner. One office of the clavicle is to hold the scapula at a convenient distance from the sternum, so that the motions of the arm may have a due degree of freedom and extent. Now, this disposition is one of the principal causes of the great frequency of fractures of the clavicle; for, as this bone supports the scapula, every impulse and force transmitted to the shoulder is communicated to the clavicle, which, being slender, first bends and then breaks, just as a stick would break under a force similarly applied to it, namely, in its central part. In consequence, then, of the clavicle serving as a point of support for the scapula, and, indeed, in particular positions, for the whole of the upper extremity, it necessarily follows, that, when a person falls upon his arm, in an extended state, the shock will be communicated along the humerus to the glenoid cavity of the scapula, and thence to the clavicle itself; so that whether the person fall on his hand, shoulder, or elbow, the clavicle is likely to be fractured at its centre.

A material difference in fractures of the clavicle will depend on one particular circumstance; namely, whether the fracture has taken place more towards the sternum, than the two bands of ligament which tie the coracoid and acromion processes of the scapula to the clavicle. If it has taken place on the scapulary side of the coraco-clavicular ligament, it must be clear, that there can be very little displacement, because the outer fragment will be fixed by the ligament binding the clavicle to the acromion, while the inner one is prevented from quitting its place by the coraco-clavicular ligament itself. But when the fracture takes place within the latter ligament, or, in other words, more towards the sternum, yet not within the limits of the rhomboid ligament, which ties the inner end of the clavicle to the cartilage of the first rib, there will then be considerable displacement, because nothing prevents the outer fragment from being drawn down by the weight of the arm and shoulder, or from being carried forwards and inwards by the pectoralis major and subclavius muscles. Hence, whenever the fracture is within the coraco-clavicular ligament, the displacement must be downwards, forwards, and inwards. Another fact to be remembered is, that it is always the outer fragment that is really displaced; the inner one being kept from quitting its natural level by the action of the sterno-cleido-mastoideus, and of the pectoralis major, which antagonise each other.

When the fracture takes place on the outside of the coraco-clavicular ligament, there is little or no displacement; and, if any at all occur, it is only in a trifling degree, such as may be produced by the outer fragment

being slightly depressed, so as to slope downwards more than natural. In this case, if we take hold of the humerus, and push it directly upwards, we find that the outer fragment of the clavicle is brought to its proper level again. Some fractures of the clavicle are *comminuted;* this may happen when the injury has been produced by direct violence; and then the nerves converging to form the axillary plexus, are exposed to contusion and laceration. The late Mr. Earle recorded an interesting case of comminuted fracture of the clavicle, where these nerves had been so injured that paralysis of the arm ensued; and it was singular that the patient could not afterwards put her hand into moderately warm water without the effects of a scald being produced, characterised by vesications, redness, &c. The fact is curious, as proving the share which the *innervation,* or the nervous influence, has in enabling the different parts of the body to bear particular temperatures.

When the clavicle is broken by a force applied to the outer part of the shoulder the fracture is mostly oblique; and if the violence has been very considerable, the end of the bone may protrude through the skin, and the case be *compound.*

The symptoms of a fractured clavicle are of the following kind:—There is a depressed and sunk state of the shoulder, more especially when the fracture is within the coraco-clavicular ligament; indeed, the shoulder will then be considerably depressed, and at the same time inclined towards the sternum; so that the space between the median line of the trunk anteriorly and the tip of the acromion will be remarkably diminished. An attentive practitioner will at once notice the approximation of the shoulder to the sternum. Then if we pass our finger from the sternal extremity of the clavicle, regularly along that bone, as soon as it reaches the situation of the fracture, we shall perceive a sudden depression in the line of the bone, arising from the circumstance already sufficiently explained; namely, the inclination of the external fragment downwards, inwards, and forwards. When we push the shoulder upwards, backwards, and outwards, so as to bring the external fragment into its proper situation, a crepitus is perceptible; or, even without elevating the shoulder, if the displacement is not so great as entirely to separate the two ends of the fracture from each other; then the crepitus may be distinguished by putting our finger on the injured part and gently moving the humerus. When we first come to a patient whose clavicle is fractured, we usually find him sitting in a particular position, with his head inclined towards the affected shoulder, and his fore-arm bent, and quietly supported on the other hand. He spontaneously chooses this posture, in order to relax the sterno-mastoid muscle, and to prevent all motion of the upper extremity, which would be exceedingly painful to him. Another sign of a fractured clavicle is the patient's inability to put his hand to his forehead; and the reason of this circumstance is, that the humerus has now no fixed point of support, and is deprived of that fulcrum which the clavicle naturally affords it. The infirmity which I speak of will always present itself, unless the fracture be on the outside of the coraco-clavicular ligament; for then the patient can sometimes raise his arm, and imperfectly perform the movement referred to. In other instances, he cannot bring his hand into contact with his forehead, except partly by bending the fore-arm, without moving the humerus, and partly by inclining the head downwards, so as to make it meet the hand. Lastly, in consequence of the way in which the outward fragment is displaced, there is always a manifest prominence, occasioned by the end of the internal fragment; the

*rising end of the bone*, as it was termed by the old surgeons, who erroneously considered it to be above its proper level.

In the treatment, we should always remember the direction of the displacement, and attend particularly to the circumstance, that the outer fragment is carried inwards, forwards, and downwards, and that the internal one remains in its natural situation; indeed, the outer one may be situated directly under it. Therefore, in order to replace the external fragment, we should carry the shoulder backwards, outwards, and upwards, and take off the weight of the upper extremity. Now in this country, in nine cases out of ten, the contrivances, used for the treatment of broken clavicles, are the sling and the figure of 8 bandage, with which the shoulders are braced backwards. A roller is passed round one shoulder, and then across the back to the other shoulder, round it, and then over the back again, crossing the first part of the bandage, and being continued in the form of an 8. But this bandage does not scientifically fulfil all the indications required; and it even has a wrong operation; for it tends to draw the shoulder inwards, or towards the sternum, as much as it inclines it backwards; and the more tightly it is applied, the more it will force the shoulder inwards. After the explanation which I have given of the nature of the displacement, I scarcely need remark, that this action of the bandage is contrary to the proper object in view, viz., that of inclining the shoulder outwards. The French surgeons, who seem to have devoted great attention to the treatment of fractures, have contrived a better method — one that is more judicious and efficient. Desault, the great surgeon at the Hôtel Dieu before Dupuytren, employed a cushion or compress, thick at the upper part, and thin below, or formed like a wedge. He put the thick end of this wedge-like compress immediately under the axilla, and fastened it there by means of two pieces of tape passed over to the other shoulder. Now this compress, when the humerus is pressed close to the side, has the effect of throwing the head of that bone outwards; so that Desault, in truth, made the humerus a lever, with which he inclined the shoulder outwards, upwards, and backwards, and the wedge-shaped compress was his fulcrum. The elbow ought to be confined and supported in a sling, and kept close to the side with a bandage. Various mechanical inventions are sold for the cure of broken clavicles; but, so far as I can judge, if we understand the indications to be fulfilled, we shall always be able to accomplish every purpose with the aid of a compress, roller, and sling.

Boyer employs first a belt, which is buckled round the chest; secondly, a piece of dimity or quilted cloth, furnished with four straps, and intended to be put round the arm. With these straps, the arm is fastened to so many buckles on the belt. Thirdly, Boyer employs a sling to support the fore-arm and elbow. When the fracture is within the coraco-clavicular ligament, greater attention will be necessary, than in other instances, to keep the displaced fragment upwards, outwards, and backwards, because the degree of displacement is more considerable.

If a young female of the higher class of society were to break the clavicle in the latter situation, she should not merely be treated with mechanical means, but kept quiet in the recumbent position for two or three weeks, because any deformity of the neck, caused by irregularity in the union of the bone, which it is often difficult to prevent without such precaution, would be a considerable disadvantage to her.

## FRACTURES OF THE SCAPULA.

The greater portion of this bone is so deep, and so protected by thick muscles, that fractures of it rarely take place. The acromion is oftener broken than any other part, and next the lower angle. The coracoid process is sometimes fractured, but much less commonly than is generally believed; and, I think, the same observation may be made with regard to the neck of the scapula, which is so strong and so well guarded from the effects of external violence, that a fracture of it is by no means a common occurrence. In some instances, portions of the glenoid cavity are broken off; but this also is an event which is oftener talked of than really met with. The body of the bone is but seldom broken. Its fractures may be perpendicular, but the greater number of them are transverse. Sometimes the scapula is fractured in more than one place; and it may be broken in several pieces by great and direct external violence.

Fractures of the body of the scapula can only be produced by direct violence, as by a blow, a gunshot injury, or the passage of a heavy body over it. I know of no other way, in which such an accident can happen; and this fact explains why severe injury of the soft parts generally accompanies it. Sometimes the violence of the injury is such as to extend its effects to the thoracic viscera, and to cause effusion of blood in the chest.

When the *acromion* is *broken*, the patient inclines his head towards the injured shoulder, the arm hangs motionless by the side of the trunk; an acute pain is felt in the situation of the injury; when the patient attempts to move his arm the pain is much aggravated, and, in consequence of the deltoid being partly attached to the acromium, some of the fibres of that muscle lose their point of insertion, and therefore cannot afford due support to the humerus, which sinks down, and consequently a part of the natural fulness and rotundity of the shoulder is lost. In fact, the head of the humerus is not held in its place by ligaments, but principally by the muscles and tendons surrounding the joint. A fracture of the acromion may be known also by the presence of a crepitus; for, when we place one of our fingers on the broken part, or hold the extremity of the acromion between the finger and thumb, and then push up the humerus, or move it freely in various directions, the crepitus will be distinguishable. An interspace or irregularity may likewise be felt between the fragments. The shape or rotundity of the shoulder can be restored by pushing up the humerus; but directly the arm is allowed to descend again, the shoulder resumes the same flattened appearance, which had been noticed previously to the elevation of the limb.

If a fractured acromion be left to itself, it will generally unite either by bone or a ligamentous fibrous substance. Now, when osseous union takes place under such neglect, the outer fragment is liable to point more downward than it ought, and the shoulder to be considerably weakened; a fact, first pointed out by Cheselden. A fracture of the acromion ought to be treated nearly in the same manner as a broken clavicle. The first indication is to take the weight of the upper extremity off the shoulder, by supporting the fore-arm in a sling, and keeping the elbow well up. Another indication is to prevent all motion of the humerus, which is accomplished by means of a sling and roller. A third is to incline the head of the humerus a little outwards, an object fulfilled with the assistance of a wedge-shaped cushion. Some surgeons prefer keeping the arm raised from the side, in order to relax the deltoid muscle, a method which ought

to be adopted if the patient were obliged by circumstances to remain in bed. The acromion sometimes unites by bone; sometimes by ligament. In the museum of University College are two preparations, one of which illustrates the first mode of union; the other, the second.

When *the lower angle of the scapula is broken off*, it is displaced downwards and forwards by the action of the serratus major anticus. In the treatment, the humerus may be brought forwards across the chest, and the hand confined upon the opposite shoulder; this position of the limb, which has the effect of bringing the fragments nearer together, is adopted abroad; but, in this country, when any part of the body of the scapula is fractured, we merely apply the spica bandage, the roller employed for which, after crossing over the scapula, is carried round the joint, and then over the back of the trunk, to below the opposite axilla, whence it passes in front of the chest to the injured shoulder, which it again encircles. The roller is conveyed in the directions here enumerated, until nearly the whole of it is expended, when it is made to conclude with a horizontal circle round the thorax. Such is the celebrated spica bandage, which is of little or no use; for it fulfils no particular indication, except the trivial one of retaining in its place the soap plaster, occasionally put over the injured part. The sling is here the efficient part of the apparatus.

When the *coracoid process is fractured*, a gread deal of mischief is generally done to the soft parts of the shoulder, just below the clavicle; for this fracture can only happen from great and direct violence. Hence the nature of the injury of the bone is often concealed by the great degree of swelling. Hence also much of the treatment consists at first in measures for diminishing the swelling, as venesection, leeches, cold lotions, &c. The coracoid process, when broken off from the rest of the scapula, is liable to be drawn downwards by the short head of the biceps, the coraco-brachialis and pectoralis minor, the muscles connected with it; they ought, therefore, to be relaxed. In one complicated instance, dissected by Mr. South, the coracoid process was broken, about half an inch from its tip, into two unequal pieces, the smaller of which remained connected above with the triangular ligament, and below with the short head of the biceps, which had pulled it down as far as the ligament would allow.* In the treatment, the shoulder should be kept quiet, which is effected by keeping the arm at rest with a sling and roller; for if the arm be motionless, the shoulder will also remain quiet.

*Fractures of the neck of the scapula* are not common accidents, but they are possible, and liable to be mistaken for dislocations of the humerus downwards, inasmuch as the weight of the limb carries the arm down along with the glenoid cavity of the scapula, and a hollow is felt under the acromion.

However, the difference between the two cases may readily be perceived, by attending to the following circumstances. In a dislocation, there is no crepitus; we cannot move the humerus about without opposition, as we can when the neck of the scapula is broken; the head of the humerus can be felt either in the axilla, or under the pectoral muscles; the axis of the humerus is changed; and the motions of the arm are stiff and confined. But, in a fracture of the neck of the scapula, we cannot feel the head of the humerus in either of the situations which I have specified; a crepitus may be distinguished when we take hold of the coracoid process, and the humerus is pushed up and moved about;

* J. F. South in Med. Chir. Trans. vol. xxii. p. 105.

no particular resistance is then made to the motion of the arm; and the proper shape and position of the shoulder and arm are easily restored by pushing the humerus upwards; but, as soon as the support is removed, the deformity returns.

The treatment consists in keeping the head of the humerus inclined outwards, by means of a thick cushion below the axilla; in supporting the elbow effectually with a sling; and in preventing all motion of the humerus by binding it to the side of the chest with a roller.

### FRACTURES OF THE HUMERUS

Are distinguished into those which take place higher up than the insertions of the pectoralis major and latissimus dorsi muscles; into those of the middle of the shaft of the bone; and into others nearer the elbow. Instances have been known, in which the fracture was situated precisely in the true neck of the bone: Sir Astley Cooper had an opportunity of dissecting a subject, in which he found the fracture actually placed, as I have mentioned, within the capsular ligament. No bony union had occurred; the fragments being joined together by means of a ligamentous substance.

*A fracture, through the anatomical neck of the bone,* at the tubercles, is a case which has lately been further considered by the same experienced surgeon. He describes the accident as being of frequent occurrence in young persons; as happening more rarely in the old; and still more rarely in the middle age. In children, it arises from a fall on the shoulder, and it has been known to be complicated with a fracture of the clavicle. As the head of the bone remains in the glenoid cavity, the shoulder does not lose its rotundity as in a dislocation. A projection of bone is perceived upon the point of the coracoid process; and when the elbow is raised and brought forwards, this projection is rendered very conspicuous. By drawing down the arm the projection is removed; but it immediately reappears on the extension being discontinued. The motion of the shoulder is painful; and the child can only raise the arm with the other hand; and the elbow is with difficulty raised from the side. After the accident, a great quantity of ossific matter is thrown out from the periosteum and fractured neck of the shaft, but very little from the broken head of the bone. In one of Sir Astley Cooper's preparations, a cup of bone is formed upon the fractured neck, so as to prevent the head from being separated from it.

In a young subject, Sir Astley Cooper recommends treating this case by binding a splint on the front and back part of the arm with a roller; placing a pad in the axilla; and using a clavicular bandage; the hand, but not the elbow, being supported in a sling. As in old persons the injury is more severe, leeches, evaporating lotions, and quietude, are to precede the application of the mechanical means. In the young, passive motion is to be employed in a month; and, in the old, at the expiration of from two months to twenty weeks.*

When the *fracture* takes place somewhere *between the tubercles,* and *the insertions of the pectoralis major, coraco-brachialis, latissimus dorsi, teres major, and deltoid,* the upper fragment has a tendency to be drawn outwards by the supra-spinatus, infra-spinatus, and teres minor, and the lower fragment to be pulled inwards by the latissimus dorsi and pectoralis

* Sir Astley Cooper in Guy's Hospital Reports, vol. iv. p. 277.

major, and at the same time upwards by the biceps, coraco-brachialis, and long portion of the triceps.

Fractures of the upper part of the humerus should be discriminated from dislocations. In a fracture, as the head of the bone is yet in the glenoid cavity, there is not the hollow under the acromion remarked in a dislocation: however, there may be a little depression, or diminution of the rotundity of the shoulder, in consequence of the lower fragment being sometimes not displaced upwards so as to produce a shortening of the limb, but, on the contrary, drawn a little downward by the weight of the part, so as to put the deltoid on the stretch, and thus, in one respect, a degree of resemblance to a dislocation may be produced. On careful examination, however, the head of the humerus may be felt in the glenoid cavity, and the shaft of the bone does not offer that resistance to being moved about in various directions, which is experienced in a dislocation. In the latter case, the head of the bone may generally be felt either in the axilla, or under the pectoral muscles: in a fracture, there is a crepitus; but, in a dislocation, this symptom is absent.

In the *fracture between the tubercles and the insertions of the above-named muscles*, when the elbow is moved upwards, the broken extremity of the lower fragment projects on the inner side of the coracoid process, and it sinks when the support of the elbow is removed. When the arm is rotated at the elbow, the broken end of the main portion of the bone is felt to roll. There is no marked depression under the acromion, or but very little from the deltoid muscle being drawn down. The motion of the shoulder is exceedingly painful; and one or more of the fingers are generally painful, or contracted, from irritation of the axillary plexus. The diagnostic signs are considered by Sir Astley Cooper to be, the lodgment of the head of the bone in the glenoid cavity; its being unaffected by rotation of the elbow; the fractured neck being perceptible under the pectoral muscle; and the surgeon being able to move the arm more freely, than in other fractures of the neck of the bone.*

Mr. Robert W. Smith has made some interesting remarks on a fracture now and then met with, and the symptoms of which may completely perplex a practitioner, not aware of the possibility of its occurrence. The injury of the upper extremity of the humerus is of the following kind:— "A fracture, traversing the upper part of the bicipital groove, detaches the greater tubercle of the humerus; thus annulling the action upon that bone of the supra-spinatus, infra-spinatus, and teres minor. The folds of the axilla, the subscapularis, and the anterior portion of the deltoid, then act almost unopposed, and draw the head of the bone forcibly inwards, against the inner part of the capsular ligament; and if, at the same time, the inner border of the glenoid cavity be broken, the head of the bone passes still further inwards, and beneath the coracoid process, amounting at length to an actual displacement, which is permitted by the increased size of the joint, just as a displacement of the head of the femur will often be the consequence of a fracture of the acetabulum." Mr. Smith considers it not very difficult to distinguish a fracture of the greater tubercle from a luxation of the head of the humerus. "One of its most remarkable and diagnostic features is the great increase in the breadth of the articulation: moreover, the glenoid cavity is not entirely abandoned; the acromion process is not as prominent as in luxation; the displacement is very readily produced. We cannot depress the deltoid

* Sir Astley Cooper in Guy's Hospital Reports, vol. iv. p. 281.

muscle, as in dislocation; and lastly, the violence which produced the lesion, has been directly applied to the injured part." Mr. Smith suspects, that bony union of such a fracture would be difficult to effect.*

Fractures of the middle of the humerus are very common, and easily recognised; for when the fracture is oblique, there is a shortening of the limb, and not only does displacement happen in this, the longitudinal direction, but there is also an angular deformity, the limb being flexible in the situation of the injury, in consequence of the solution of continuity in the bone. A crepitus will likewise be readily perceived, so that no difficulty can present itself in the diagnosis.

Fractures situated towards the elbow sometimes extend into the joint, and either the inner or the outer condyle may be detached. A fracture of the external condyle produces pain in the movements of flexion and extension of the elbow; but Sir Astley Cooper deems the crepitus, occasioned by the rotatory motion of the radius, the principal diagnostic symptom. If the portion of the condyle broken off be large, it is drawn a little backwards, and the head of the radius with it; but, if the portion be small, this displacement does not occur. By a careless practitioner, an oblique fracture, detaching the internal condyle, may be mistaken for a dislocation of the ulna backwards; but the error will not happen if it be recollected that, in such a fracture, there will be crepitus, and that, after we have apparently reduced what may be supposed to be a dislocation, the displacement will immediately return on the limb being left to itself. But, of all accidents about the elbow, that most likely to be mistaken for a dislocation is a separation of the lower epiphysis of the humerus in a young subject, the olecranon projecting considerably backward. The part is readily restored to its proper shape, but, on being left to itself, the deformity immediately returns.

In the treatment of fractures of the humerus, the principal indications, after the requisite extension, counter-extension, and coaptation, have been performed, are, first, to support the fragments duly in their proper position with respect to each other; secondly, to prevent all motion, not only of the broken bone itself, but also of the ulna and the radius.

When the fracture is situated above the insertion of the pectoralis major and latissimus dorsi, Sir Astley Cooper recommends splints, the clavicular bandage, and the wedge-shaped pad in the axilla, with its broader part upwards; but, says he, "above all, it is necessary to permit the arm to hang by the side unsupported at the elbow, so as to let the weight of the arm be a constant source of extension upon the broken end of the bone." In one case, Mr. Tyrrell failed in keeping the fracture in a state of coaptation, until he had recourse to a rectangular splint, a part of which rested against the side, while the arm, raised to a right angle, reposed upon the other part of it.

When the fracture is situated in the middle third of the humerus, it is usual to apply either two or four splints; some practitioners use four, and others only two; one on the outer part of the arm, and the other on the inner side of it. A sling is always necessary. An assistant is to take hold of the elbow and hand, and support the fore-arm, while the surgeon puts on the apparatus; during which part of the business, the former should make a little extension, so as to bring the ends of the fracture in apposition.

When the fracture takes place more towards the elbow joint, common

* R. W. Smith in Dublin Journ. of Med. Science, vol. xii. p. 224.

splints are deficient in one material respect; namely, they cannot control the movements of the radius upon the articular surface of the humerus. Such splints can operate also but trivially and imperfectly, even in steadying the fragments of a fracture so low down; for only a small part of the apparatus extends below the solution of continuity. Of late years, therefore, it has been customary in cases of this description to employ an angular splint, one part of which is adapted to the inner side of the arm, and the other part to the palmar side of the fore-arm. I consider this apparatus far more efficient, and better calculated to fulfil scientifically the chief indications. The angular splint, put on in the manner I have explained, acts powerfully in keeping the humerus steady, and in preventing all motion of the elbow-joint and bones of the fore-arm. Simple as the contrivance is, and essential as it is to the successful treatment of fractures near the elbow, it has only been employed a few years. Of course, the arm is to be put in a sling in this, as well as in other fractures of the humerus.

When the outer condyle is detached, we should relax the muscles arising from it, which is accomplished by placing the hand in the supine position, with the fingers extended; on the contrary, when the inner condyle is broken off, the muscles, arising from that process, should be relaxed, which is done by placing the hand in the state of pronation, with the fingers bent. If the hand be kept supine, the angular splint, already described, will not fit the limb; and another kind of splint, which is also an angular one, but so contrived as to accommodate itself to the front of the arm, will be useful, with a corresponding one for the posterior part of the limb.

If, when a surgeon is called to a fracture of the humerus near the elbow, he should not happen to be provided with angular splints, I recommend him to use strong thick pasteboard, which, after being softened in water, is to be applied. When dry, it will form an excellent case for the limb, answering in every respect as well as the angular splint.

In the treatment of fractures of the lower end of the humerus, passive motion should begin at the expiration of three weeks in a child, and of four in an adult, in order to prevent anchylosis.

Sometimes the humerus is first dislocated into the axilla, and its head then broken off, which is thrown on the inner side of the inferior costa of the scapula. Sir Astley Cooper has seen many of these cases in the living, and has dissected three in the dead. In one of the latter, the fractured neck of the shaft of the humerus was situated in the glenoid cavity, widely separated from the head of the bone; and the end of the broken bone had formed with the glenoid cavity a new and good articulation, with a capsular ligament over it, partly of new production.

With regard to the diagnosis, the depression of the shoulder is less striking than in simple dislocation into the axilla; the head of the bone can be distinctly felt in the latter situation, but does not roll when the rest of the humerus is rotated; a crepitus may generally be felt, if the elbow be raised outwards, and the arm rotated; the end of the shaft advances towards the coracoid process, and though readily moved back, it easily slips forward again; and, lastly, the violence required for the production of this accident being greater than that causing a simple dislocation, the degree of contusion and the pain and swelling are more considerable. Here extension is only useful in bringing the upper end of the shaft into the glenoid cavity, where a useful joint is formed. The head of the bone

is not acted upon by it. A pad is to be placed in the axilla, a clavicular bandage used, and the arm supported in a sling.*

### FRACTURES OF THE FORE-ARM

Are remarkably frequent. Fractures of the radius perhaps happen as often as those of any other bone in the body, except the clavicle; and the reason of this is, because it is articulated with the carpus, and has to receive all the force communicated to the hand in falling, and indeed on every other occasion. When a person falls, he stretches out his hand to save himself; this part then comes violently in contact with the ground, and the force is immediately communicated from it to the radius, which bends and gives way generally in its central portion, but sometimes near the wrist, a fracture of the upper end of the radius rarely or never happening in this manner. The majority of fractures of the radius take place in its middle third, or near the wrist; and when the upper part happens to be broken, the injury is produced by a blow, or some species of direct violence. Another reason why the radius is oftener fractured than the ulna is, that the former is situated at the outer and upper part of the fore-arm, so that it is more exposed to the action of direct violence than the neighbouring bone.

When a fracture of the radius is suspected, we should first inquire, whether the patient can or cannot perform the movements of pronation and supination of the hand; for if he can do these well, then we may be certain that the radius is not broken. Or we may take hold of the patient's hand and rotate the radius for him, while the fingers of our left hand are placed upon it. If the bone is not broken, the upper portion of it will follow the movements of the hand, as it always naturally does; but if it is broken, considerable pain will be felt on attempting these motions of supination and pronation, — there will be a crepitus; and the upper fragment will remain motionless. In many instances there is displacement, the lower portion of the bone being in the prone position, and the upper in the supine one; and the ends of fracture tending towards the inter-osseous space. There can be no alteration in the length of the bone or limb, while the ulna remains perfect, aud serves as a kind of splint.

When *both bones* are *broken*, the nature of the accident is still more obvious, because there is an angular deformity of the limb, and a distinct crepitus, as well as a loss of the motions of supination and pronation.

*Fractures of the ulna* alone are generally produced by direct violence, as blows, kicks, &c.; for any force or violence communicated to the hand has little or no effect upon that bone. This circumstance enables us at once to understand why, when the ulna alone is broken, it is generally by direct violence; and why, also, when both bones are simultaneously broken, it is most commonly also by direct violence, such as the passage of a heavy body over the arm, or a violent fall, or blow on the injured part.

When the radius is broken, we should bend the elbow, and then make a little extension and counter-extension, taking care to avoid pressing the ends of the fracture into the inter-osseous space. It is a grand point in the treatment to preserve the inter-osseous space perfect; for, if we neglect this indication, the radius and ulna may grow together, and the motions of supination and pronation be for ever lost. Splints for the fore-arm, therefore, should not be jointed longitudinally, but be rather of a flat or trivially excavated shape; and in particular, a tight bandage, which

* Sir Astley Cooper in Guy's Hospital Reports, vol. iv. p. 272.

would depress the radius too much against the ulna, ought not on any account to be employed. Two splints are commonly put on; and, after the reduction, either no roller at all should be applied directly to the fore-arm itself, or merely a slack one. Then one of the splints, properly padded or lined with soft materials, is to be laid along the inner part of the fore-arm, from the bend of the elbow nearly to the ends of the fingers, and another along the outside of this part of the limb. It is generally considered best to keep the radius nearly in the mid-state between pronation and supination. Sometimes, when the radius is broken near the wrist, and a good deal of swelling is present, we might be inclined to suppose the case a dislocation; but generally there will be no difficulty in making out that the case is a fracture, for (to say nothing of the rarity of such a dislocation) the nature of the injury is generally indicated by a crepitus, except in young subjects, in whom the case is often a mere separation of the epiphysis. We can also constantly feel the styloid process below the solution of continuity. In this case, if displacement occur, the lower fragment is mostly drawn backward by the action of the long supinator and extensor carpi radialis, but, in few instances, forward by the influence of the pronator quadratus. The reason of the greater frequency of the displacement backward is in some measure explained by the patient usually falling directly on the hand at the period of the accident, by which means the fragment is forced backwards. The fragments must be put into the proper position, and splints and a sling employed, due care being taken to prevent the hand from inclining too much downwards.

*The olecranon* is most liable to be fractured by falls on the elbow, and not usually by the action of muscles, as is the case with the knee-pan. It may be broken at its point, or more towards its base. In some instances, when the fracture occurs near its base, and the ligamentous fibres, extending from the olecranon to the coronoid process of the ulna, are not completely ruptured, the upper fragment may not be displaced or retracted; but if those fibres be completely torn, the upper fragment will be drawn upwards by the triceps. The extent of separation between the fragments will also be influenced by the circumstance, whether the elbow be bent or extended; for, in the latter position, the lower fragment does not contribute to the displacement at all; but, when the arm is bent, the lower fragment recedes, and materially increases the interspace between the fracture. When the upper fragment is drawn away from the lower one, no crepitus can be perceived, unless the arm be extended, and the upper fragment pressed down; but the nature of the case will always be clear enough, even without this symptom, except when the limb is much swelled. Indeed, the swelling, consequent to fractures about the elbow, is frequently prodigious, and comes on with surprising rapidity; so that it is an object always to examine the limb well at an early period, before any obscurity has arisen from the enlargement of soft parts. Whether the patient retains much power of extending the arm, materially depends upon whether the ligamentous fibres, spread over the olecranon from the coronoid process, happen to be torn or not; because if they should be completely ruptured, that power would be exceedingly diminished.

There is a difference of opinion among practitioners, respecting the best mode of treating fractures of the olecranon. We should naturally suppose that the limb ought to be kept extended, the greatest approximation of the fragments being thus produced; but Désault, the great predecessor of Dupuytren, at the Hôtel Dieu in Paris, objected to this posture of

the limb, on the ground that, although the fragments grew together, yet they were separated at their internal edges, and the joint remained permanently weak. Hence he recommended a middle position, between the half-bent and perfectly extended state, or, in other words, a trivially bent position of the elbow. The same practice is also preferred by a few surgeons of the present day, as being, according to their judgment, less irksome to the patient and more efficient, inasmuch as the cure takes place without any imperfection being left in the action of the joint. But I do not consider this point as one entirely settled; for several practitioners of the greatest experience, among whom is Sir Astley Cooper, are decidedly of opinion, that the extension should be complete. Sir Astley Cooper finds, as other surgeons do, that the olecranon generally unites by ligament; and he observes, that if the limb be kept somewhat bent, there will be a greater length of the ligamentous substance, and the joint will be proportionably weaker. The late Mr. Sheldon was an advocate for complete extension; and, so far as my own experience goes, I have found no reason to follow Désault's advice on this matter. In fact, I have never seen any ill consequences from keeping the arm extended, and mean to follow this method, until its disadvantages have been more clearly proved. Frequently, in a case of fracture of the olecranon, we cannot apply the bandage, or any splint, until the fourth or sixth day after the accident, and sometimes not till later. Now this is one example, in which the good general rule of applying the splints, as soon as possible, to a broken limb, should be dispensed with; our duty is to try to reduce the inflammation and swelling before any apparatus, that makes pressure on the limb, can be advantageously applied. We are called upon, therefore, to employ leeches, cold evaporating lotions, purgatives, and even bleeding from the other arm, if the inflammation and swelling are very considerable. The inflammation having been reduced, we put on a figure of 8 bandage, which will answer pretty well, especially when a well-padded splint is laid along the front of the limb, in order to prevent flexion of the joint. If we choose to adopt the plan of slight flexion, we may put on a splint, constructed with a kind of hinge, or joint, exactly in front of the elbow, and furnished with a screw, by means of which its degree of flexion can be regulated and fixed.

In *compound fractures of the olecranon*, in consequence of the degree of inflammation and swelling sure to ensue, it is best not to apply any splint or bandage at first; but to lay the limb on a pillow, close the wound, and try to keep down inflammation of the joint with cold evaporating lotions, leeches, venesection, and saline purgative medicines. If matter form, an early opening is to be made. Bad comminuted fractures of the olecranon sometimes occasion a necessity for amputation, as was exemplified in the case of Charles Hussey, under my care in University College Hospital, in November, 1835.

When the *coronoid process* is broken, and the arm extended, the olecranon projects back in such a degree as to create the appearance of a dislocation; but it may be known that this is not the case, because, directly the arm is bent, the olecranon returns to its natural place again; and in addition to this circumstance, a crepitus can be felt. The treatment consists in keeping the fore-arm and elbow at rest in the bent position, and applying a figure of 8 bandage round the joint, after having had recourse to leeches, cold lotions, &c. for three or four days, in the event of the swelling being considerable.

But fractures about the elbow are not always so simple as the cases we

have been noticing; they are sometimes very complicated. Thus one preparation in the museum of University College illustrates a case, in which the ulna is broken at the elbow, the posterior fragment being displaced backwards by the action of the triceps; the coronoid process is broken off; the upper head of the radius is also dislocated, from the lesser sigmoid cavity of the ulna, and drawn upwards by the action of the biceps. In this complicated accident, the ulna is broken in two places.

### FRACTURES OF THE CARPUS, METACARPUS, AND BONES OF THE FINGERS.

The carpal and metacarpal bones can be broken only by great direct violence, as by gun-shot wounds, the action of machinery on the parts, or the passage of the wheel of a heavy carriage over them. Now, under these circumstances, so much injury is frequently done to the soft parts, that it becomes necessary to amputate without delay. However, if the case will admit of an attempt being made to preserve the limb, or any part of the hand, the main indications will be, to remove all loose splinters of bone which are near the surface, to apply for the first three or four days light superficial dressings and cold lotions, and afterwards emollient fomentations and poultices, till the inflammation has subsided and the sloughs have been detached. If there has not been much bleeding from the part, leeches may be applied to it. The bones of the fingers are seldom fractured, for they can only be broken by direct violence. The treatment is simple, the injured finger merely requiring to be supported with pasteboard, and the hand kept in a sling.

### FRACTURES OF THE PELVIS.

The particular shape of the pelvis, the sort of circle or arch which it represents, and the vast strength and thickness of its several bones, are circumstances at once apprising us, that the pelvis can be broken only by great and extraordinary degrees of violence directly applied to it; as by the passage of a heavy waggon over it, or by its being pressed between the wheel of a carriage and a wall or post. From the manner in which these fractures usually happen, it is manifest, that the injury done to the bones is unfortunately not the most serious part of the mischief; the soft parts generally, and often the bladder or colon, being seriously injured. Sometimes the bladder or intestines are ruptured; sometimes blood is extravasated either in the abdomen or the pelvis; and, in other instances, where the rami of the ischium and ossa pubis are broken, spiculæ of bone may be driven into the bladder or urethra. A preparation in the museum of University College illustrates a case, in which there was a fracture of the ramus of the ischium, and one of the fragments tore the urethra; the consequence was an effusion of urine in the cellular substance of the perineum, and sloughing of all the parts among which the urine passed. Another preparation, in the same collection, was taken from a person, whose rectum was lacerated by a portion of fractured sacrum. In such cases, one frequent consequence is a paralysis of the bladder and lower extremities. In gun-shot fractures of the pelvis, spiculæ of bone may be forced completely into the bladder, and afterwards become the nuclei of calculous formations, so as to oblige the patient to submit to the operation of lithotomy.

Fractures of the anterior superior spinous process, and of the crista of the ilium, may take place, without much additional mischief; but other fractures of the pelvis are frequently fatal. I have seen two cases, in

which the accident arose from the passage of heavy waggons over the pelvis: one of these patients died in a quarter of an hour. There will sometimes be effusion of blood in the abdomen; and, in other instances, the bladder or intestines are ruptured. The fracture sometimes extends through the acetabulum, and then the case is liable to be mistaken for a dislocation of the hip; because the superior fragment is drawn upwards, and the limb consequently shortened, while the trochanter major is thrown a little forward: and thus there will be two symptoms of a dislocation of the hip. However, if the hand be applied to the crista of the ilium, and the thigh bone be then rotated, there will be no difficulty in making out the accident; for there will be a crepitus, and not that considerable resistance to motion of the femur, so invariably experienced in a dislocation.

With regard to the treatment of fractures of the pelvis, if we except antiphlogistic measures, there is not a great deal to be done. A bandage might be applied round the pelvis; but, as its usefulness is questionable, the best practical surgeons do not have recourse to it. We should bleed the patient freely, to prevent inflammation of the pelvic viscera; and if the bladder or urethra were ruptured or paralytic, a catheter should be passed, to prevent effusion of urine. In the latter case, we should keep the catheter in the passage, lest the urine escape by the lacerated opening into the cellular membrane, whereby great, and sometimes fatal, mischief would be produced. Repose, antiphlogitsic measures, and attention to any particular symptoms which may arise, but especially retention of urine, are the chief objects in the management of fractures of the pelvis.

Some fractures of the pelvis have a favourable termination, the bones uniting, and the patient recovering. One preparation, in the museum of University College, was taken from a person, in whom the sacrum and os innominatum had both been fractured; yet, the broken parts united, so that the patient probably lived long after the injury. The chances of recovery depend, however, on the degree of violence with which the injury is inflicted, and its effects on the viscera; and, if the bladder, bowels, medulla spinalis, and other important organs escape injury, the patient may ultimately get well. Sometimes he dies of peritonitis, of which I have seen instances.

### FRACTURES OF THE THIGH BONE

Are divided into three classes, in respect to situation: the first comprises those in the upper part, or in the neck, of the bone; the second, such as take place in the middle third of its shaft; and the third, fractures situated in the lower third of the shaft, or towards the condyles. Those in the middle of the shaft are most frequent in persons under a certain age; but in old subjects, fractures of the neck of the bone take place with remarkable frequency.

Fractures of the shaft of the femur may be *simple* or *compound*; they may also be *complicated* with a wound of the femoral artery, which, however, is a rare occurrence. Sir Astley Cooper met with such a case, in which it was necessary to perform amputation. Fractures of the thigh bone may also be *double*. In children, the shaft is frequently broken in the *transverse* direction; but, in other subjects, the fissure is most commonly *oblique*. The fracture may be caused by direct violence, as by the passage of the wheel of a heavy carriage over the limb, the fall of a heavy body upon it, the kick of a horse, and various other kinds of injury; but,

on other occasions, the femur is broken by some description of force, which first bends it, and when it has yielded as much as it can, it breaks, generally at some point of its middle third.

What are the symptoms of a fracture of a shaft of the thigh bone? — Supposing the fracture to be oblique, a shortening of the limb is usually noticed, the lower fragment being drawn behind the upper one, and a little inwards; the limb is flexible in the situation of the fracture; the lower fragment, with the knee, leg, and foot, is rotated outwards, all the stronger muscles, acting upon that part of the broken bone, tending to twist it in this direction. Although the lower fragment is commonly drawn upwards and inwards behind the upper one, it is possible for the lower fragment to be displaced in a different manner, and so as to lie in *front* of the upper one; but this occurrence is a deviation from what is ordinarily seen, and is explicable by the particular mode in which the accident has been produced, viz. by the application of direct violence, and the operation of the force upon the posterior part of the limb, so as to propel the lower fragment forwards. Another symptom of a broken thigh is a crepitus, that can be distinctly felt on moving the limb. If the fracture be an oblique one, together with the shortening of the limb, there is a rotation of it outwards, and, what is termed the angular deformity, the axis of one portion of the bone not corresponding to that of the rest of it. The retraction of the lower fragment constantly occasions an increased bulk, or fulness of the upper part of the thigh, because the attachments of several of the muscles are brought nearer together, and their bellies swelled into a preternatural shape. The truth of this observation is well illustrated in the state of the adductor muscle, which, by forming a considerable prominence at the upper and inner part of the thigh, communicates to it a very unnatural shape. That it is the muscles which produce the displacement of the fractures, cannot be doubted, because, if the muscles of the broken limb were paralytic, there would not be any retraction of the lower fragment, or shortening of the thigh. In a person affected with paralysis, there might be no shortening of the limb at first, or while the muscles were incapable of action; but if the paralytic affection happened to yield before the fracture had united, a retraction of the lower fragment would yet ensue. Indeed, such a case is recorded by Bichat. When the accident took place, all the muscles of the lower extremity were in a paralytic state; and though the fracture was an oblique one, no retraction whatever of the inferior fragment followed. The moxa was applied, and, in a few days, the muscles began to regain their power of action; and in proportion as this improvement was effected, the ends of the fracture acquired a tendency to displacement, not previously evinced, and a considerable retraction of the lower fragment ensued. In transverse fractures of the shaft of the femur, no shortening of the limb may happen, yet the angular deformity and rotation outwards will be observed. The foregoing observations render it manifest, that it is chiefly the lower portion of the broken femur which is displaced; but it would be incorrect to regard the displacement as exclusively affecting only the lower fragment. When the patient is placed on too soft a bed, which yields to the weight of his trunk, the pelvis sinks, and pushes the upper fragment along with it, which thus has a disposition to be propelled over the lower one. Supposing also the fracture to be situated just below the trochanter minor, the psoas and iliac muscles, attached to that process, might act with great effect in displacing the upper fragment in the direction forwards and upwards.

It was principally with reference to fractures of the lower extremity, that Pott recommended the plan of attending to the relaxation of the muscles as the best means of facilitating the reduction, and promoting the maintenance of the fragments in their right place. One would suppose, from several passages in his treatise, that he really imagined it possible completely to relax all the muscles by a certain position of the limb, and this in such a manner as entirely to deprive them of all power of disturbing the ends of the broken bone. No position of the limb, however, will do so much as this eminent surgeon was induced to believe. A certain position may relax those muscles, which have the greatest power of disturbing the fracture; yet the mass of muscular fibres remaining unrelaxed, will always be sufficient to derange the fracture; and consequently position alone, however important and useful it may be, will not accomplish strictly what Mr. Pott represents; it will not effectually deprive the muscles of the power of disturbing the fracture. This truth enables us at once to understand how necessary it is to attend to other means for maintaining the reduction, and especially to avail ourselves of the best mechanical contrivances for this purpose. So correct is the principle which I am now adverting to, that if the particular position of the limb, selected for the purpose of relaxing the muscles, were to be incompatible with the employment of the most efficient apparatus, then, the treatment would be erroneous, because, advantageous as position may be in relaxing the most powerful muscles connected with the broken limb, the aid of an efficient apparatus is still more important. From what is stated in my general observations on Fractures, in the first section of this work, even the superior usefulness of relaxing the muscles is now sometimes disputed, and the plan of keeping them in the opposite condition advocated.

Broken thighs are treated on three different plans, each of which is occasionally preferred. In the first, the limb is kept extended, and the patient lies on his back; a position disapproved of by Pott, because it does not relax those muscles which have the greatest power in producing displacement, namely, those which are capable of drawing the lower fragment upwards, inwards, and behind the upper one, or, in other terms, the muscles arising from the pelvis, and inserted either into the femur, the patella, the tibia, or the fibula, and which, making the pelvis their fixed point, and the portion of the limb below the fracture their moveable one, displace the lower fragment in the foregoing direction.

In the extended position, various kinds of long splints are employed. Désault employed three splints; one on the outside of the limb, a second on the inside, and a third on the upper part, or front of the thigh. He was very particular in placing the patient on a firm unyielding bed; for if the pelvis sinks into a hollow of the bedding, this change will inevitably derange the position of the fragments. He began with applying the eighteen, or many-tailed bandage, then a long splint, well padded, on the outer part of the limb; he next put a handkerchief or band on the perineum, or rather on the tuberosity of the ischium, the ends of which handkerchief or band were carried through a fissure in the upper part of the long external splint, and the effect of this was to prevent the splint from slipping upwards. Then the foot was also made steady by passing a handkerchief or bandage through a fissure in the lower part of the splint, which was brought over the foot across the instep, and then fastened to the splint again. Thus the limb was fixed and secured both at the hip and the foot. Other splints, however, were made use of: one at the inner side of the limb, extending from the groin to the foot; and a

shorter one, reaching along the front of the thigh from the groin to the kneepan.

Boyer invented another apparatus, which was also intended to be used in the straight position of the limb. His long external splint is furnished with a screw at the lower end, by means of which it can be lengthened or shortened at pleasure. The principle of his apparatus is to keep up permanent extension; but, for the screw to have its full effect, it is necessary that the upper end of the splint should be securely fastened to the pelvis. For this latter purpose, Boyer put a thigh-strap over the tuberosity of the ischium, much in the same manner as Désault did the handkerchief, or band; but the portion of the thigh-strap below the crista of the ilium, on the outside of the pelvis, had a kind of fob or pocket in it, calculated to receive the upper end of the splint, and thus prevent it from slipping upwards, or moving at all laterally. The limb having been first put up with the many-tailed bandage, the long external splint, lined with soft materials, is applied; the foot is next fixed much in the same way as in Désault's plan, and the inner and upper splints are put on, the extension being kept up by lengthening the outer splint, which is done by turning the screw at the lower part of the splint. In University College Hospital, we adopt the straight position, and employ only the external long splint, which, with a handkerchief, rolled up and filled with soft materials, and common rollers, compose the whole of the apparatus. If we ask ourselves, what are the indications to be fulfilled? the answer is, to keep the broken part of the bone steady; to maintain the limb to its proper length; and to hinder it from turning too much either outwards or inwards. Now, for these purposes something is needed as a fulcrum, to which the limb is to be bound. The splint is converted into this fulcrum by its upper end being fixed to the side of the pelvis with the handkerchief, that passes under the tuberosity of the ischium, and the ends of which are then conveyed up to the fissure in the upper part of the splint, and there fastened to it, so as to keep it from slipping upwards. When, therefore, the limb has been bandaged, the long splint placed along the outer side of the limb, and the foot and rest of the limb have been secured in the best position to this splint with rollers nearly as far up as the fracture, the next thing is to make as much further extension as may be needed, and then fasten the two ends of the handkerchief to the notch in the upper end of the splint, so as to prevent it, and of course the limb, which is bound to it, from becoming retracted. These are the simple and admirable principles, on which alone fractures of the thigh can be very successfully treated.

The second plan of treating fractures of the shaft of the femur is that recommended by Pott, in which the limb and the pelvis are laid on their external side, with the thigh half bent upon the pelvis, and the leg moderately bent upon the thigh. In this method, two splints are sometimes applied, but generally four. The fracture is reduced by an assistant taking hold of the limb above the broken part of the bone, and performing counter-extension, while the surgeon makes extension from a part of the limb below the situation of the injury. The patient is laid on his side, with the pelvis inclining as much as possible in the same direction. The limb is placed on its outer side, with the thigh half bent upon the pelvis, and the leg bent in a similar degree upon the thigh itself. Before reducing the fracture, the long splint, with the pad and eighteen-tailed bandage upon it, should be put under the thigh; the reduction of the fracture is then to be accomplished, and the tails of the bandage next methodically laid down, one over the other, beginning with those just

above the knee. The eighteen-tailed bandage, when neatly applied, looks exceedingly well, and is convenient; for it can be opened without the slightest disturbance of the fracture, or motion of the limb. In private practice, it is usual to apply, under the bandage, a piece of brown soap plaster to the integuments in the immediate vicinity of the fracture. By proceeding in the manner here explained, the other splints may be applied with the greatest facility. When Pott's position is adopted, one important thing is to afford due support to the foot, for which purpose a soft cushion or pillow is generally employed; and the knee must also be supported by similar means. But this treatment of broken thighs in the bent posture, with the patient on his side, is not exactly consistent with the most scientific principles. In the first place, one general principle, acknowledged by all the best practical surgeons, is that of keeping all joints in any way connected with a fractured bone, perfectly motionless; but here no measures are taken for the fulfilment of this very important object. On the contrary, the patient can move every joint without restraint. The splints do not confine either the hip, the knee, or the ankle; hence, I should say, that this is an inferior method of treatment, and I am not surprised that it should be one which occasions deformity more frequently than any other, and is losing ground from day to day in the estimation of the profession. But supposing this position were in some respects the best that could be selected, yet, as it could not be maintained for any length of time, it would prove inefficient. In fact, take what pains we may, the patient will never remain long in the posture specified, but will always turn on his back, and thus the fracture will become deranged again.

A third plan has been proposed and adopted, which consists in placing the patient on his back, with the thigh bent on the pelvis, and the leg bent on the thigh, while the limb is supported in this position on a *double inclined plane.* The most simple instrument of this kind merely consists of two boards of the requisite length, nailed together at an angle, and provided with a foot-piece, and a few pegs along the margins, to keep the pads from slipping off the apparatus. Double inclined planes, however, are now brought to great perfection; and fracture-beds, as they are called, are generally so constructed as to admit of serving the same purpose. Amesbury's apparatus, which answers as a double inclined plane, is a very good one; but, in University College Hospital, whenever I have adopted this position for a broken thigh, the preference has been given to M'Intyre's apparatus, which is more simple, and does not require, in addition to the front splint, any lateral ones, unless the thigh be very bulky; or even the eighteen-tailed bandage; a common roller being applied so as to include both the limb and the apparatus on which it lies, and, consequently, admitting of removal without any disturbance of the part. All well made double inclined planes can be fixed at any angle by means of a screw. In Amesbury's apparatus, the thigh part may be lengthened or shortened at the surgeon's option, which is an advantage, the brass part sliding very conveniently in either direction. The foot-piece also admits of being shifted, and its position and length can be adapted to the particularities of every case. If this, or any other double inclined plane, be used, we have no occasion for an under splint, because the surface of the machine itself answers the purpose of one. The ankle is kept steady by means of the leather case or slipper for the foot. M'Intire's apparatus may be used without any other splint, though when the thigh is very bulky, an anterior splint is useful. The limb, after having been

covered with a roller, is laid upon the apparatus, coaptation performed, and then the limb and apparatus together encircled with other rollers from the foot up to the pelvis. Thus the limb will be kept perfectly steady, and all the joints motionless. By means of the thigh-strap and pelvis strap belonging to the apparatus, the pelvis and lower extremity are also rendered, as it were, one piece, only moveable together. The strap is passed round the pelvis, and through the fissure in the upper part of the external splint, near the great trochanter. Amesbury's inclined plane is excellently finished, and the splints of a good shape, light, yet strong. With this apparatus, three splints are intended to be used for a broken thigh, and also the eighteen-tailed bandage. In some hospitals, the treatment of broken thighs on a double inclined plane is preferred to the method of Désault, with all the improvement and simplicity to which it has now been brought. A double inclined plane is always to be well covered with soft materials, especially the projecting part of it under the ham.

### FRACTURES OF THE NECK OF THE THIGH BONE

Are divided, first, into those which happen *within the capsular ligament;* secondly, into those which occur *on the outside of it,* or partly in this situation; and thirdly, into such as extend *through the great trochanter.*

With respect to the symptoms of a fracture within the capsular ligament, the patient will complain of severe pain in the hip; and there will be shortening of the limb. It was once calculated, that shortening might happen to the extent of from one to two inches and a half; but the observations of Boyer, and of Messrs. Earle, Stanley, and R. W. Smith *, prove, that, unless the capsular ligament be torn, no retraction of the limb in this last degree can happen. The extent of the retraction will also depend on whether or not the reflection of the capsular ligament over the neck of the bone be torn; for, in the event of its not being lacerated, there will be no shortening of the limb at all; neither will there be another usual symptom, namely, eversion of the limb. When the neck of the thigh bone is broken, as all the strong muscles attached to the shaft and trochanters have a tendency to turn the limb outwards, so as to evert the toes and knee, this is a common symptom of the accident; but if the reflection of the capsular ligament over the neck of the femur happen not to be torn, such symptom may be absent. When the limb is much shortened, we may not feel a crepitus; but if we draw the limb downwards, and rotate the foot inwards, the crepitus will then be distinctly felt. When there is displacement, the great trochanter will not form such a prominence at the side of the pelvis as it naturally does; and if there be a shortening of the limb, the same process will be found to be nearer to the crista of the ilium than in the sound state of the limb. Another symptom, accompanying and indeed resulting from the displacement of the outer fragment, is a great fulness of the upper part of the thigh, from the muscles having their attachments brought nearer together.

In a few uncommon examples, the knee and toes are actually turned inwards, instead of outwards; and the explanation given of the fact is, that the fracture takes place sufficiently towards the outside of the great trochanter, to prevent the muscles from acting on the lower fragment so as to turn it outwards, while some fibres of the glutæus medius and

* See Dublin Journ. of Med. Science, vol. vi. p. 206.

minimus, yet continuing attached to the external portion of the trochanter, retain the power of turning it inwards, and consequently the whole limb. This is one explanation that has been suggested; but it is not considered altogether satisfactory by some very good judges. It is alleged, that fractures, entirely within the capsular ligament, are sometimes attended with inversion of the limb, and to such cases the explanation proposed would manifestly not apply. Besides, as Dupuytren has remarked, why should not the great adductor muscle be more than enough to counteract the action of the anterior fibres of the glutæus medius and minimus? At all events, the cause of the occasional inversion of the limb, when the fracture is completely within the capsular ligament, if it be a fact, appears to me not at present accounted for.

When the fracture is on the outside of the capsular ligament, namely, between that ligament and the trochanter major, the retraction of the limb is greater, than in the fracture within the capsular ligament; a point, on which Boyer is corroborated by the observations of Messrs. Earle, Stanley, and Smith. This kind of accident is mostly occasioned by the application of great and direct violence; while other fractures, situated within the capsular ligament, are usually produced by slighter degrees of force. The generality of cases, which occur in London, are caused merely by the foot slipping off the curb-stone, or by falls on the hip, not always attended with great violence. The reason why so slight a cause is capable of producing this mischief, is, that, after the age of fifty, the neck of the thigh bone becomes weak and slender, and its shell thinner, and incapable of affording as much resistance to force, calculated to fracture it, as it did in an earlier period of life. It is partly on this account, that fractures of the neck of the thigh bone are so frequent in old people, and partly on account of a change in the direction of the axis of this part of the bone in them; for in consequence of its greater weakness, it bends upwards, and forms a right angle with the pelvis, instead of sloping more or less upwards from the trochanter to the head of the bone. Here another reason is discerned why fractures more easily take place in aged than young subjects; because any force, operating on the trochanter major, will break the cervix of the bone with greater certainty, when the trochanter projects very much, in consequence of the above-mentioned change in the direction of the neck of the bone. In some old subjects, in fact, we find the trochanter absolutely higher than the head of the bone, the neck having yielded thus much to the weight of the body. But the other fracture of the neck of the femur, namely, that which takes place further outwards, or more towards the great trochanter, beyond the external limit of the capsule, is generally produced by great degrees of violence; and is not particularly restricted to old subjects, but presents itself also in young ones. Therefore, when great and direct violence has been concerned, the patient is under fifty, the limb a good deal shortened, and the crepitus readily perceived, there is ground for suspecting that the fracture is on the outside of the capsular ligament, or partly on the outside of it; for sometimes the fracture is oblique, and sometimes longitudinal, and occasionally it is incomplete, the fissure extending only partially through the neck of the bone. In general, we cannot feel a crepitus in fractures within the capsular ligament, unless the limb be brought to its natural length; but, when the fracture is on the outside of the capsular ligament, a crepitus can be felt with facility. If the fracture extend obliquely through the trochanter major, there may be little or no shortening of the limb; for there is such an extent of surface

in the fractured part of the bone, and such a direction of the fissure, as are very likely to prevent this kind of displacement. In this case, we perceive a crepitus, but the foot is not so much turned out as in the other example.

When the neck of the femur has been broken, it becomes shortened, being more or less absorbed, and the head of the bone consequently taking a situation, as it were, between the two trochanters. This circumstance, having been known by those who were looking out for instances of bony union, after fractures of the neck of the thigh bone, led to a dispute on the subject; because, in consequence of the discovery, that, under circumstances of disease, the neck may be shortened, and the head assume a similar position to that observed after fractures, many examples of what were supposed to be fractures, which had admitted of bony union, were rejected on this ground. Hence, also, various specimens, picked up in churchyards and other places, and whose histories are unknown, should not be too readily considered as proofs of the bony union of a previous fracture.

Fractures of the neck of the thigh bone are more frequent in women than men, and two reasons may be assigned for this fact; first, the neck of the femur in women is naturally longer and more slender than in the other sex; and, secondly, as the pelvis is wider, the trochanters project in a greater degree, and are consequently more exposed to external violence. In this metropolis, fractures of the neck of the thigh bone happen either from the foot suddenly slipping off the curb-stone, or from falls on the side of the pelvis. In Paris, where the pavement is differently arranged, and the curb-stone is not so common, the accident is usually produced by falls on the hip. When the neck of the thigh bone is fractured, and the fragments are not separated, the reflection of the capsular ligament from one to the other not being torn, the diagnosis is generally attended with some obscurity, because most of the characteristic symptoms are absent; for instance, there is neither shortening of the limb, nor eversion of it. Yet, the patient cannot raise it from the surface on which it is deposited—he cannot lift it up from the bed; he may, perhaps, contrive to bend his leg slightly, but he cannot raise it up. Though a degree of obscurity may prevail at first, the nature of the case will mostly be apparent enough in a few days; for at this period the reflection of the capsular ligament often gives way, sometimes in consequence of the patient moving his limb too much, sometimes in consequence of the surgeon doing the same thing; but, in whatever way occasioned, it leads to a retraction and eversion of the limb.

I have already referred to the rare case where the foot and knee are *inverted*, and to the endeavour to account for it by the fracture having taken place in such a direction through the trochanter major as to leave attached to the pelvic fragment the insertions of the obturator internus, the gemelli and pyriformis, which muscles are naturally concerned in rotating the thigh outwards; while the other, or external fragment, is drawn forwards and inwards by the gluteus medius, so as to invert the limb. This explanation has not, however, been deemed satisfactory by some good judges of the subject. Supposing the action of the gluteus medius on the outer fragment to be the cause of the limb being turned inwards, it is certainly difficult to comprehend why the effect should not be counteracted by the adductor, which is a much more powerful muscle, and always disposed to rotate the femur outwards. Yet, the anomaly must, I believe, depend upon some peculiarity in the direction of the fissure.

Other explanations have been offered, one of which is founded on the well-known fact, that when the neck of the thigh bone is broken, that portion of it which remains connected to the head is sometimes forced into the cancellous structure of the outer fragment, and is immovably wedged in it. Now, if this were to happen in a particular way, it is conceived that the inversion of the limb might be produced. Dupuytren suggested another explanation, which is, that when the neck of the femur is fractured obliquely, if the inner fragment happen to be situated in front of the other fragment, then the limb may be turned outwards; but if the inner fragment be behind the other, then the limb may be inclined forwards, and the knee and foot turned inwards. This is a point in surgery still requiring further investigation.

But, one still more interesting question, relative to fractures of the neck of the thigh bone, has been, whether those which are completely within the capsular ligament, and transverse with respect to the neck of the bone, are capable of osseous union. The fact, that bony union is possible in such cases, is now completely established, and almost every museum contains specimens illustrative of it. Sir Astley Cooper possesses a fine example of it, which I have examined more than once at his house. The museum of my friend Mr. Langstaff contains one that is a complete demonstration of such union, and which, with several interesting drawings in the same collection, I have frequently been permitted, through that gentleman's kindness, to show to the surgical class of University College. The particulars of the fracture with bony union are published in one of the volumes of the Medico-Chirurgical Society of London. The bony union is complete in the shell of the bone; the centre of the fissure is united by a fibrous substance; but the osseous consolidation of it is perfect at its circumference. The patient died about two years after the accident.

Another unquestionable instance of perfect union by bone, after a transverse fracture of the neck of the femur, within the capsular ligament, is exhibited in the case of Dr. James, an English physician, who fell from his horse as he was riding near Bordeaux, and fractured the neck of the femur; he recovered from the effects of his accident, but died seven months after it of some visceral disease. On examination, the fracture was found, by Dr. Brulatour, an eminent surgeon of that city, to be united by bone; and it appears from the engraving of the part, that it was a transverse fracture of the neck, entirely within the capsular ligament. The engraving is valuable, not only on account of its showing a perfect bony union of a fracture within the capsular ligament, but also because it gives us an accurate representation of the diminution in the length of the neck of the bone, arising from absorption. Dr. Brulatour has likewise given a view of the size and shape of the head and neck of the other femur in the natural state. Thus we are enabled to see at once the difference, which has been produced in the length of the neck of the bone, and in the position of its head, with respect to the trochanters; it being, as it were, situated between them, with scarcely any portion of the neck remaining. Dr. Brulatour has also favoured us with a section of the head and neck of the femur, which was the subject of the injury. Several drawings in Mr. Langstaff's museum illustrate the various ways, in which nature attempts the reparation of fractures of the neck of the thigh bone. One drawing exhibits an immense quantity of bony matter, thrown out by the portion of the neck, or the fragment, nearest the trochanter major; together with the thickening of the capsular ligament.

Another drawing was made from a case in which anchylosis had taken place: and a third is a view of an oblique fracture of the neck of the femur, in which there would not be much, if any, retraction; bony union has occurred at the outer part of the fissure, while the rest appears to be united by a fibrous substance. A fourth drawing shows the efforts which nature has made to repair the fracture of the neck of the femur, by throwing out a vast quantity of bony matter. I remember the gentleman very well from whose case the drawing was made: he resided near St. Bartholomew's, and met with the injury by falling from the upper part of his house into the street; he lived several years after the accident, but was quite a cripple. The callus has formed a sort of new acetabulum, which, together with the increased thickness and strength of the upper portion of the capsular ligament, enabled the patient to use the limb in a certain degree. In one preparation, in Mr. Langstaff's museum, the fracture is within the capsular ligament; and the union, by means of a ligamentous fibrous substance, retains the fragments in such close contact, that Mr. Langstaff is of opinion, that, if the patient had lived long enough, the case would have terminated in bony union. Yet, the process necessary for its accomplishment, is not so easy and sure as that by which the generality of other fractures are united. When the head of the bone is completely detached, doubtless one circumstance unfavourable to bony union is the scanty supply of blood which it receives, and which consists merely of the small quantity conveyed to it through the vessels of the ligamentum teres.* Another circumstance is the difficulty of maintaining the fragments steadily in apposition; they are generally disturbed too much, and the proper apparatus is not kept on long enough. In fact, Dupuytren contends, that, in consequence of the disadvantageous condition in which the neck of the thigh bone is placed for bony union, the patient ought to be confined, and the requisite apparatus kept applied for a very long period, that is to say, from a hundred and twenty to a hundred and forty days. In this country, surgeons rarely persist in maintaining the limb quietly in a desirable posture for a space of time at all equal to what has now been specified. Mr. Langstaff, who has paid a good deal of attention to this subject, is also led to believe that, if the limb were kept a sufficient length of time without motion, the ligamentous union would generally be converted into an osseous one. The circumstance of the fracture being oblique or transverse, influences very much the facility and chances of bony union; for, if the case be oblique, part of the fissure will extend beyond the external limit of the capsular ligament, and then admit of osseous union with as much ease and certainty as any ordinary fractures.

When transverse fractures of the neck of the femur within the capsule do not unite by bone, they unite by a ligamentous substance; the

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* As the fracture is sometimes united by osseous matter, the supply of blood is, of course, not always inadequate to the purpose. From the valuable observations of Dupuytren, Cruveilhier, and Breschet, on the process by which fractures are united, it appears that the vessels of the surrounding tissues perform an active part in the work of reparation. But, as Mr. Mayo has justly noticed, these tissues are excluded by the untorn synovial and capsular membranes from communicating with the fracture. "They are sometimes, indeed, seen to make the ordinary effort towards reparation of the adjacent fracture. Thus a portion of an ossified provisional callus is often met with *external* to the attachment of the capsular membrane to the neck of the femur. But the effort is ineffectual; the callus cannot reach the fracture, whether it remains entirely disunited, or is glued together by an exudation from the ends of the bone." See Outlines of Pathology, p. 9.

capsular ligament becomes thickened and strengthened, and ligamentous bands extend from it to both fragments, and sometimes from one fragment to the other. In a few instances, another mode of reparation is established; osseous matter is thrown out by that portion of the fractured neck which is connected with the trochanters, and the callus from this source assumes a shape calculated to support within it the end of the other fragment; in other words, a kind of socket is formed in the outer fragment, which, as well as the other fragment, becomes coated with what is termed the ivory deposit, a very smooth hard substance, by means of which the friction between the two fragments is lessened, and motion facilitated; it answers, in fact, the purpose of cartilage.

With regard to the treatment of fractures of the neck of the femur, I may remark that, at one period, several surgeons considered the chance of bony union so hopeless, when the fractures were entirely within the capsule, that they did not deem it worth while to direct the treatment expressly to the attainment of such union, and they merely put the limb for two or three weeks on a double inclined plane, or on pillows or bolsters laid under the ham. Such, indeed, is the practice of Sir Astley Cooper, who places a pillow or bolster under the ham, and if the patient be very old, and the fracture attended with symptoms denoting its situation to be within the capsular ligament, all idea of subjecting the case to very long confinement is renounced. At the end of two or three weeks, the patient is allowed to get up and use crutches. Other surgeons do not pursue this method; and, having greater confidence in the possibility of obtaining bony union, they recommend the confinement to be longer, and the fracture to be more carefully put up. With this view, some of them employ the double inclined plane, and apply the pelvis strap so as to make the pelvis and apparatus, as it were, one piece, between the two parts of which no motion can happen. In France, Dupuytren used to make a double inclined plane with pillows, duly arranged under the limb; but the objection to this plan is, that there is nothing to prevent the patient from changing his position, or the limb from assuming another posture; and if Dupuytren's method has the recommendation of simplicity, it is not a good one in other respects, since it cannot be depended on for keeping the limb steady. In University College Hospital, fractures of the neck of the femur are generally treated with Désault's long splint, applied as already explained. An ingenious treatment was proposed by Hagedorn, the principle of which was to make the sound limb the part on which a long splint might be fixed, to the extremity of which a footboard for the other limb was attached. Thus the surgeon had a fixed surface on which the foot of the injured limb could be placed and fixed in the most desirable position. In truth, the right principle in the treatment always consists principally in bringing down the limb to its proper length, and regulating the position of the foot; for nothing of importance can be done with splints, except inasmuch as they may serve for regulating the position of the limb, and keeping it steady. Hagedorn's apparatus has a slipper, and, by placing the foot in it, any direction may be given to this part of the limb, considered advantageous. Ingenious as Hagedorn's plan is, it has not been much employed, chiefly because it is found to be very irksome to the patient. In America, Professor Gibson has taken the trouble to modify the apparatus, by carrying the splint as high as the axilla, and applying to the injured limb a splint which extends also as high as the armpit.

When the lower part of the thigh bone is fractured, or when the

fissure goes into the knee joint, the extended position of the limb is often preferred, because it keeps the head of the tibia in contact with the condyles of the femur, and thus has a most useful operation in keeping them steady. Were it not for this consideration, we should be inclined to advise the bent position of the limb, in order to relax the gastrocnemius and the popliteus, which have a tendency to draw the lower fragment towards the ham; but Sir Astley Cooper, whose experience and judgment are equally great, found, that more advantage was derived from the effect of the extended position in bringing the head of the tibia in contact with the condyles of the femur, than from the relaxation of the muscles in question. In such a case, lateral splints should be applied, in order to afford due support to the broken part, and keep it motionless. In these cases, a considerable degree of swelling generally comes on, so that for a few days the surgeon is obliged to defer the use of splints, and aim at the reduction of the inflammation by means of leeches, venesection, cold applications, &c.

### FRACTURES OF THE PATELLA

Commonly happen in the transverse direction, and are caused by the powerful action of the extensor muscles of the leg. The circumstance most frequently causing the bone to be fractured in this manner, is that of a person making a violent effort to save himself from falling backwards, when he has lost his equilibrium; for then the extensors of the leg act with immense force to keep the femur and the pelvis forwards; and as the knee is always somewhat bent at the moment, only the lower portion of the patella is actually in contact with the condyles of the femur, over which the muscles break it transversely, as already mentioned. However, this is not the only way in which a fracture of the patella may be produced, for sometimes the bone breaks while the leg is perfectly extended. When we hear of cases, in which the thrust of a gorget into the bladder, in lithotomy, made the muscles of the thigh act so violently as to break the knee-pan, we may conclude, that the accident happened when the knee was bent, because the position, in which the patient is bound for that operation, would make this tolerably certain; but it is alleged, that the patella has been fractured by the violent action of the muscles in epilepsy, even when the limb was in the straight or extended posture. The patella may be broken in the longitudinal, or perpendicular direction, by direct violence. Not long ago, a case occurred in the Hôtel Dieu at Paris, where the patella was fractured both in the longitudinal and transverse directions, the bone being split into nearly equal quarters; the accident was, of course, produced by direct violence, for I scarcely need observe, that such a fracture could not have been the result of the action of the extensor muscles of the leg.

When the patella is fractured, the symptoms vary according to circumstances: in the first place, whether the tendinous expansion covering the bone be lacerated at the same time that the fracture takes place, is a circumstance making some difference; secondly, much will depend upon the degree of laceration of the tendinous covering of the bone. When both these parts are torn through, the upper fragment may be retracted a considerable distance up the thigh, as far, perhaps, as four or five inches; but if they are not lacerated, the fragments will hardly be separated at all. Of course, while the fragments are much apart, we are not able to perceive a crepitus; but, if we extend the leg, so as to relax the extensor muscles, we may push down the upper fragment, and bring it into con-

tact with the lower one, and then a crepitus will be immediately distinguished. When attempts are made by the patient to bear upon the limb, it will be found, that he cannot support the weight of his body upon it; and he falls forward on his knee. If the upper fragment is completely detached from the lower one by rupture of the tendinous expansion covering them, the distance between them may also be increased by bending the knee; so that, in general, when the fracture is transverse, the case is evident enough. But, in a longitudinal fracture, the displacement is not so manifest, and more attention will be requisite to detect the real nature of the accident; yet if we relax the extensors, we may generally feel a crepitus in this case also, and with no great difficulty, notwithstanding there may be considerable swelling, in consequence of the species of violence that has produced the accident, namely, a direct blow, or kick; for longitudinal or perpendicular fractures of the patella, as I have already explained, cannot happen from the action of the extensor muscles of the leg, but always require for their production direct external violence.

The treatment consists in paying attention to two circumstances: — one is to relax the extensor muscles of the leg as much as possible; the other is to bring the upper fragment into contact with the lower one, and keep it so. Now, the first object, namely, the relaxation of the extensor muscles of the leg, requires that their lower attachments should be put as near to their origins as possible. The rectus, therefore, is to be relaxed by bending the thigh on the pelvis, by which the patella and the upper part of the brim of the acetabulum and the anterior inferior spinous process of the ilium, the insertion and origins of this muscle, are brought into as much approximation as can be effected by position. Now this will partly relax the rectus, but not the vasti and cruralis, which require the leg to be extended. For maintaining the limb in this position, the surgeon is to place the leg and thigh on an inclined surface, rising gradually and regularly all the way from the tuberosity of the ischium to the heel; the trunk being also raised on another inclined surface, so as to incline the front of the pelvis towards the thigh. The other circumstance to be attended to, or that of bringing the fragments into apposition, and keeping them so, is fulfilled by pushing the upper fragment down into its proper situation, and applying a roller to the lower part of the thigh, just above the upper fragment. Some surgeons put a few circles of a roller above the patella, and others below the knee, after which the upper and lower ones are laced together with packthread. Some years ago, it was the custom, after the limb and patella had been put into the proper position, to apply a roller a few times round the thigh, above the upper fragment, and then to finish the bandage by passing the same roller round the knee, in the form of a figure of 8; but this figure-of-8 direction of the bandage, though it may look well, is of no real use. Sir Astley Cooper first applies a leather strap to keep the upper fragment near the lower one, and then applies another strap, which passes from the first, down one side of the leg, across the sole to the other side, along which it ascends to the circular strap again.

Dupuytren employs the uniting bandage and a compress, which seem to answer very well; indeed, a case is related by Sanson, which he saw treated by Dupuytren with these simple means, where the union was so strong, that when the patient afterwards met with an accident, in which the extensors of the leg were made to act violently, the united part of the bone did not give way, but the ligamentum patellæ. Putting the

limb in a fracture-box is a convenient mode of keeping the leg and thigh steadily in the proper posture. Any of the plans, however, which I have enumerated, may be practised with success; but it should always be remembered, that the maintenance of the limb in the right position is of still greater importance, than any roller or apparatus for confining the upper fragment near the lower one.

Transverse fractures of the patella generally unite by a fibrous or ligamentous substance, and not by bone. There have been instances, however, in which a union has taken place by bone; but they are rare. On the other hand, longitudinal fractures of the patella, occasioned by direct blows, frequently unite by osseous matter. In the museum of University College, is a preparation taken from a coachman, who fell from his coach-box, when his knee came violently into contact with the pole of the carriage; the consequence was a comminuted fracture of the patella. Osseous union has taken place. Unfortunately, however, the case had an unfavourable termination; for, too much pressure having been employed, inflammation of the knee joint came on, and the man ultimately died. In the same collection is another specimen of a transverse fracture of the patella produced by direct external violence. The apex, which was broken off, is united again by means of bone. Mr. Gulliver has recorded two cases of bony union. The first is that of a sailor, who fell on his knee from the maintop of a brig: the second is that of a soldier, whose patella was fractured by a gun-shot. Mr. Gulliver also broke the patellæ of rabbits and dogs; first by blows, so as not to divide the aponeurosis, which covers it, and, in such cases, the union was osseous; and secondly, he cut the bone and aponeurosis through with cutting forceps, and, under such circumstances, no bony union followed. His conclusions are, that when the aponeurosis is completely divided, as in fractures of the patella from the violent action of the extensors of the leg, bony union is not to be expected; because, in such cases, it is impossible to keep the fragments in accurate contact; and that osseous union is simply the effect of the immovable coaptation of the fragments, the provision for which, in certain fractures from external violence, is the integrity of the aponeurosis in front of the bone.* It sometimes happens, that, after the cure of a fractured patella, the patient meets with an accident, in which the extensor muscles of the leg act with such violence that they lacerate the ligamentous substance, which is the usual bond of union in transverse cases; and then even the skin and synovial membrane may give way, and the knee receive injury of so serious a nature as to call for amputation. Some preparations in the museum of University College prove, that a fracture of the patella may be followed by severe disease of the knee joint;—as inflammation of the synovial membrane, abscesses, and absorption of the cartilages.

### FRACTURES OF THE BONES OF THE LEG.

We might suppose, on looking at these bones, and seeing one of them so strong and the other so slender, that the fibula would most frequently be fractured; this is not the case. The tibia, strong as it is, is oftener broken than the fibula, and one reason of this is its superficial and exposed situation in front of the leg. In fact, its anterior surface is merely covered by the integuments. Another reason is, that the tibia receives all the weight of the body when a person leaps, or alights with his foot

* Edinb. Med. and Surgical Journ. Jan. 1837.

forcibly on the ground. The fibula is covered to the extent of its two upper thirds by thick muscles, and the rest of it may be said to be very much protected by the tibia itself. Indeed, the peronæi muscles alone are sufficient to guard it from the effects of ordinary degrees of violence directed against the outside of the leg.

When the tibia is broken singly, the injury is generally caused by direct violence, more especially if the fracture happen at any point of the two upper thirds of the bone. The fracture is then usually produced by a blow, a kick, or the passage of the wheel of a heavy carriage over the limb. The lower third of the tibia may be fractured either by direct or indirect violence, or as the result of what the French surgeons call a *contre-coup*. A fracture of the upper third of the tibia is frequently transverse; but one situated in the two lower thirds of the bone is generally oblique. When the tibia is the only bone broken, and the fracture is in the upper third of it, some attention is necessary to discover the nature of the accident, because there is no change in the shape of the limb; for the fibula, being perfect, acts as a splint, so that there can be no shortening of the member, while the extensive surface of a fracture, in this situation, tends equally to prevent both retraction and displacement. However, the slightest inequality of the tibia may always be detected by passing the finger along the anterior edge or spine of that bone, when, if there be a fracture, some projection or irregularity, at the part where the fracture is situated, will be perceived. On moving the ankle and knee rather freely, we shall also perceive, that, exactly in the place of the solution of continuity, the bone, instead of being firm and unyielding, has a degree of motion it it, or yields when pressed upon. If both bones should happen to be broken, then the case will be evident enough, as a change will be noticed in the shape of the limb, an angular deformity, the heel being drawn more or less backward and upward by the muscles of the calf. We shall also observe a shortening of the limb, and that the foot is twisted either inwards or outwards. Were any other circumstance necessary to convince us of the nature of the accident, we should have such a criterion in the very distinct crepitus, that could be felt without the least difficulty.

When the fracture is situated at any point of the lower two thirds of the tibia, the fissure through the bone will frequently extend obliquely from above downwards and from behind forwards. Hence, the extremity of the upper fragment will be very sharp, and likely protrude through the skin, making the case a compound fracture. When the fibula is broken, as well as the tibia, the latter bone generally gives way first, and then the weight of the body being transmitted to the fibula, this bone also breaks. Such is the explanation offered by Dupuytren, as that which applies to the majority of cases; but sometimes both bones are fractured at once by direct violence, as happens when the wheel of a heavy carriage passes over the limb.

Although the fibula is, on the whole, less frequently broken than the tibia, still the accident is common enough; so common, indeed, that Dupuytren calculates, that fractures of the lower third of the fibula amount in number to one third of all fractures of the legs. Fractures of the upper two thirds of the fibula are generally caused by direct violence, while those of its lower third are most frequently occasioned by a forcible twist of the foot. The twist most commonly happens in the direction outwards, and, when this is the case, the fibula usually breaks from two to four inches above the external malleolus. When the fibula is broken,

in consequence of the foot being twisted outwards, the inner edge of the sole is in contact with the ground, and the upper end of the lower fragment inclines inwards towards the tibia. The fibula may also be broken by the foot being twisted inwards, in which event, the deformity will be different, for the outer edge of the sole will be against the ground; the sole itself will be turned inwards; and the upper end of the lower fragment will be directed outwards, away from the tibia.

The generality of fractures of the leg may be conveniently treated in the slightly flexed position, with the limb supported on M'Intyre's apparatus; or the leg may be placed on Amesbury's or some other double inclined plane, and supported with lateral splints. The bent position is by far the most comfortable to the patient, and it has the advantage of relaxing the powerful muscles of the calf. However, when the fracture is situated high up, near the knee, the limb may be kept in the extended position, which, as Sir Astley Cooper well observes, converts the condyles of the femur into a surface, against which the upper fragment can be steadily maintained.

Fractures of the upper part of the fibula generally unite without any permanent ill consequences, even though they may be neglected, and taken little care of. No doubt, many of them are never detected at all, in consequence of being unattended with displacement. But, fractures of the lower part of the fibula require more caution; for if they are not rightly managed, the patient will sometimes be a cripple for life, the foot remaining distorted outwards, and the individual being obliged to walk on the inner malleolus, instead of on the sole of the foot.

Dupuytren adopts a simple and effectual plan for the treatment of those fractures of the fibula which proceed from a violent twist of the foot outwards. The whole of his apparatus consists of two rollers, a splint about two feet in length, and a pad stuffed with oaten chaff, much thicker at one end than the other. The pad is applied to the inside of the leg, with its thick end downwards, and then the splint is put on, which, by extending beyond the inner edge of the sole, makes a fixed point at a convenient distance from it, against which the foot is kept inclined inwards by means of a roller. The splint is first secured on the part with a few turns of the roller round the upper part of the leg. If the fibula is broken by a twist of the foot inwards, Dupuytren applies the splint and pad on the outer side of the leg.

Some fractures of the leg have been treated successfully with splints made on the principle of the fracture-box, and the lateral parts of which admit of being let down, or put up, by means of hinges. Assalini's splints are thus constructed. If they are employed, the limb must then be kept in the extended position. Certain compound fractures are very conveniently dressed when such a splint, or a common fracture-box, is employed. In University College Hospital, M'Intyre's apparatus is commonly preferred to others, as being more simple, requiring no additional splint, keeping the limb perfectly steady, and, what is of high importance, allowing a great part of its surface to be uncovered, and the wound, if any be present, dressed, without the slightest disturbance of the fracture. Greenhow's apparatus likewise appears to me a highly meritorious one for the preceding objects; but less simple and more expensive: with it the whole of the leg may be uncovered, and a wound dressed without moving the fracture in the slightest degree.

### FRACTURE OF THE OS CALCIS

Is a rare accident; the fracture always occurs behind the junction of this bone with the astragalus. The treatment consists in relaxing the muscles of the calf, and applying splints and bandages for the purpose of preventing motion of the ankle. In the museum of University College is a specimen of a fracture of the os calcis united.

## PARTICULAR DISLOCATIONS.

### DISLOCATIONS OF THE LOWER JAW.

While the mouth is shut, the lower jaw cannot be dislocated: but when the teeth are separated, and the mouth widely open, the condyles pass forwards on the eminentiæ articulares; and while they are in this position, if there be any spasmodic action of the depressors of the chin, or of the external pterygoid muscle, to bring them a little more forwards, they will slip under the zygomatic processes, and thus a dislocation will be produced. The condyles of the lower jaw can be dislocated in no other direction than that forwards under the zygoma; and the accident may happen either in the manner I have described, or in consequence of some external violence acting upon the body of the bone, at a time when the mouth is open. In fact, at that period, a very slight force, applied so as to depress the chin, will make the condyles glide under the zygomas; and hence, dentists, if they are rough and careless in their proceedings for the extraction of the teeth, may dislocate the lower jaw.

The dislocation can only take place forwards under the zygoma; and this is true with respect to the two kinds of dislocation to which the lower jaw is liable: one in which both the condyles are displaced, and the other, the particular case where only one of them is dislocated; which is less common. The lower jaw, however, is subject to another kind of accident, attended with a partial displacement of it, namely, the case in which the condyle of one side slips out of the inter-articular cartilage: this is called a *subluxation of the jaw;* the condyle does not quit the capsule, but merely the inter-articular cartilage; the jaw becomes motionless, and the mouth continues slightly open. We meet, then, with three cases, the *dislocation of both condyles;* the *dislocation of one;* and the *subluxation*, or mere displacement of one condyle from the inter--articular cartilage.

The symptoms of a complete dislocation are the following: — In consequence of the position assumed by the bone, when the condyles are thrown forwards out of the glenoid cavities, the mouth must necessarily remain open, — it cannot be closed; for this would be prevented by the coronoid processes touching the cheek bone. The power of speech is of course considerably impaired, the pronunciation of the labial consonants being impossible. After the bone has remained unreduced for some time, it is true, the mouth will become rather less widely open; but still it cannot be closed on account of the mechanical impediment to which I have alluded. The chin is considerably lengthened, the cheeks stretched and flattened, and the lower teeth, if they could be brought up as high as the upper ones, would be much in advance of them. In consequence of the irritation of the parotid gland, there is a profuse secretion of

saliva, which is incessantly dribbling out of the mouth. In addition to the preceding symptoms, a depression may be perceived just in front of the meatus auditorius externus, occasioned by the removal of the condyle from its place. When the dislocation is restricted to one side, of course, the depression will be perceptible only in front of the corresponding ear.

When the case is a dislocation of only one condyle, we may notice, especially in thin persons, a slight distortion of the chin or mouth, an inclination of it towards the opposite side; but, in fat subjects, this kind of deformity may be so slight as perhaps not to excite attention. At one time, it was supposed, that an unreduced dislocation of the lower jaw would be fatal: it is certainly a very distressing occurrence; but there is no truth in the foregoing statement, for cases are on record of individuals, who lived many years in this pitiable condition.

In the treatment there are two indications: *to reduce the displaced part or parts of the bone*, and *to keep them reduced*. These indications apply indeed to every dislocation, which has not existed too long to render their fulfilment totally impracticable. The manner of reducing a common and complete dislocation of the lower jaw is very simple. The mouth is already open, so that there is space enough between the teeth to admit of the introduction of the thumbs into the mouth. The surgeon, recollecting the principle explained in my general observations on dislocations, endeavours to make the dislocated bone a lever for reducing its head, or its condyle; he therefore introduces his thumbs into the mouth, and applies them on the molar teeth; in short, they are to serve as the fulcra, on which he is to make the bone move: his fingers are next applied underneath the chin to the body of the bone; he now pushes the condyles with his thumbs downwards and backwards, at the same time that he brings the chin upwards and forwards with the pressure of his fingers; and as soon as the condyles are thus extricated from the zygomas, the temporal and masseter muscles act so quickly and suddenly in pulling them back into the glenoid cavities of the temporal bones, that if the surgeon were not very prompt in moving his thumbs towards the cheeks, out of danger, they would be severely bitten. It is on this account, that some practitioners usually put on a pair of thick gloves, before proceeding to reduce a dislocation of the lower jaw. Indeed, the rapidity is very great with which the bone returns into the articular cavities, when the condyles are extricated from their confinement under the zygomatic processes. Then the *second indication*, or that of keeping the bone reduced, is accomplished by a very simple plan: as there cannot be any displacement of the condyles, while the mouth remains closed, it is usual to apply, directly after the reduction, the four-tailed bandage, in order to keep the mouth in this safe and desirable position. The two front tails of the bandage are brought to the back of the head, and the two posterior ones applied to the forehead. The bandage is worn for about ten days, and the patient is restricted to spoon diet, and directed to avoid conversation. If there be a great deal of swelling, bleeding, and other antiphlogistic measures will be advisable. When only one condyle is displaced, and pressure made with the thumbs on the molar teeth of both sides of the jaw, sometimes we cannot succeed in effecting the reduction; and I therefore recommend Mr. Hey's advice not to be forgotten, which is, to apply the thumb only on the side where the dislocation has taken place, and to let the lever-like movement be directed particularly to the displaced condyle, and not to the other. By attending to this maxim, I

lately reduced, without much difficulty, a dislocation of one condyle in a woman brought to my house by my neighbour, Mr. Delisser.

In the *subluxation of the lower jaw*, when the condyle is thrown out of the inter-articular cartilage, the jaw is rendered motionless, and the mouth cannot be entirely shut. It is an accident that does not call for the interference of a surgeon, as the condyle usually returns into its place again in a few minutes, without assistance.

When the reduction of a dislocated jaw is attended with extraordinary difficulty, we should have recourse to bleeding and other means of weakening the muscles.

A person, who has once dislocated his jaw, will always be liable to the accident again from slight causes; and sometimes merely laughing, or yawning, will bring it on.

### DISLOCATIONS OF THE CLAVICLE

Are much less common than fractures. The clavicle may be dislocated either at its sternal extremity, or at its junction with the acromion; but the dislocation of the sternal end is more frequent: first, because that end of the bone is naturally more moveable; and, secondly, because its ligaments are considerably weaker, than those which tie the other extremity of the clavicle to the acromion. The accident, when it occurs, mostly happens in children and women, in whom the ligaments are weaker, and the articular cavity shallower, than in male adults.

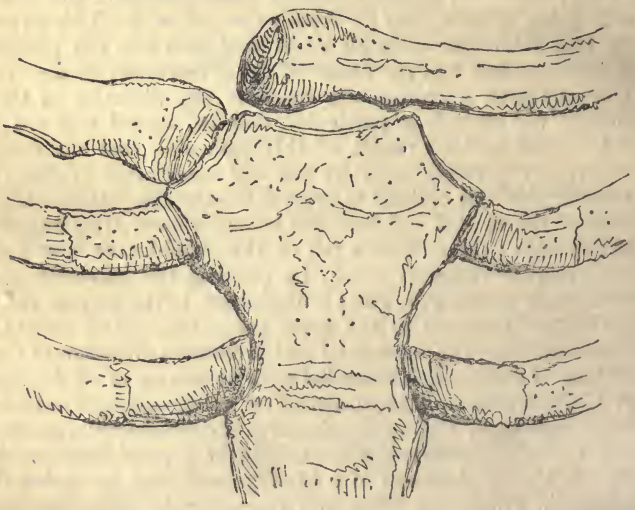
In what direction does the *dislocation of the sternal end* of the clavicle usually take place? It happens in most cases forward; the dislocation backwards being so rare, that Sir Astley Cooper, with all his experience, has only met with one example of it, and that was not produced by external violence, but was the result of great deformity of the chest and spine, whereby such a change was made in the direction of the whole trunk, and of the clavicle in particular, that its sternal end was thrown backwards. One curious result of this case was, that the œsophagus was dangerously pressed upon by the dislocated end of the clavicle, which the surgeon was obliged to saw off to save the patient's life. The dislocation of the sternal end forwards is much more frequent, and may occur in two ways; either from a fall on the shoulder, or from the application of external violence, which, by pushing the acromion suddenly and considerably backwards, gives a disposition to the sternal end of the clavicle to start forwards in the same proportion. The nature of the case is obvious, from the superficial and prominent situation of the bone. The accident, if complete, is attended with laceration of all the ligaments and part of the tendinous attachment of the sterno-mastoid muscle. The treatment consists in the application of a wedge-shaped cushion under the axilla, to make the humerus act as a lever in propelling the shoulder outwards; in the employment of a bandage and sling to confine the arm in a position, in which the elbow and fore-arm are duly supported, and held rather backwards, while the shoulder is inclined a little forwards; and in putting a compress on the sternal end of the clavicle, and keeping it there with the bandage.

The *acromial end of the clavicle* can be dislocated only in one direction, which is upwards. It cannot be dislocated downwards; for the root of the coracoid process of the scapula, and the ligament extending from this process to the acromion, resist a dislocation downwards; but sometimes, by great violence, the scapula itself is driven downwards, and the acromial end of the clavicle then projects upwards. Sir Astley Cooper, in his

work on dislocations, gives us a drawing of such a case. Here the ligaments, tying the clavicle and acromion together, are torn, as well as some of the bands of ligaments connecting the clavicle with the coracoid process. The treatment consists in keeping the shoulder inclined outwards, by placing a wedge-shaped cushion below the axilla, and in using the figure-of-8 bandage, with a soft pad in each axilla, to prevent its margins from being chafed. When, by this means, the shoulders are drawn back, the acromion returns into its place. The arm is of course to be kept up with a sling.

My friend, Mr. Morton, of University College, has favoured me with the particulars of an unusual dislocation of the sternal extremity of the clavicle; the displacement of it being upwards and inwards.

Etienne Caréron, æt. 39, mason, admitted into the Hospital of La Charité, on account of an injury, which was caused by his having been violently squeezed between a wall and a cart, in such a manner that the left shoulder was thrust inwards with great force. On examination, the sternal extremity of the left clavicle was found to have been displaced from its natural situation, and was now placed *above* the upper edge of the sternum, producing a slight deformity in the contour of the lower part of the front of the neck. It seemed, from the description of the accident which was given by the patient, that the force producing the injury had acted in such a direction as to push the sternal extremity of the dislocated bone *upwards*, and *behind* the sternal portion of the sterno-cleido-mastoid muscle. The articulating surface of the internal extremity of the



dislocated clavicle lay opposite to that of the clavicle of the sound side, and was supported by the superior border of the sternum. The attachment of the sterno-cleido-mastoid muscle to the first bone of the sternum did not appear to have suffered any laceration. M. Velpeau considered it to be very probable, that the dislocation was in the first place backwards, but that the force continuing to act, the end of the clavicle was afterwards driven upwards, and across the front of the root of the neck, and behind the sterno-cleido-mastoid muscle. The dislocation was reduced in the usual manner, and the apparatus of Désault for fractured clavicle em-

ployed to retain the end of the bone in its proper place. The bandages used were steeped in a solution of "dextrine," which, when dry, rendered the whole immoveable.

Sept. 6. The apparatus has been reapplied, as the extremity of the clavicle had again become slightly displaced in the same direction as before.

Sept. 15. Doing very well.

### DISLOCATIONS OF THE HUMERUS AT THE SHOULDER

Are so common, that it has been rather incorrectly supposed, that they equal in number all other dislocations put together; and when various circumstances relating to the shoulder joint are considered, we must discern several which account for the frequency of these accidents. First, the glenoid cavity is very shallow and small in proportion to the size of the head of the humerus, which, in the perpendicular direction is twice as broad as the articular cavity, and in the transverse direction, not less than three times as wide. Secondly, this joint derives no material strength from ligaments, the capsular ligament being particularly weak and thin below, where there is nothing to resist dislocation, and thick above, where the acromion, coracoid process, and triangular ligament, form insurmountable obstacles to such an accident. Thirdly, we are to remember, that the shoulder joint is capable of motion in every direction, and the muscles surrounding it and attached to the humerus are numerous, the consequence of which disposition is, that the head of the bone must in many positions make considerable pressure against the capsule. Dislocations of the humerus would, indeed, be more frequent than they are, if the scapula were more fixed; but as this bone is as moveable as the humerus itself, the glenoid cavity accompanies all the movements of the head of the latter bone, and thus forms a very accommodating support to it.

The head of the humerus is subject to *three complete dislocations*, and *one of an incomplete kind.* The most common of the three complete dislocations takes place downwards into the axilla, the head of the bone pressing against the inferior costa of the scapula, and passing into that situation between the long portion of the triceps, and the tendon of the subscapularis, which is sometimes lacerated. In the next most frequent case, the head of the humerus is thrown under the pectoralis major and pectoralis minor muscles, on the sternal side of the coracoid process, so as to lie below the middle of the clavicle. As the pectoralis minor is attached to the coracoid process, the head of the bone must pass under that muscle in order to reach the situation which has been specified. This fact, I believe, is not demonstrated in any preparations in London; but Sir Astley Cooper refers to a specimen, from the appearance of which, it was inferred that the head of the humerus had certainly passed under the pectoralis minor, as well as the pectoralis major. The third complete dislocation is backwards, on the dorsum of the scapula, under the spine of that bone: but this is so rare an accident, that Baron Boyer, in the whole course of his experience, never met with more than two examples of it, one of which was accidentally noticed in the dead subject. Sir Astley Cooper, also, during an experience of more than forty years, has met with but few instances of it. One such case was brought to University Hospital, and reduced by Mr. Morton, late house-surgeon.

In the *incomplete* dislocation, the head of the humerus is thrown forwards on the external side of the coracoid process, and the capsular ligament is lacerated; but the bone does not entirely quit it.

What are the symptoms of a dislocation of the head of the humerus into the arm-pit? *Three symptoms are common to all dislocations of the shoulder:* first, *loss of the rotundity of the shoulder;* secondly, *a hollow under the acromion;* thirdly, *the acromion forms, or seems to form, a greater projection than natural.* In addition to these symptoms, when the head of the humerus is lodged in the axilla, there will be a lengthening of the arm; if we look at the patient from behind, the elbow of the affected limb will plainly seem to be lower than the elbow of the other arm; it will also be inclined a good way from the trunk, and the patient cannot put it close to his side. This latter circumstance is one of the first things about which I usually make inquiry, when called to a supposed dislocation of the shoulder; and if the patient can put his arm close to his side, I then know that there cannot be a dislocation into the axilla. In such a dislocation, he is also unable to raise his arm to a level with the acromion. In consequence of the limb being lengthened, and the humerus carried downwards, the deltoid is necessarily flattened, and this, not merely on account of the bone quitting its place, but from the fibres of the muscles being put on the stretch. It is, indeed, in consequence of this, that the arm is held out from the side. The long portion of the triceps is also stretched; and one effect of this is, that the fore-arm is always found more or less extended, while the stretched condition of the head of the biceps accounts for the hand being thrown into the state of supination. If the arm be raised from the side, we may distinctly feel the head of the humerus in the axilla. In addition to the above symptoms, the functions of the joint are suspended, and, instead of free motion of the arm, there is an extraordinary rigidity of it. The manner, in which the accident commonly happens, is this; — the patient falls while his arm is raised from his side, or, I should rather say, he endeavours to save himself from injury by holding out his arm; the arm comes to the ground in this position, and the resistance of the ground suddenly throws the lower portion of the humerus upwards, and propels its head downwards, which latter movement is at the moment also promoted by the spasmodic and violent action of the pectoralis major and latissimus dorsi muscles. Thus, supposing the arm to be raised from the side at the time of the fall, without too much inclination either backwards or forwards, the dislocation will be into the axilla.

In another *dislocation*, which is tolerably frequent, *where the head of the humerus is thrown under the pectoral muscles*, and on the inner side of the coracoid process, the head of the bone can be felt in its new situation; the axis of the bone is also directed towards this point; not towards the glenoid cavity, but the centre of the clavicle. The elbow is seen to incline more or less backward. The head of the humerus being more wedged in its new situation at the inner side of the coracoid process, than when it lies in the axilla, the limb is still more rigid, and there is less possibility of moving it. The limb is also shortened; whereas, in the luxation downwards, it is lengthened. In addition to these, there will of course be the three common symptoms, namely, a hollow under the acromion, a considerable projection of that process, and a diminution of the rotundity of the shoulder.

The dislocation forwards, under the pectoral muscles and centre of the clavicle, takes place in the following manner: while the arm is inclined somewhat backwards, and separated from the side, the person falls with great force on his elbow, or lower end of the humerus, the head of which is consequently forced upwards and forwards. It does not always pass

immediately underneath the clavicle, but undergoes that secondary species of displacement, to which I invited attention in the general observations on dislocations: it is first thrown under the pectoral muscles, and then the action of the muscles draws it higher and higher, till it is brought close under the centre of the clavicle at the inner side of the coracoid process.

A dislocation backwards can scarcely happen, except when the arm is inclined forwards, across the front of the chest, and it is difficult to imagine how any force can act so as to dislocate the bone, even when the arm is in this position; for any violence, at all likely to be applied, would generally propel the arm against the chest, and this, no doubt, is the reason why the dislocation backwards is uncommon. As the head of the bone is always conspicuous below the spine of the scapula, the diagnosis is not liable to any mistake. In this case, the elbow is not separated from the side, as it is in the more common dislocation into the axilla.

What is the mischief produced when the head of the humurus is dislocated downwards into the axilla? There is sometimes a laceration of the tendon of the subscapularis; the tendon of the long head of the biceps is also stated to be sometimes broken or displaced; but so far as the dissections of Sir Astley Cooper and Boyer go, it appears that neither of these circumstances has fallen under their notice. One instance, however, is recorded by Mr. Hey, where, in a compound dislocation of the shoulder, an extremely rare case, the head of the humerus protruded through the integuments, and the tendon of the biceps was really torn. Of course, the capsular ligament is lacerated, and there may be a laceration of other tendons and muscles.

Every plan for reducing dislocations of the shoulder ought to combine three principles; namely, extension, counter-extension, and the employment of the shaft of the bone as a lever for moving its head into the glenoid cavity; and also a fourth principle, which is the relaxation of the muscles, so far as this may be practicable, without neglecting the other indications. The manner of making counter-extension is by means of a girth or sheet, applied round the chest, and either held by the assistants, or fixed to some point in the direction opposite that in which we purpose to make extension. A piece of strong linen, with an aperture or slit in it, for the reception of the arm, will serve very conveniently both to fix the chest, and hold back the scapula. Whatever means be employed for keeping back the shoulder, the pressure is not to be applied to the glenoid cavity, or too near the acromion; for then it would form an obstacle to the return of the bone into its proper situation.

With regard to the manner of making the extension, and the direction in which such extension ought to be made, I may observe, that French surgeons would generally make extension as far as possible from the joint concerned: thus, in a dislocation of the shoulder, they would make it at the wrist: but, in this country, the extending means are most commonly applied at the lower part of the humerus itself; and the reason for this is, that British surgeons frequently prefer keeping the fore-arm bent, by which means the biceps is relaxed. They consider that, as the portion of this muscle attached to the coracoid process must be stretched when the arm is extended, it would in this state tend to hinder the shoulder from being kept properly back; and, on this account, they keep the fore-arm bent, and apply the extension to the lower part of the humerus. In the plan used in France, there is the advantage of a long lever, which, perhaps, fully counterbalances the good derived in our

method from the relaxation of the biceps. Before applying the napkin, or cloth, for the purpose of making extension, it is customary to place something immediately round the limb, in order to prevent the skin from being chafed or too much irritated; and, in this country, it is usual to apply a piece of wet linen, or a few turns of a flannel roller, for the purpose. We then take a piece of strong calico, or linen, which must be three yards long, and half a yard wide, and fold it longitudinally, till it forms a long extending means, about three inches in width. An ingenious way of applying this is mentioned by the late Mr. Hey, which is rather difficult to describe, though very simple to show: he places the noose first in an elliptical form round the limb; he next takes one of the ends and passes it over to the opposite side through the noose; then he does the same with the other end; and the more this apparatus is pulled, the tighter it becomes. The contrivance is simple and effectual. Another contrivance is what the sailors call the clove-hitch knot, a drawing of which may be seen in Sir Astley Cooper's book. With the cloth, three yards in length, there is, when it is applied, more than a yard left for the assistants to make extension with. When the dislocation is downwards into the axilla, the extension may first be made in the direction of the axis of the bone, that is, downwards and outwards, in order to dislodge its head from the inferior costa of the scapula. When sufficient extension in this direction has been made, the next object is to have recourse to the lever-like movement of the shaft of the bone, and, for this purpose, many surgeons place one knee in the axilla, and make a fulcrum of it, and as soon as they see, that the head of the bone has been by these means brought towards the glenoid cavity, the extending power is relaxed, and the muscles draw it into its place. On such principles, the reduction is, in general, easily effected. If the patient be intoxicated, then we are to take advantage of this condition, in which a dislocation may often be reduced without performing any extension at all; indeed, when the person is faint, or intoxicated, if we place the bone over the back of a chair, or over our knee, the dislocation may often be reduced with little or no extension. I have seen this frequently done on drunken persons; and sometimes the bone will slip into its place on the patient moving the arm himself, while it is suspended over the back of a chair, or the mere weight of the limb will be sufficient to effect the reduction. An old and not a bad method of reducing a dislocation in the axilla is that, in which the surgeon places his heel in the arm-pit, and makes extension from the hand or wrist. The heel not only fixes the chest, and keeps back the shoulder, but constitutes a fulcrum on which, by the lever-like motion of the limb, the head of the humerus can be directed into the glenoid cavity. It would appear that, in some cases, the connection of the supra-spinatus muscle with the greater tubercle, is the cause of the resistance to the extending power.* Here the resistance is most effectually overcome by raising the arm, and relaxing the supra-spinatus. On this subject, Sir Philip Crampton justly remarks, "The success, which not unfrequently attends the method of reduction (first recommended by Mr. White, of Manchester) by drawing the arm directly *upwards*, in a line parallel to the axis of the trunk, is, no doubt, to be attributed chiefly to the relaxation, which it effects, of the supra-spinatus and deltoid muscles. It is probable also, that, in this position of the humerus, the head of the bone is in some measure unlocked from the neck of the scapula, against which it is (when

* Sir Astley Cooper on Dislocations, p. 377.

dislocated downwards) strongly compressed by the contraction of the muscles." Mr. Hey particularly recommended White's method for old dislocations. In 1785, a memoir in favour of the same practice was addressed to the Academy of Surgery, by M. Mothe. The consideration of the anatomy and pathology of the dislocation into the axilla led Malgaigne, one of Dupuytren's pupils, to be an advocate for the method, which gained also the approbation of the latter distinguished surgeon. White first described this mode of reduction in a paper, printed in 1764.*

When the *dislocation* is *forwards*, under the centre of the clavicle, the elbow is inclined backwards and downwards, and, if we were to attempt to bring the head of the bone direct from its situation, below the clavicle, into the glenoid cavity, we might fracture the coracoid process. This shows the necessity of attending to the principle of first dislodging the bone from the situation in which it has been thrown by the secondary displacement. In this dislocation, the bone is first thrown out of the glenoid cavity under the pectoral muscles, but does not mount up to its situation under the centre of the clavicle till the secondary displacement takes place. This displacement must first be obviated by pulling the bone downwards and backwards in the direction assumed by its axis, as one of the effects of the accident. Now, as soon as the head of the bone has been brought below the coracoid process, we are to incline the elbow more forwards, and bring it closer to the side; thus we shall direct the head of the bone towards the glenoid cavity; at the same time we may use a band, or napkin, placed under the upper part of the humerus, as a fulcrum; for, in this case, we cannot well get our knee under the axilla, so as to make a fulcrum of it.

It has sometimes been suspected, that all dislocations of the shoulder are first downwards; but a dissection, the particulars of which are given by Sir Philip Crampton, proves, that this is not the case, for the bone was thrown under the pectoral muscle, without the lower portion of the capsular ligament being at all torn.

The other less common dislocation, where the *head of the humerus* is thrown *upon* the *dorsum of the scapula*, is believed by Sir Astley Cooper to differ from other luxations of the shoulder in being the result of muscular action alone. He has recorded one case, in which the displacement of the head of the humerus was produced by the convulsive action of the muscles in an epileptic fit. I remember one case, however, in which this dislocation arose from a violent blow on the front of the shoulder. In the example lately recorded by Sir Astley Cooper, it was found, on dissection, that the tendon of the subscapularis and the capsular ligament had been torn from the smaller tubercle of the humerus, and the bone was consequently drawn back by the action of the infra-spinatus and teres minor. Hence, there was no support given to the head of the bone, when reduced, and, consequently, a return of the displacement ensued. This, however, is an exception to what has usually happened; for, after the bone has been reduced, the reduction has commonly been permanent.

This dislocation is peculiar in not being attended with any elevation of the elbow from the side. The reduction may generally be accomplished by fixing the shoulder, making extension, and then pushing the head of the humerus forwards towards the glenoid cavity. In one case, Sir Astley

* See Crampton's Obs. in Dublin Journ. of Med. and Chemical Science, vol. iii. p. 181.

Cooper bent the elbow at a right angle, and, raising the arm, carried it behind the patient's head, so as to bring the hand across the back of the neck to the opposite shoulder. Then forcing the elbow back, and pressing upon the head of the bone, he pushed it under the inferior costa of the scapula, and it instantly returned into the glenoid cavity. This dislocation has also been reduced with the heel in the axilla, and extension made in the direction of the trunk.*

Thus the reduction of dislocations of the humerus is performed on the combined principles of extension, counter-extension, relaxation of the biceps, and the lever-like movement of the shaft of the bone. I might add to these the very important principle of dislodging the head of the humerus from the situation in which it has been thrown by the secondary displacement. When difficulty in effecting the reduction is experienced, we can have recourse to debilitating means, such as copious bleeding from a large orifice in the vein, or the administration of tartarised antimony, with the view of bringing on that collapse of the muscular system, which naturally accompanies faintings and nausea. Then, so far as the muscles are concerned, the difficulty of reduction is removed, and the head of the bone, if the case be not an old dislocation, may be readily put into its right place again. Sometimes, in examples of difficulty, the multiplying pulley is used. After the reduction, the next indication is, to prevent the bone from slipping out of the glenoid cavity again. For this purpose a sling is generally sufficient; but, for greater security, if the patient be tipsy and restless, we should confine the humerus to the side with a roller.

It is mostly allowed, that the humerus may be incompletely dislocated, and remain fixed on the outside of the coracoid process, the front of the capsular ligament being torn, but the head of the bone not being thrown out of it. The reality of the accident is sometimes disputed. I have not seen any decided example of it in my own practice; but Sir Astley Cooper's observations leave, I think, no doubt about its possibility; and in his work is a plate, representing the state of the parts, as found on dissecting the shoulder after such an accident. Should it be met with, the reduction ought to be effected on the same principles as are observed when the head of the bone is thrown to the inner side of that process; and after the reduction, a compress is to be applied in front of the head of the humerus, just on the outside of the coracoid process, supported by the spica bandage. In one instance, recorded by Mr. South, the coracoid process was broken.†

### DISLOCATIONS OF THE ELBOW.

The *displacement of both bones of the fore-arm forwards* cannot take place without a fracture of the olecranon, which process of the ulna forms a mechanical impediment to such an accident; indeed, it is an accident of great rarity. In the museum of University College is a preparation, in which the olecranon was fractured, and also the coronoid process; and the radius and ulna were dislocated, but not both of them forwards, for the ulna was thrown backwards.

A boy, in attempting to leap over a post near my house, fell down and dislocated his elbow; it was a dislocation of the ulna backwards and of the radius forwards. I had not the slightest difficulty in reducing the

* See Guy's Hospital Reports, vol. iv. p. 265.
† See Med. Chir. Trans. vol. xxii.

case, which terminated favourably. The most common *dislocation* of the elbow, is that in which *both bones* are thrown *backwards*, either with or without a fracture of the coronoid process.

When the coronoid process is not fractured, it passes into the fossa at the back of the humerus, in which the olecranon is naturally situated. On this account the arm cannot be completely extended; the olecranon forms a remarkable projection behind the arm; and the distance between the point of the olecranon and the internal condyle is conspicuously increased; the humerus itself also forms a projection in front of the upper part of the bones of the fore-arm; and the radius is thrown on the outside of, and above, the external condyle. It is of great use, in these dislocations, to attend precisely to the relative positions of the point of the olecranon, and the external and internal condyles; for, sometimes the swelling is so great as to prevent us from making out the case satisfactorily, unless we avail ourselves of these beacons. In the dislocation of the ulna backwards, the distance between the olecranon and the internal condyle is remarkably increased; these points may always be felt in the fattest persons, and however great the swelling.

In the dislocation of the ulna backwards, there is a laceration of the capsular ligament, and of the internal lateral ligament, and generally, also, of the annular ligament of the radius, which is closely connected to the external lateral ligament. In consequence of the lower head of the humerus being thrust forwards, the brachialis anticus is liable to be torn; but the tendon of the biceps generally escapes, and is tightly applied round the lower articular surface of the humerus. However, if the dislocation has been caused by excessive violence, that tendon may be torn, and even other mischief done; for example, the brachial artery may be ruptured, the median nerve torn, and the veins at the bend of the elbow burst. In the ninth number of Cruveilhier's great work on Pathological Anatomy, some notice is taken of a case, where such complications occurred in a lady, who fell from her horse with prodigious force.

The mode of reducing this dislocation is simple: — The surgeon may apply his knee to the bend of the arm, and, taking hold of the wrist, bend the elbow over his knee with the advantage of a considerable lever; the coronoid process will then quit the fossa at the back of the humerus intended for the olecranon, and, by continuing the movement of flexion a little further, he will find the bone return into its right situation. Now, if the coronary or annular ligament of the radius be torn, this bone will slip out of its place again, unless means be taken to prevent it. With this view, we should apply a compress over the head of the radius, to press it down towards the lesser sigmoid cavity of the ulna; and we should prevent the radius from moving by means of splints, one on the outside, and another on the inside of the fore-arm. If a case of this description were to remain unreduced, which sometimes happens, nature makes great efforts to repair the mischief; and it is to be observed, that the dislocation is complete, the articular surfaces not being at all in contact with each other. Sometimes, indeed, a surprising attempt is made to form a new socket for the humerus. In the plates of Cruveilhier's celebrated work, a representation of such a dislocation, and of the efforts made by nature to repair the mischief, is given; a considerable quantity of bony matter has been thrown out to form a socket for the humerus. These plates also show the changes which take place in the shape of the bones, when their functions have been destroyed by remaining long un-

reduced. In the instance here exhibited, a very limited degree of motion remained; and nature had done all in her power to produce a new articular cavity.

Sometimes the dislocation takes place in another way, the *ulna* being *thrown backwards*, and the *radius forwards;* the former bone assuming the position described in the last dislocation. The case is reduced nearly in the same way as the foregoing; but we are to make some extension, for otherwise we could not bend the elbow with the radius in front of the humerus; and after the requsite degree of extension has been made, the bones will return to their proper situations on bending the elbow over the knee.

In other instances, we find a dislocation of the radius alone; the upper head of which bone quits the lesser sigmoid cavity of the ulna, and is thrown on the outside of the external condyle, and sometimes behind it. The nature of the accident is sufficiently obvious; for the head of the radius is thrown on the outer part of the arm. I have seen three or four examples of this case, and there are many instances of it on record. There is an engraving of one such case, which was dissected by Cruveilhier; the dislocation had not been reduced, and nature had formed a sort of fibrous capsule for the reception of the head of the radius, which capsule Cruveilhier thinks was derived either from the remains of the annular or of the external lateral ligament. The same plate also illustrates the change, which takes place in the articular surface of a bone that has been long out of its place. For the reduction of this dislocation, the best plan is first to make extension of the arm, and to limit the extension as much as possible to the radius; thus we can draw the displaced bone into its proper situation. Now, the head of the radius will be apt to slip out of its place again, unless means be taken to prevent it; we must, therefore, hinder all motion of the radius with splints, and support the head of it with a compress. This tendency of the head of the radius to quit the lesser sigmoid cavity after the reduction, is owing to the annular and oblique ligaments being torn. A child was once brought to me at the Bloomsbury Dispensary, with this dislocation; the accident had occurred seven weeks before I saw the case, and nothing would avail in keeping the head of the radius in its place: we applied splints for three or four weeks, but at the end of this time, the bone glided into, and out of, the articular cavity as readily as ever.

The most common *lateral dislocation* is *where the ulna is forced outwards* into the place of the radius, which is propelled off the articular surface of the humerus altogether. In this state of the bones, there is no suitable cavity behind the humerus for the reception of the olecranon in the extended condition of the fore-arm. The consequence is, that complete extension cannot take place: neither can flexion be well performed. The case is sufficiently manifest from the extraordinary projection formed by the inner condyle on one side, and by the radius on the other. Extension and counter-extension are to be made, and the ulna and radius reduced by lateral pressure.

*Dislocation of the lower end of the ulna from the sigmoid cavity of the radius* takes place mostly from a forcible pronation of the hand, the ulna being then thrown back, and the hand fixed in the position of pronation. There is a possibility, however, of the displacement occurring in the other direction, or of the ulna being thrown forwards and the hand supine. Here extension is to be made, and the displaced bone pressed in the direction required to bring it into the proper position again: then a splint is to be applied to prevent the radius from moving.

## DISLOCATIONS OF THE WRIST.

A gentleman once asked me if it were true that the wrist was never dislocated? To which I answered, that it was not possible for me to agree in that doctrine, because I had seen a case, in which the lower end of the ulna protruded through the skin. However, his question related to the possibility of a dislocation of the radio-carpal articulation. Various anatomical reasons are assigned by Dupuytren, why the radius should always rather break, than be dislocated from the carpus; and he distinctly declares it as his belief, that there is not, in all the records of surgery, an unequivocal specimen of such a dislocation. He had sometimes been called to cases, supposed at first to be true dislocations of the wrist, but which afterwards proved to be only fractures of the radius near that articulation. One or two instances of such mistakes, verified by dissection, are brought forward, in which practitioners of eminence had been deceived. Hence the Baron is led to conclude, that a dislocation of the wrist is scarcely a possible event, and that the accidents, reputed to be such, were in reality fractures of the radius close to the joint, with more or less displacement of the hand. It cannot be doubted, I think, that this is generally the fact: but it would be making a bold assertion to say, that such a dislocation never happens. Great as Dupuytren's experience is, it is merely a drop in that great ocean of experience, to the rich treasures of which the surgeons of every age have successively contributed. Instead of representing a dislocation of the radius from the carpus as impossible, it would, I believe, be more correct to say, that the accident is exceedingly rare. In Sir Astley Cooper's work, there is a drawing of a dislocation of the carpus backwards, which, no doubt, is particularly uncommon; for when a person falls on his hand while it is extended, the force would almost always sooner break the radius than dislocate it towards the palm; but if the hand were in the state of flexion, so that the back of the hand received the force, then a dislocation might perhaps be a more likely event. Cruveilhier had an opportunity of dissecting such a dislocation, as he believed it to be, in which the radius and ulna had been thrown on the back of the hand, and the state of the parts is represented in one of his plates; the patient, he conceives, had fallen on the back of the hand with considerable force. Yet Dupuytren and Cruveilhier took different views of this preparation, so that further investigations are desirable. In Cruveilhier's book, we also find an engraving from a case, in which the radius had been dislocated by the contraction of a burn. Sir Astley Cooper also speaks of a boy, who fell on the palm of his hand, and whose carpus was driven backward. I am not therefore disposed to consider Dupuytren's doctrine as completely established; in fact, it is difficult to restrict the effects of external violence on the joints, considering the infinite variety of circumstances by which they may be modified and influenced. If we were to meet with a dislocation of the radio-carpal articulation, it would be easy of reduction, as dislocations of ginglymoid joints usually are; the extension and counter-extension need only be made in a degree sufficient to diminish the friction between the articulating surfaces, and then pressure is to be made on the displaced bones in the direction calculated to bring them into their right situation again. Extension and counter-extension would be necessary, if the dislocation of the carpus were forwards, and splints would be required; for otherwise the movements of the hand might bring on a return of the dislocation, and prevent the speedy union of the ligaments

### DISLOCATIONS OF THE BONES OF THE CARPUS FROM ONE ANOTHER.

The bones of the carpus are not very liable to be dislocated from one another: however, there is one in the second phalanx, which is occasionally thrown out of its place, — I mean the os magnum. This bone is received into a deep cavity formed by the scaphoid and lunar bones, and when the hand is violently bent, it will sometimes start out of this cavity, and form a considerable projection at the back of the wrist. The reduction is occasionally difficult; but, if the bone be left unreduced, there will not be much inconvenience, — there will only be a slight weakness of the wrist. Thus, in one instance, which was attended by Sir Astley Cooper, the inconvenience, resulting from the non-reduction of the dislocation, was, that the young lady, who was the subject of it, could not practise music — she could not play on the piano-forte. The case will be evident from the situation of the bone, and its projection beyond the other bones of the carpus. The accident chiefly occurs in children and females, from the greater weakness of their ligaments, and also from the cavity of the scaphoid and lunar bones being more shallow in them than in male adults. In reducing this dislocation, we are to bring the hand into the extended position, and then press firmly on the projecting bone with our thumbs. The common plan of palliating this dislocation, when it cannot be reduced, is to apply a compress and bandage over it, or straps of adhesive plaster.

The *metacarpal bones* can hardly be separated from one another except by great and direct violence; and so closely are they tied together and to the carpus, that scarcely any thing, except gun-shot violence, the bursting of a fowling-piece, or pistol, or the fall of some ponderous body on the hand, can dislocate them. However, the metacarpal bone of the thumb is more frequently dislocated than any other; and, from its having motion in every direction, it seems capable of being dislocated in four directions, namely, inwards, outwards, forwards, or backwards; but experience proves, that it is ordinarily dislocated only forwards or backwards. When a person falls on the radial edge of his hand, and the thumb is carried violently inwards, the head of the metacarpal bone will be thrown on the back of the trapezium. In other instances, the displacement is in the opposite direction, and the head of the metacarpal bone of the thumb is then thrown between the metacarpal bone of the fore-finger and the inside of the trapezium. The reduction is easy: the principle is to make counter-extension from the wrist, and extension from the thumb, and to press the bone in the proper direction.

### DISLOCATIONS OF THE THUMB

Are sometimes difficult to reduce, especially those of the first phalanx from the metacarpal bone. There are some persons, however, who have the ligaments of this joint so loose, that at their option they can not only dislocate the first phalanx by the action of the flexor muscles, but even replace it again by the action of the extensors. In such instances of spontaneous dislocation and reduction, the ligaments are preternaturally loose. Sometimes this may be the result of disease, or the neglect of a dislocation, where the bone had been reduced, but not well supported in its place.

In the common dislocation of the thumb, the head of the first phalanx is thrown on the back of the head of the metacarpal bone, so that the first phalanx projects backward, while the head of the metacarpal bone inclines

towards the palm, the thumb remains without the possibility of being straightened, and the second phalanx is fixed in the bent position. It is from there being no laceration of the lateral ligaments that the reduction is so difficult; for the wedge-shaped head of the first phalanx glides with its narrow part through the aperture between the lateral ligaments, and brings the broad part within them. Thus the first phalanx is completely and firmly wedged between the lateral ligaments, which must therefore be considered as forming the principal impediment to the reduction. The muscles of the part also being strong, form some resistance to the reduction, especially as the surface for the application of the extending means is very limited. From these various causes, there is occasionally so much difficulty in the reduction, that, in a case in St. George's Hospital, about fifty years ago, extension was made with such force, that the thumb was pulled off. The case is alluded to by Mr. Hey, of Leeds, in his Practical Observations on Surgery. Some time ago, a young man came to my house with this dislocation. He was sent to me by Mr. Hughes, of Holborn, who had tried in vain to reduce it. Wishing Mr. Hughes to be present at the reduction, I desired him to call upon me in the afternoon, that we might try our skill together; but, in the meantime, the patient happened to meet with a relation who was a surgeon, and who reduced it for him. I inquired how this gentleman succeeded, and was told that he fixed a piece of tape round the thumb, and secured it with the *clove-hitch* knot, which is one in familiar use amongst sailors; he then fastened a common street-door key to the tape, and, of course, was thus enabled to make extension with considerable force, and with success. In fact, I had been thinking of trying a very similar method. Sir Astley Cooper, in his work on Dislocations, explains his plan of reduction. He first puts round the thumb a piece of soft wet leather, to prevent the skin from being injured, and then applies tape over it, which he secures by the clove-hitch knot. The knot proposed by Mr. Hey would also answer. The sailor's knot differs from Mr. Hey's chiefly in there being two circles, or nooses, made instead of one. Sometimes Mr. Hey succeeded without making any extension at all, merely by pressing the head of the first phalanx towards the metacarpal bone. Indeed, it is easy to understand, that if the broad part of the bone were confined behind the lateral ligaments, the more powerful the extension, the greater would be the difficulty of effecting the reduction. Sir Astley Cooper particularly recommends the first phalanx to be bent before the extension is made.

When the reduction of the first phalanx of the thumb cannot be effected by ordinary modes, it has been proposed to divide one of the lateral ligaments with a couching needle. The most experienced surgeons, however, object to this practice, on account of the frequency with which tetanus follows injuries of the tendinous and ligamentous tissues about the thumb. Sir Astley Cooper thinks it far more prudent even to let the dislocation remain unreduced, than occasion the risk of so frightful and unmanageable a disease as traumatic tetanus. Other surgeons recommend cutting off the head of the metacarpal bone with a small saw, or a pair of cutting pliers, which is perhaps better than dividing one of the ligaments.

Sometimes the dislocation is in the other direction, and the metacarpal bone is at the back of the first phalanx; then there is no difficulty in the reduction.

The *second phalanx* is sometimes dislocated backwards; and, in compound cases of this description, Sir Astley Cooper recommends cutting

off the articular surface of the first phalanx. After the reduction of either of the abovê-mentioned dislocations, the joint must be supported with pasteboard and tape. After a fortnight, we are to begin to employ passive motion.

The phalanges of the fingers are most frequently dislocated backwards; moderate extension soon replaces them.

*Compound dislocations* of the thumb frequently lead to tetanus, — so frequently, indeed, that some surgeons have thought it advisable to amputate in all such cases, rather than attempt reduction; but, in this counsel, I am not disposed to agree; for, from the observations which I have delivered on the subject of traumatic tetanus, it appears, that amputation is a very uncertain means either of preventing, or curing, this disorder.

### DISLOCATIONS OF THE VERTEBRÆ.

The dorsal and lumbar vertebræ have such extensive articular processes, while their bodies are so large, their ligaments so strong and numerous, and the motion between any two of them so trivial, that they hardly can be dislocated; and, indeed, Sir Astley Cooper states, that he has never seen a dislocation of the dorsal or lumbar vertebræ unaccompanied by a fracture of one or more of their bodies, or of the oblique or articular processes. He has never seen it happen from a simple laceration of the intervertebral substance. Generally, there is a fracture of the articular processes, and of one or more of the bodies of the vertebræ, with dislocation of the articular process of one vertebræ from that of the next. A dislocation from laceration of the intervertebral substance alone, may be deemed impossible in the lower part of the spine. But, in the upper part of the vertebral column, there may be a dislocation of the vertebræ unaccompanied by a fracture, because the articular surfaces of the bodies of the cervical vertebræ are less extensive, and the spinous and articular processes less oblique. At St. Bartholomew's Hospital, there is a preparation in which a portion of the intervertebral substance is lacerated, between the fifth and sixth cervical vertebræ, with a partial separation of those bones from one another, and a dislocation of the articular processes on both sides. There is another instance in the museum of the same hospital, of partial fracture of the bodies of the two lower cervical vertebræ, accompanied with dislocation of the articular processes. But the case, in which there was dislocation and no fracture of the articular or oblique processes is sufficient to prove, that there may be dislocation of the upper vertebræ without any kind of fracture. By the favour of a gentleman, who was attending my lectures, I was once enabled to show the Surgical Class of University College a specimen of complete dislocation of the middle of the cervical vertebræ, without fracture. The person, from whom it was taken, was killed instantaneously by coming in contact with the top of a gateway, as he was sitting on an omnibus, which was going with great speed.

In one of the last volumes of the Medico-Chirurgical Transactions, a case is recorded, in which the body of one of the dorsal vertebræ was fractured, and, at the same time, there was a dislocation of one of the articular processes of that bone from the corresponding articular process of the first lumbar vertebra, without fracture of them.

If we are to believe the statements of Desault, and others, dislocations of the articular processes of certain portions of the spine have occasionally been reduced.

## DISLOCATIONS OF THE HEAD.

There is no case on record, in which the os occipitis has been suddenly dislocated from the atlas by external violence, so firmly are they connected together. But there may be dislocations of the os occipitis from the atlas in consequence of disease. Now, this kind of displacement generally arises from a scrofulous caries of the joint, or of the atlas itself. There are also cases on record, in which exostoses from the occipital bone, or from the atlas, or from the petrous portion of the temporal bone, led to displacement of the atlas. Here, of course, the space for the medulla spinalis is diminished, yet it is not rendered sufficiently narrow to produce fatal consequences. If the patient live long enough under these circumstances, anchylosis of the atlas to the os occipitis may follow, the anchylosis sometimes extending to the dentata, and even to the vertebræ below it. There are several specimens in the Museum of University College, in which this sort of bony consolidation is illustrated. The symptoms of scrofulous disease of the upper cervical vertebræ, leading to displacement of them, were first accurately described by Professor Rust, of Vienna, and a good account of them was subsequently drawn up by Mr. Lawrence, and inserted in the Medico-Chirurgical Transactions. Most of the patients are young subjects. I have witnessed several cases within the last three or four years, and they were all in young persons, two of whom were girls. At the Bloomsbury Dispensary, a boy was under my care two or three years with this disease, which at length terminated in anchylosis.

The symptoms are, great pain on moving the neck or turning the head; after a time, more or less difficulty in swallowing is felt; if pressure be made on the part, the patient experiences great agony; the voice is hoarse, and there is oppression of the breathing; but the most characteristic symptom, when the patient is not lying down, is, that he is almost always found supporting his head with both hands placed under the lower jaw, either because motion of the head gives him pain, or because the support of it gives him relief. After some time, the patient generally becomes afflicted with vertigo, or is attacked by convulsions, which suddenly carry him off, or he lingers for a considerable period, and dies hectic. Before the fatal termination, a crepitus may sometimes be felt.

The treatment is conducted on the same principles as that of other scrofulous diseases of the bones and joints, that is, if there be pain and inflammation, we apply leeches, and if the affection partake of a more chronic character, we make an issue, or apply the moxa, a blister, or a seton, to keep up a discharge from the neighbouring parts, and excite counter-irritation, whereby the morbid process in the bones may be arrested.

*Dislocations between the atlas and the vertebra dentata.* — The rotatory motion of the head is performed by the atlas moving on the dentata, or rather by the former bone and the os occipitis revolving on the latter. Now, when this motion is carried beyond a certain point, a dislocation is the consequence. Here, then, a dislocation may be produced by external violence; and, in fact, many cases on record prove the possibility of such a dislocation. If the ligament, which ties the processus dentatus to the edge of the foramen magnum, receive a violent twist, by a forcible turn of the head to the right, the left side of the dentata may be carried in front of the corresponding articular process of the atlas, while the right side of the dentata is forced behind the corresponding articular surface of

the atlas. When the processus dentatus is dislocated from the space between the transverse ligament and the forepart of the atlas, it will press upon the medulla oblongata and spinal cord, and produce immediate death. In general, there is not a rupture of the transverse ligament, but the processus dentatus slips under it. Sometimes, however, the dislocation of the processus dentatus backwards is preceded by a rupture of the transverse ligament: but this can take place only in two ways,—first, from a fall with great force on the occiput, as happened in a case recorded by Boyer; and, secondly, from a violent fall on the chin, as mentioned by Sir Charles Bell. In children, the processus dentatus is particularly weak, and therefore liable to be broken; indeed, in any subject, in whom it is more slender than usual, it may be broken, and then the lower portion of it, passing under the transverse ligament, will make fatal pressure on the spinal marrow. In consequence of this process not being fully developed in children, and the ligaments being weaker in them than in adults, the common trick of lifting them up by the chin and occiput ought to be discontinued, for it has led, in many instances, to a sudden displacement of the processus dentatus, and instant death. A fracture of the atlas, with displacement of the processus dentatus, and fatal pressure on the spinal cord, is recorded by Sir Astley Cooper. But one of the most curious and interesting examples of a fracture and displacement of the atlas is related by Mr. Benjamin Phillips. The man, who met with the accident by a fall from a hayrick, lived forty-seven weeks after the injury, and then died of hydrothorax. Until the last week of his life, he was able to walk to the water-closet. On dissection, the condyles of the occiput were found yet to rest upon the articulating surfaces of the atlas; but, so much of the latter bone, as includes the surfaces by which it is articulated with the occiput and with the axis, had been violently separated from the posterior portion of its ring, and carried downwards and forwards, until it arrived upon the same plane as, but anterior to, the axis, to the body and transverse processes of which it became attached by perfect bony union, while the posterior fragment had suffered no displacement. The atlas, under these circumstances, presented two spinal foramina, and four transverse, but no odontoid process passed through the anterior spinal foramen; and to the circumstance of its having been fractured, instead of the transverse ligament giving way, Mr. Phillips ascribes the escape of the man from immediate death.*

As dislocations of the atlas from the second vertebra may be set down as inevitably fatal, it is unnecessary to say any thing about their treatment. We do hear, it is true, of dislocations of the head being rectified; but these are not the description of cases now under consideration, but merely examples of the displacement of one of the articular processes of the cervical vertebræ, erroneously called a dislocation of the head. A cure of such displacement is possible, and Desault actually succeeded in reducing an accident of this kind, by fixing the shoulders, and inclining the spine in the direction, opposite to that in which it was thrown.

### DISLOCATIONS OF THE RIBS.

The ribs cannot well be dislocated at their vertebral extremities; but a separation of the ribs from their cartilages sometimes takes place, and then they are generally displaced outwards. In Sir Charles Bell's

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* See Med. Chir. Trans. vol. xx. p. 78, &c.

Surgical Reports are the particulars of an interesting case, in which most of the ribs were dislocated in this manner, in consequence of the person being pressed between a post and a waggon. Dislocation of a single rib is sometimes met with. The proper treatment consists in the application of a long piece of pasteboard wetted, so as to fit the part accurately, and over this a broad roller should be applied, or a piece of linen, which is to be laced. When the pasteboard becomes dry, it forms an exact case for the part, and fits so closely as to prevent all motion of the end of the rib. Here it is also necessary to bleed the patient freely, as there is a chance of inflammation of the chest, and even of the abdomen; for the violence, producing such a dislocation, is always great; and, when a person is jammed between a wall or a post and a waggon, the contusion of parts is frequently not restricted to the chest.

### DISLOCATIONS OF THE HIP.

At this joint, the femur is liable to at least four dislocations. Those, recognised by all surgeons, are the following: — In the *first*, the head of the femur is thrown upon the dorsum of the ilium, above the acetabulum and a little behind it, and under the glutæus minimus muscle, with the trochanter forwards: this is by far the most common direction in which the head of the femur is dislocated. The *next* in order of frequency, is where the head of the thigh bone is thrown into the obturator foramen, or upon the obturator externus muscle, and the obturator ligament. In the *third* dislocation, the head of the femur is thrown inwards and upwards upon the horizontal branch of the os pubis. The *fourth* is where the head of the bone is thrown backwards into the sacro-ischiatic foramen, and is lodged on the pyriformis muscle. In a *fifth* case, which is exceedingly rare, the head of the femur takes a lower position, namely, behind the tuberosity of the ischium downwards and backwards. Such a dislocation, however rare, is possible; and even those who doubt the possibility of it, caution us, when we are reducing a dislocation on the obturator foramen, not to incline the limb too forward, lest the head of the bone should slip into that very position. Sir Astley Cooper, who never met with such a case, cautions us against making extension, for the reduction of the dislocation into the obturator foramen, with the limb raised too much in front of the axis of the body. An instance of dislocation downwards and backwards was recorded by Mr. Keate. In this instance, the lodgment of the head of the femur behind the tuberosity of the ischium arose from a secondary displacement. A gentleman fell into a ditch, with his horse upon him; he lay under the animal for some time; his thigh-bone was dislocated, and the head of it was found to have been forced secondarily behind the tuberosity of the ischium. However, many surgeons only admit the possibility of four dislocations of the thigh, and Delpech is one of them.

Except where the capsular ligament is much relaxed by the effects of disease, there must always be, in dislocations of the thigh-bone, a laceration of the capsular ligament. There are instances recorded of persons who could dislocate the thigh-bone spontaneously, and afterwards replace it again without assistance. A gentleman, who attended my lectures, informed me of a person so circumstanced, and related some of the particulars to me. I suppose that, in such cases, there must be an unusual relaxation of the synovial membrane, a rupture of the ligamentum teres, and perhaps an imperfect state of the acetabulum. But such examples are rare: Sir Astley Cooper mentions one instance; I have heard of other cases,

but I never saw one myself. In most dislocations of the hip, the ligamentum teres is ruptured: now, we should suppose, from a mere anatomical consideration of the joint, that the head of the femur might be dislocated on the obturator foramen, without any rupture of the ligamentum teres; for as that ligament is fixed to the anterior inferior part of the acetabulum, it seems to be capable of allowing the head of the bone to pass out of the socket on that side; but it is a disputed point, whether a dislocation can take place here without a rupture of this ligament. Sir Astley Cooper states, that a dislocation downwards and forwards, or into the obturator foramen, cannot take place unless the ligamentum teres be ruptured, and he details one or two dissections, which corroborate this assertion. On the other hand, Delpech asserts, that the ligament is not always ruptured; but, I believe, this can only be the case, when some of the brim of the acetabulum is broken off. Sir Astley Cooper is of opinion, that the ligamentum teres is always ruptured in this dislocation, because the accident cannot occur to a living person, except when his limb is in a state of abduction; and that, in such position, the ligamentum teres is on the stretch, and therefore, if the force applied go so far as to dislocate the joint, the ligamentum teres must first give way.

With regard to the symptoms of a *dislocation upon the dorsum of the ilium*, as the head of the bone is carried upwards, there must be a shortening of the limb; and as it is also thrown backwards, and the trochanter forwards, there must be an inversion of the limb; the knees and toes will be turned inwards; the great toe considerably, so as to be placed on the instep of the opposite foot; the prominence of the trochanter will be diminished, which necessarily happens, because the neck of the thigh-bone takes the direction of the side of the ilium: the trochanter is also nearer than natural to the crista of the ilium. The head of the bone can be felt on the dorsum ilii. The symptoms, then, are, a shortening of the limb; an inversion of the foot and knee; and the change in the position of the trochanter, namely, its proximity to the crista of the ilium being increased, and its own prominence diminished. The limb cannot be separated further from the opposite one, but it may be slightly bent.

This dislocation can only happen when the patient has the inferior extremity in front of the axis of the body, with the foot inclined inwards. While he is in this position, if any great force act on the foot or knee, it will tend to throw the head of the femur out of the acetabulum upon the dorsum of the ilium. Surgeons have been much perplexed to know why, in this case, the toe should always be inclined inwards; they inquire why the head of the femur should always be thrown backwards, and the trochanter forwards. In this country no explanation has been offered of the fact, or none that has been admitted as a good one. In France, what has been considered there as a satisfactory explanation of the fact, has been offered, and is the following: — The lower and inner part of the capsular ligament, not being lacerated, keeps the great trochanter forward, and the head of the bone is therefore always directed backward. Whether this explanation be admissible or not, it is difficult to say; but, in France, surgeons not only account for the position of the femur in this dislocation, but in all the others, in the same manner, namely, by the consideration of the way, in which the remains of the lacerated capsular ligament act upon the great trochanter.

The dislocation upon the dorsum of the ilium, being attended with a

shortening of the limb, might be mistaken for a fracture of the upper part of the femur; but the discrimination between the two cases is easy, when it is recollected that, in ninety-nine cases out of a hundred, the toes are everted in the fracture, while, in the dislocation upon the dorsum of the ilium, they are always turned inward. Another difference is, that the limb is altogether less moveable, or more rigid, in the dislocation than in the fracture. Then, in a fracture, even if it be one of the neck of the femur, we may, on drawing the limb downwards, feel a crepitus, and, on discontinuing the extension, the shortening of the limb will immediately recur.

The next most frequent *dislocation* of the head of the femur is that in which it is thrown *upon the obturator foramen*, or rather on the obturator externus muscle, and obturator ligament. Here one particular symptom is always noticed, viz. the body is inclined forward by the tension of the psoas magnus and iliacus internus muscles; the limb is lengthened from two to four inches; and in the state of abduction, with the knee and foot widely separated from those of the opposite limb. The buttock is flattened in consequence of the glutæi being drawn downwards, and stretched; and the prominence of the great trochanter is lessened in this, as well as in all other dislocations of the hip. The head of the femur is always plainly perceptible in its new situation, and the trochanter is separated further than natural from the crista of the ilium. With respect to the position of the foot in this dislocation, contradictory statements prevail. Sir Astley Cooper describes the position of the foot as being very little to be depended upon, and as sometimes but trivially altered, though frequently turned a little inwards. On the contrary, Delpech states, that the foot is generally turned outwards. The trochanter should always be particularly attended to in this, and, indeed, in all dislocations of the femur. Its situation and position, with respect to the crista of the ilium, is a point to be strictly considered; and, in this dislocation, the distance between the two parts is increased.

In the *dislocation, where the head of the bone is thrown upon the horizontal branch of the pubes*, the limb is shortened and turned outwards, and the head of the femur is felt, forming a distinct prominence below Poupart's ligament, and to the outer side of the femoral vessels. This is the only *common* dislocation of the hip, always attended with considerable eversion of the limb; for the example of luxation behind the tuberosity of the ischium, which is said to present the same symptom, is exceedingly rare.

In the *dislocation backwards into the ischiatic notch*, the limb is turned inwards, but not in so great a degree as in the dislocation upon the dorsum of the ilium; there is also a slight shortening of the limb, for the natural position of the ischiatic notch is a little higher than that of the acetabulum. There is likewise a diminution in the projection of the trochanter, and the head of the bone in thin persons may be felt in its unnatural situation, on rotating the thigh inwards.

The particular direction, which the head of the bone takes in each variety of dislocation, is determined by the position of the limb at the moment when the force operates that occasions the displacement. Thus, there cannot be a dislocation into the sacro-ischiatic notch, unless the lower extremity be, at the moment of the accident, elevated in front of the axis of the body, or the body bent forwards over the thigh.

In reducing dislocations of the femur, three grand or leading principles must constantly be attended to; namely, *counter-extension*, *ex-*

*tension*, and *the employment of the shaft of the bone as a lever for reducing its head*. These are the principles which are of the greatest consequence; for we cannot fulfil the principle of relaxing the muscles in these cases, because the bone is actually fixed in a particular position. But, though we cannot avail ourselves of the principle of relaxing the most powerful muscles by *position*, it is in our power, when great difficulty is encountered, to weaken them in another way, that is, by bleeding the patient. We may also find it necessary, in some instances, to reduce the force of the muscular system by giving nauseating doses of tartarised antimony, by which means a temporary weakness and collapse will be produced, during which we are enabled to overcome with facility the slight resistance of the muscles.

Counter-extension is performed by fixing the pelvis, which is done by means of a girth passed between the scrotum and the upper part of the dislocated thigh, and fixed to a point directly opposite that towards which the extension is to be made. Extension is generally made in this country at the lower part of the femur; but abroad, the lower part of the limb, or the ankle, is preferred for this purpose, and thus a longer lever is gained. The length of the lever is indeed of great advantage, and hence, I am not surprised, that many foreign surgeons should adopt this method of making the extension. The pelvis being fixed in the manner I have mentioned, by means of a girth or table-cloth, we are next to apply the extending means. Now, in whatever situation we make extension, we should adopt some contrivance to prevent the skin from being chafed; therefore, if we make extension with a sheet, we must apply, underneath it, a wet roller; if a pulley is used, there is an apparatus for the purpose, frequently lined with flannel.

When the dislocation is upon the dorsum of the ilium, the direction of the extension ought to be obliquely across the other knee; and of course the counter-extension should be made towards some point precisely in the opposite direction. It is usual, in reducing the dislocation upon the dorsum of the ilium, for the patient to be placed on his back, either on the floor, or on a four-post bedstead. Then, if it be the right femur that is dislocated, extension must be made in a direction obliquely across the left knee, with the pulley attached to the left post at the foot of the bed; while the counter-extending means are applied to the pelvis, as already described, namely, between the scrotum and the dislocated thigh, and fastened to a point precisely opposite to that towards which the extension is to be made. Now, as the pulley is fixed high, in this instance, the counter-extension girth must be fixed lower down than the edge of the bedstead. As soon as the extension has been carried far enough for the apparatus to be tense, and the patient to feel the effect of the power employed, we should not go on increasing the force at random, but proceed cautiously and slowly, lest mischief should result. It is best, as soon as the muscles are put on the stretch, to wait a little, and let them gradually fatigue themselves, until their power of resistance is lessened. In short, the principle is, not to relax the extending power, but to keep it up until the head of the femur has descended near the acetabulum; but directly it is low enough for the lever-like movement to operate efficiently, the extension ought not to be increased. We are now to put in practice the principle of making the shaft of the bone a lever for the reduction of its own head, which is accomplished by taking hold of the lower part of the limb, and rotating it outwards. The head of the bone is thus inclined directly towards the acetabulum by the

lever-like movement of the limb. But supposing great difficulty were to be experienced in effecting the reduction in this way, we should then apply a napkin, or band, to the thigh below the groin, and draw the upper part of the femur outwards with it, at the moment that the limb is suddenly rotated outwards, and the foot carried a little across the other. The napkin acts as a fulcrum for the lever-like movement, and the reduction is readily affected. When the brim of the acetabulum is very high, and the patient particularly strong, immense difficulty may be encountered in the reduction, unless the band be applied round the thigh. The principles upon which this dislocation of the thigh-bone is reduced are therefore simple; they are only three, namely, counter-extension, extension, and the employment of the shaft of the bone as a lever for reducing its head; the latter being performed by rotating the limb outwards, and inclining the ankle inwards, as soon as the extension has been carried far enough. This latter manœuvre will bring the head of the bone towards the acetabulum; but if unusual difficulty is experienced, a band should be applied round the upper part of the thigh, in order that this portion of the femur may be drawn outwards. Such a band is in fact a fulcrum to assist in the execution of the lever-like movement of the limb. By these means, the dislocation, if not of too long a standing, may always be reduced.

I come now to the reduction of the next most frequent form of dislocation of the femur; that in which the head of the bone is thrown upon the obturator foramen. Here the limb is in the state of abduction, and, consequently, if extension were made in the direction in which the limb is thrown, without taking some precautions to prevent the pelvis from being drawn to one side, this would inevitably happen. Therefore, the common means of fixing the pelvis will not be sufficient; it will be necessary to put a girth or napkin round the pelvis, to counteract the tendency, which the extension would have to carry it too far sideways. In the reduction of this dislocation, then, two means are made use of for the counter-extension, which, without them, could not be conveniently fulfilled. The reduction of the dislocation on the obturator foramen is a simple proceeding; in fact, as soon as the head of the bone is dislodged from its situation, it will generally return of itself into its right place, on inclining the ankle inwards. But if we cannot succeed by this plan, then we are to have recourse to the band round the thigh, in order to draw the upper part of the femur outwards, and thus a fulcrum is obtained to promote the effect of the movement of the lower part of the limb inwards. There is one caution, however, to be observed in reducing a dislocation upon the obturator foramen, which is, to be careful, that, while we are making extension, the limb does not incline forward too much, and the head of the bone slip backward behind the tuberosity of the ischium, and thus constitute another form of dislocation, which is sometimes considered to be irreducible, though I am not aware of the facts upon which this view is founded.

In the *dislocation into the sacro-ischiatic notch*, the direction of the extension should be across the middle of the opposite thigh. The patient is most conveniently placed on the uninjured side of his body. This is a more difficult dislocation to reduce, than that upon the dorsum of the ilium. Hence, we generally find it necessary to apply the band round the upper part of the thigh, as a fulcrum, or rather as a means of raising the head of the bone over the brim of the acetabulum. At the period of attempting this, we should also give the lower part of the limb a twist

outwards, by which movement the head of the bone will be inclined towards the acetabulum, with all the force of a long and considerable lever.

In the *dislocation on the horizontal branch of the os pubis*, the patient is also to be placed on his side; the pelvis is to be fixed with the common apparatus, and a band applied round the upper part of the thigh for the purpose of raising the head of the bone over the brim of the acetabulum. The direction of the extension ought to be in a line rather behind the axis of the body, and, as soon as the head of the bone has been drawn low enough for the lever-like movement to be put in practice, then the extension should cease, or, at all events, not be increased. The usual means are now to be put in force for completing the reduction, namely, the lever-like movement of the limb, and the use of the band round the upper part of the thigh as a fulcrum. In short, all dislocations of the thigh are reduced on the same principles; and whoever understands these well and scientifically, can never be at a loss. Relaxation of the muscles cannot be accomplished by position, though it may be so by the effect of bleeding and nauseating doses of tartarised antimony. In many cases, indeed, and especially in those of long standing, such means become important auxiliaries, without which there would be no chance of success.

A *dislocation downwards and backwards*, in which the head of the thigh-bone is absolutely thrown behind the tuberosity of the ischium, was seen by Mr. Keate, the patient being a gentleman, whose horse fell with him into a ditch. It appears that the animal lay upon him for some time — for five or ten minutes — during which he continued struggling to liberate himself from his painful situation as well as he could. From the particulars, it seems that the original dislocation was upon the obturator foramen, but by a secondary displacement, which occurred during the patient's struggles, the head of the bone was thrown behind the tuberosity of the ischium, the very situation from which Sir Astley Cooper considers that the reduction would have been impracticable. However, in this case, the reduction was attended with no very great difficulty; the bone was first replaced upon the obturator foramen, and afterwards, by pursuing the plans proper for reduction of the dislocation on the obturator foramen, the head of the bone was replaced. In this instance, there was abduction of the limb, and the head of the bone could be plainly felt behind the tuberosity of the ischium; the toes were also turned considerably outwards. If there be no mistake in the account, the case proves, in the first place, the possibility of such a dislocation; and secondly, so far from its being irremediable, that there is no great difficulty in effecting the reduction. We also find an enumeration of the symptoms, namely, a lengthening and an abduction of the limb, eversion of the toes, and the being able to feel the head of the bone in its unnatural situation.

### DISLOCATIONS OF THE PATELLA.

The patella is liable to three dislocations: first, outwards on the external condyle; secondly, inwards on the internal condyle; and lastly, upwards, with rupture of the ligamentum patellæ. There are also some other modes of displacement; for occasionally the patella is simply twisted with the inner edge forwards and the external one backwards, so as to form a considerable projection on the front of the knee; and sometimes it is thrown on the external condyle and twisted round. But the most

frequent form of displacement of the patella is, where it is thrown flat upon the external condyle. This dislocation is most commonly seen in persons, whose knees are considerably inclined inwards. In persons of this conformation, we may readily conceive, how the action of the extensors of the leg will draw the bone outwards. When persons are knock-knee'd, as it is called, and the ligament of the patella particularly loose, this dislocation is very apt to take place, the action of the extensors of the leg being often sufficient to produce it, without the aid of external violence. Sir Astley Cooper relates the case of a young girl brought up to tumbling, in whom the ligaments of the knee-joint and patella were so loose, in each limb, that both patellæ slipped to the outer side of the external condyle of the femur, whenever the extensors acted. The dislocation inwards, however, is generally produced by external violence, or a blow on the external edge of the patella, by which it is driven inwards. Both these dislocations are reduced on the same principles, namely, by relaxation of the extensors of the leg, and then pressing the displaced bone outwards or inwards, according to the direction of the displacement. There is generally no great difficulty in effecting the reduction. However, instances are known in which considerable difficulty was experienced; and such a case was met with by Mr. G. Young, who found, however, that by placing the patient's foot against his own shoulder, and pressing on the patella with both hands, while the limb was in this position, the reduction became very practicable, though the ordinary method failed. Owing to the looseness of the ligaments in certain individuals, and an extraordinary obliquity of the articular surface of the lower end of the femur, it is sometimes difficult to maintain the reduction after it has been accomplished, and then it becomes necessary to apply a roller over the patella, in the figure of 8 manner, in order to keep it in its place. If there were much swelling, the roller should not be applied until the inflammation had been lessened with cold lotions, purgatives, leeches, &c.

When the dislocation takes place upwards, in consequence of a rupture of the ligamentum patellæ, there is generally a great deal of swelling about the joint, for this dislocation can only be produced by great and direct violence, or extraordinary efforts of the extensor muscles, by which the synovial membrane is torn, and a severe degree of inflammation commonly follows. Here also the principle of relaxing the extensors of the leg should be observed, by placing the limb on an oblique plane, extending from the tuberosity of the ischium to the heel. We cannot apply a bandage at first; but after three or four days, when the inflammation and swelling are diminished, a roller should be put round the lower part of the thigh, so as to confine the patella as near as possible to the tibia. After about three weeks, it is advisable to have recourse to passive motion of the joint; that is, a person must be directed to bend and extend it a little every day, for the purpose of preventing anchylosis.

In one of the volumes of the London Medical Gazette is a case, in which the patella was not only thrown outwards upon the external condyle, but twisted, so that the front surface of the bone was turned backwards, and its posterior surface forwards; but such an accident is far less common, than the simple dislocation outwards.

### DISLOCATIONS OF THE KNEE.

The knee-joint does not derive much strength from the conformation of the bones, but is rendered immensely strong by the number, the

strength, and the arrangement of its ligaments; so strong, indeed, that its dislocations are rare; no other joint equally exposed to external violence being so seldom dislocated. However, dislocations of the knee-joint may take place, and in four directions. The head of the tibia may be displaced *inwards* or *outwards;* but when the dislocation is in either of these directions, it is always incomplete, and the accident is exceedingly rare. Lateral dislocations of the knee-joint are more uncommon than those in which the head of the tibia is thrown either backwards or forwards. There was a case in Guy's Hospital, where the *tibia* was *dislocated backwards* and the *condyles of the femur forwards*, and such pressure made on the popliteal artery by the displaced tibia, that the pulsation of the anterior tibial artery at the instep was stopped. All dislocations of the knee are exceedingly rare, yet we occasionally read of them; and perhaps, in the course of twenty years, there may be one case brought into a large hospital. There can be no difficulty in recognising them; for the projection of the tibia and femur will render them sufficiently obvious. When the tibia is dislocated forwards, there is generally some laceration of the gastrocnemius and popliteus muscles. Sir Astley Cooper met with a case of incomplete dislocation of the knee-joint, in which the *external condyle was thrown off the head of the tibia forwards*, and *the internal condyle backwards;* and in this case, he found, that there was no laceration of the crucial ligaments; but if the tibia were completely dislocated backwards, then the crucial and lateral ligaments, and the above muscles, might be lacerated.

The principles of reduction consist in bending the knee, so as to relax the strong muscles of the calf; and, while the femur is fixed, in making extension and pressing the head of the tibia in the proper direction.

*Dislocation of the condyles of the femur from the semilunar cartilages.* — Sometimes the ligamentous bands, which fix the semilunar cartilages in their natural situation, become more elongated and relaxed than usual; and this is particularly liable to be the case, when there is a collection of fluid in the joint; and under these circumstances, if the person, in walking, happens to bring his foot in contact with any obstacle, one or both condyles of the femur may be dislocated off the corresponding semilunar cartilage or cartilages; the result is, that the patient cannot straighten his leg; and a sudden attack of severe pain in the joint is felt. The plan adopted by Mr. Hey, consists in forcibly extending the limb, and then bending it as far as possible; this plan I have tried with success. In some cases, however, it will not answer, and then other plans may be tried. One of these consists in bending the thigh, and twisting the leg suddenly outwards; this has occasionally had the desired effect. Sir Astley Cooper mentions a patient, who could never get the condyles replaced upon the semilunar cartilages, unless he followed this plan; he used to put himself on the floor, and then, by bending his thigh, and twisting his leg outwards, he was always able to accomplish the reduction and procure instant relief. When once this accident has happened, it will be liable to recur ever afterwards; hence it is frequently prudent for the patient to wear a laced knee-cap, so as to keep the knee steady and duly supported.

### DISLOCATION OF THE FIBULA.

The upper head of the fibula is rarely dislocated by external violence: I have never seen a case thus produced; but a dislocation of the upper head of the fibula is occasionally met with in consequence of disease,

and then it is thrown backwards. This, however, is not a common case. The treatment consists in the employment of such remedies as are calculated to stop the morbid process going on in the joint, which is generally of a scrofulous nature; we are to blister the part, and when we have stopped the further progress of the disease, we should perhaps employ compression to fix the head of the fibula in its proper place.

### DISLOCATION OF THE ANKLE JOINT.

The ankle joint is frequently dislocated. The tibia may be dislocated off the astragalus in four directions. The most frequent case is that where the tibia is dislocated inwards, the tarsus being forced outwards; in this accident there is a fracture of the fibula about two inches and a half or three inches above the malleolus externus, or the lower end of the bone, its most slender part. There is a considerable projection of the malleolus internus, rendering the integuments over it exceedingly tense; the broken part of the fibula inclines inwards towards the tibia; and the position of the foot is altered, its outer edge inclining upwards, while its inner edge is turned downwards, so as to come in contact with the ground. When the accident is caused by a person jumping from a great height, that portion of the tibia which is bound by ligament to the fibula is split off, and remains connected to the broken part of the latter bone, the ligament binding the fibula to the tibia in this situation being so strong, that it does not give way.

There are two methods of treating this dislocation, though the plans of reduction approved of by all surgeons are the same; namely, we are to relax the strong muscles of the calf; this is an invariable principle; and then by making the requisite counter-extension, and practising extension from the end of the foot, the tibia may be easily replaced. But, whether the leg should remain in the bent position, or should be kept extended, after the reduction has been effected, seems to be a point, on which some of the most experienced surgeons differ. Sir Astley Cooper is an advocate for the straight position of the leg, and for the application of lateral splints, each having a foot-piece attached to it, in order to prevent the foot from moving to either side. On the contrary, Baron Dupuytren adopts another plan: the foot being displaced outwards, he first applies a thick wedge-shaped cushion at the lower part of the inside of the leg, with the thick end downwards, and over that he applies a long splint; the wedge-shaped cushion is to fill up the space between the inner edge of the sole and the splint, which must extend some way beyond the foot. Having secured the splint with a roller above, he next applies a bandage below in the form of the figure of 8, and thus draws the foot inwards towards the splint, which serves as a convenient fixed point.

In the other lateral dislocation of the ankle, the tibia is thrown off the astragalus, in the direction outwards. This is a rarer accident than the former; in fact, it cannot happen without the application of immense force; and, when it does take place, there is generally a fracture of the malleolus internus, or else an oblique fracture of the lower end of the tibia extending into the joint. Sometimes the astragalus is also fractured, and the fibula is broken into several pieces. The deltoid ligament is unbroken; but the outer part of the capsular ligament is torn. When the fibula breaks, the external lateral ligament remains entire; but, if the fibula is not broken, then the external lateral ligament is ruptured.*

* See Sir Astley Cooper's Treatise on Dislocations, ed. 4. p. 236.

A violent twist of the foot inwards may produce the accident. The position of the foot is the reverse of what it is in the foregoing case; for it is the outer edge of the foot that comes in contact with the ground, while the inner edge is thrown inwards and upwards; and the malleolus externus forms an extraordinary projection. The reduction is effected on the same principles as in the dislocation of the tibia inwards, and therefore comprises relaxation of the strong muscles of the calf, counter-extension and extension. Sir Astley Cooper adopts the same method of treatment in this as in the dislocation of the tibia from the astragalus inwards: he puts the leg in the extended position, and applies lateral splints with foot-pieces. Baron Dupuytren also adopts the plan, which I have mentioned, as his practice in the dislocation of the tibia inwards, but he puts the wedge-shaped pad and the long splint on the outside of the leg; for here the object is to bind the foot in this direction.

In the third dislocation of the ankle joint, the lower head of the tibia is thrown off the astragalus forwards upon the os naviculare; and there is a lengthening of the heel and a shortening of the foot. The dislocation may be either complete or incomplete; the tibia may be thrown either off the astragalus altogether, or only partially, half of it resting upon that bone, and half upon the os naviculare. In the latter case, the shortening of the foot may be inconsiderable, and scarcely noticed by a careless practitioner.

A dislocation of the tibia off the astragalus backwards, with elongation of the foot and shortening of the heel, must be very uncommon; for Sir Astley Cooper gives no instance of it in his valuable work, and Baron Dupuytren never met with an example of it.

### DISLOCATION OF THE ASTRAGALUS.

Another more interesting kind of *dislocation* is that of the *astragalus* itself forwards from the os naviculare and os calcis, so as to form a considerable projection on the instep. This is not a very common accident, but it sometimes happens. I have seen not less than three examples of it. The dislocation may be either complete or incomplete. The reduction is sometimes exceedingly difficult; and when it cannot be effected, the accident is a serious one; for the patient is never afterwards able to put his heel to the ground, and his ankle remains permanently stiff. I remember being called in to a lady who had met with this accident two or three weeks before I saw her. Reduction was quite impossible; she was a fat woman, and the injury was attended with so much swelling at first, that the surgeon who saw her directly after the occurrence of the accident, could not make out the case. I perceived that it was a dislocation of the astragalus; and reduction being impracticable, she remains lame, with a stiff instep.

In consequence of this dislocation being sometimes irreducible, even under the most skilful treatment, it has been proposed, when reduction cannot be affected, to remove the astragalus altogether. This has sometimes been done; and when it is a case of compound dislocation of the ankle joint, accompanied by displacement of the astragalus, it may be the best practice to cut away the latter bone; but, in simple dislocations, I think, this proceeding would not be justifiable. Of course, in all cases, we should first try to reduce the bone. The plan of reduction is to relax the muscles of the calf, extend the foot as much as possible, and then press the bone into its place. Cases are recorded, in which the skin covering the displaced bone, inflamed and sloughed, and the bone became

exposed. In such a case Sir Astley Cooper divided the ligamentous connections of the astragalus, and removed it: there was not so much weakness of the joint produced as might have been expected, and in eleven months the gentleman, who was the subject of the accident, was able to perform his duties as a cavalry officer, which implies a considerable power of using the joint.

Mr. Benjamin Phillips favoured me with the particulars of an accident, in which the astragalus was dislocated backwards, and lay under the tendo Achillis. Another instance has been lately published, in which the astragalus was completely dislocated, without any change in its relations to the tibia and fibula.*

* See Dublin Journ. of Med. Science, vol. xiv. p. 235. The patient was Mr. Richard Carmichael, the justly eminent surgeon of Dublin.

END OF SECTION II.

THE

# FIRST LINES

OF THE

# PRACTICE OF SURGERY.

## SECTION III.

### OPERATIONS.*

The following general maxims, in relation to operative surgery, deserve attention: —

1st. Before undertaking any capital operation for the cure of a disease in one situation, we ought to consider whether the patient has any incurable organic affection about him elsewhere; and if he has, we should decline to operate. What is the good of amputating a limb for a diseased joint, when the patient is dying of tubercular phthisis? Where the wisdom of performing an operation for the cure of an external aneurism, when the patient's doom is already sealed by the existence of an internal one? At all events, nothing but the immediate destruction of the patient, if an operation were not performed, would be a vindication for it under such circumstances. Even, with respect to some minor operations, it is a rule not to perform even them, when the patient is afflicted with any incurable internal disease. Thus, a fistula in ano is not to be cut, a pile is not to be extirpated, if the patient is known to labour under disease of the liver or lungs.

2d. An operation is rarely advisable, unless the whole of the diseased parts can be removed. When, however, a tumour is not of a malignant character, and only produces inconvenience by its size, or particular situation, the partial extirpation of it will sometimes relieve the patient. The truth of this observation is often exemplified in operations on the tonsils, in the state of chronic enlargement and obstructing the communication between the mouth and the pharynx. When a true exostosis cannot be entirely taken away, the partial removal of it will sometimes afford great relief by diminishing its size, and obviating the ill-consequences of its pressure on neighbouring organs. I have known the same practice extended to bronchoceles, which, by their pressure, were causing obstruction of the breathing, and of the return of blood from the head.

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* Those for Herniæ and various Diseases of the Eye, and some other operations, have been already described.

3d. Before resorting to an operation, we should maturely consider, whether there is any chance of cure by milder means; and, if the circumstances of the case afford time for a trial of them, this ought undoubtedly to be made.

4th. Some diseases, for which desperate operations are occasionally undertaken, are known to admit, in a few instances, of a natural cure. Here the surgeon of proper moral feelings, before determining to operate, will consider well, whether the patient has the best chance of life from such an operation, or from the possibility of a spontaneous cure.

5th. Operations should not be rashly performed with an entire disregard of the state of the patient's general health. We should inquire into his previous habits and modes of life, and the present state of his constitution; whether he be plethoric; of a phlogistic diathesis; of a very nervous irritable fibre; one, who has already suffered from erysipelas; or who has any symptoms, justifying the suspicion of the existence of a serious, or incurable, visceral affection.

6th. When the time permits, we should bring the patient's constitution into as favourable a condition as possible for the operation by means of medicine, diet, and regimen. In particular, the weak should, if possible, be supported and strengthened; and the robust and plethoric, who are always predisposed to inflammation, be restricted for a few days to low diet, and have the bowels emptied; and, where little blood is likely to be lost in the operation, and the operation sure to fail if inflammation follow it, the performance of venesection may be prudent. The truth of this remark is illustrated in the treatment of cataracts. As highly sensitive, hysterical, and nervous subjects, not only frequently have violent constitutional disturbance after operations, but sometimes die very suddenly, immediately or shortly after their completion, we should avoid, if possible, operating on such individuals; or, if an operation must be done on them, we should apprise their friends of the uncertainty of the result, and administer a cordial, with a dose of laudanum, a little while before the operation commences.

7th. Another rule is to let every instrument, and every article likely to be required, be in readiness and perfect order before the operation is begun: instruments of the best construction; ligatures; forceps; tenaculums; sponges; warm and cold water, towels, bandages, &c. &c.

8th. The patient should not be informed of the necessity of his submitting to an operation long before the period of its performance. The shorter the interval, between the communication of the painful intelligence to him and the performance of the indispensable measure, the better; because the mind, brooding on the expected suffering, too frequently causes an aggravation of the disease, and a most unfavourable derangement of the general health.

9th. Patients, about to undergo operations, should not have any opportunity of seeing the knives, saws, and other formidable instruments arranged for the occasion. The principles of humanity would dictate this precaution, were it not suggested by the obvious advantage, in a surgical point of view, of having the patient as free as possible either from agitation or depression, while the operator is executing perhaps a tedious, a delicate, or a very difficult task.

10th. Every operation that is well performed, whatever may be the time taken up in its completion, is done quickly enough.

11th. In the ligature of arteries, the removal of tumours, dead bone, or extraneous bodies, it is advantageous to make a free division of the

skin; without which, every other step in the operation will be seriously retarded, and the patient suffer on the whole infinitely greater pain, than if a proper external incision had been made at once.

### OPERATION OF TREPHINING.

The trephine is frequently applied to various bones of the body; but, when we speak of the operation of trephining, we usually signify that which consists in sawing out a portion of the skull, as is practised in order to enable the surgeon to raise a part of it producing dangerous pressure on the brain; to discharge collections of matter or blood, which have the same effect; to extract a ball, or other foreign body lodged under the skull; to remove a sequestrum, extending through both tables; or to extirpate tumours growing from the surface of the dura mater.

Every part of the cranium cannot he trephined with equal safety. However, the mere presence of a suture ought not to deter the surgeon from making the perforation in any place which seems advantageous. I believe, also, that the fears, respecting wounds of the longitudinal sinus, have been vastly exaggerated; and that, if the situation of a depressed fracture, or extravasation, demanded the removal of a piece of the skull directly over this vessel, the operation would be justifiable. The longitudinal sinus has often been wounded by spiculæ of the cranium, and sometimes it has been punctured with a lancet, in order to bleed the patient; yet the hemorrhage was easily stopped with a small compress of lint.* But, though I feel warranted in making this statement concerning the longitudinal sinus, I am not acquainted with any facts, showing that hemorrhage from the lateral sinuses would not prove more serious. These latter are much larger; and as they occupy the deep transverse furrows in the inner surface of the os occipitis, a trephine applied over them would be likely to wound them.† Velpeau lays it down as a maxim, deduced from various facts on record, that the trephine may be applied over the sinuses as well as to most other parts of the cranium; but though he has no fear of the bleeding, because hemorrhage from a large vein may always be commanded by moderate pressure, he allows that a wound of the sinus exposes the patient to two dangers; viz. inflammation of the wounded vessel, and the entrance of air into it.‡

Authors generally interdict the application of the trephine to the anterior inferior angle of the parietal bone, on account of the trunk of the spinous artery of the dura mater being situated in a groove on the inner

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* Cases in Surgery, by J. Warner, p. 8. edit. 4.; Marchetti, Obs. 4. Sharp's Operat. p. 144. edit. 3.; Pott's Chirurg. Works, vol. i. p. 156—159. edit. by Earle. 1808. Even so far back as the torcular Herophili in a child, a wound of the sinus by a spicula of bone, though the blood at first spirted out to the distance of two feet, and extinguished a candle, did not afterwards give any trouble from hemorrhage, which did not return when a dossil of lint had been held a little while on the wound. See Velpeau, De l'Opération du Trépan, p. 129. This case, be it observed, was in a child, and of course the sinus of less diameter than in an adult. In Hargrave's Operative Surgery, however, it is stated, on the authority of Mr. Read, that hemorrhage from the termination of the longitudinal sinus, may always be stopped by very moderate pressure.

† Janson contrived to trephine over the lateral sinus without wounding it, and thus succeeded in extracting a ball from the cerebellum. See Compte Rendu, de l'Hôtel-Dieu de Lyon, p. 47. 1822. I should not imagine, as M. Velpeau does, that it would generally be easy to apply the trephine without wounding the sinus, unless blood or matter lay between it and the inner table.

‡ De l'Opération du Trépan, p. 132.

surface of that part of the skull. For my own part, I should never be afraid of trephining here; for, if the above vessel were wounded, a little lint, introduced into its orifice, would immediately stop the bleeding; or we might imitate Larrey, and touch the mouth of the vessel with a heated probe.

It is a maxim to avoid trephining any part from which a complete circle of bone cannot be sawn, without hurting the dura mater. The inequalities on some parts of the inner table of the skull, make attention to this rule necessary. Thus, the centre of the forehead is rather an inconvenient place for the trephine, because, when the spine of the os frontis is prominent, it cannot be sawn, without the dura mater being wounded by the teeth of the saw. At all events, if the surgeon were to apply the trephine to this part, he should complete the separation of the bone with an elevator, instead of making any dangerous attempt to saw entirely through the projecting spine.

Surgical writers caution us not to trephine over the frontal sinuses, and, not without reason; for, if the perforation be continued in the direction in which it begins, the inner table will be sawn entirely through on one side of the circle, before the other is at all divided. However, the outer table may be first removed with a large trephine, and the inner table then perforated with a smaller one, placed evenly and perpendicularly on the posterior surface of the sinus.*

The trephine cannot be applied lower down on the forehead, than half an inch above the superciliary ridge of the os frontis, without risk of injuring the orbit. If requisite, it may be applied to the squamous portion of the temporal bone; for wounds of the temporal muscles are not at present so much dreaded as they were by our ancestors. The unevenness of the os occipitis, the course of the longitudinal and lateral sinuses, and the way in which a part of this bone is covered by muscles, have made surgeons fearful of applying the trephine to it. However, there are two small spaces on each side of the groove for the longitudinal sinus, where a trephine may be safely applied.† The operation may even be done below the transverse ridge, near the foramen magnum, as a division of the attachments of the splenius and complexus would not be dangerous, while unrelieved pressure on the cerebellum would certainly be fatal. ‡

When the bone is already sufficiently exposed by a wound, the operation may commence at once; but otherwise, it is first requisite to make room for the application of the trephine by an incision of a crucial form, or shaped like the letters T or V. None of the scalp should ever be removed. The incision should be made directly down to the bone; but, in fractures, attended with separation of the edges of the fissure, or with comminution, the danger of pressing too hard with the knife is obvious.

It would be dangerous to apply the trephine to depressed portions of the skull. The perforation is always to be made on that side of the fracture, where the elevator can be most conveniently introduced beneath the depressed bone for the purpose of raising it. In cases of extravasation, the perforation ought to be made at the place where there are traces of

* C. Bell's Operative Surgery, vol. i. p. 439.

† See Warner's Cases, p. 18. ed. 4.

‡ Faivre, Anc. Journ. de Méd. t. lxviii.; Caisergue, as quoted by Velpeau, De l'Opération du Trépan, p. 139.; A. Copland Hutchison, in Med. Chir. Trans. vol. ii. p. 104.

violence done to the scalp, unless particular considerations exist against the blood being effused under that part of the cranium, as noticed in the remarks on Injuries of the Head, in the second section of this work.

When the scalp has been divided, and loose splinters of the cranium are found under it, they ought to be taken away with the forceps or finger; for they can only be regarded as extraneous bodies, the continuance of which may be productive of dangerous irritation. Depressed pieces of the skull, causing bad symptoms, are sometimes completely detached, and admit of removal in the same manner.

In every instance of fracture with depression, unattended with motives for believing that the pressure on the brain arises partly from extravasation, provided such depressed fracture can be raised with a pair of forceps, or an elevator, without applying the trephine, the latter operation may be dispensed with.

When a depressed fracture is exposed, the bone may sometimes be raised to its proper level with an elevator; and then no necessity exists for sawing away any portion of the cranium, unless blood, extravasated beneath it, render such proceeding advisable. The point of the elevator is to be put under the edge of the depressed piece of bone, and a fulcrum for the instrument obtained on the margin of the adjoining portion of the cranium. In other instances, the fracture may be so shaped, that the depressed portion of bone can be cut across with one of Hey's saws at the part connecting it to the rest of the skull, and thus be easily removed, there being then no occasion to take away with the trephine any other portion of the cranium. Thus, supposing a depressed fracture to represent two sides of a triangle, a simple and straight division of the bone through the base of this triangle, with one of Hey's saws, will enable the surgeon at once to remove the broken and depressed piece of bone.

The instruments required in the operation are, a scalpel for the division of the scalp, three trephines with crowns of various diameters, and sliding centre pins, capable of being securely fixed with a screw when drawn out to the proper extent. One of the most common defects of modern trephines is, the liability of the centre-pin to slip back as soon as pressure is made on the instrument, which is thus rendered useless. Every case of trephining instruments should also contain an elevator, a pair of forceps, calculated to remove the bone when sufficiently loosened by the trephine; Hey's saws, with the teeth in straight and semicircular rows; a small brush, with which the teeth of the saw are to be now and then cleaned in the progress of the operation; and a lenticular knife, with which any irregularities of bone, at the margin of the opening made with the trephine, are to be removed. The plan of scraping away the pericranium from the part of the skull on which the trephine is about to be applied, is now condemned, as more likely to detach that membrane to a pernicious extent, than really to facilitate the action of the trephine.

The operation of trephining is divisible into four stages; first, that in which the bone is exposed; secondly, that in which it is sawn; thirdly, that in which it is taken away; and fourthly, that in which other measures are pursued, in order to fulfil the object in view.

On the first, I have but little more to say. When the squamous portion of the temporal bone is to be exposed, the incisions are usually made in the form of the letter V, with the apex directed towards the zygoma, so that their direction may correspond in some degree to that of the fibres of the temporal muscle. The flap is then raised from the point upwards.

Generally, the bleeding from branches of the temporal or occipital artery, caused by dividing the scalp, should be allowed to continue a little while, as having a beneficial effect in checking further effusion of blood in the head, or inflammation; but, if the hemorrhage be profuse, and the pulse considerably reduced, ligatures will be necessary.

The removal of a portion of the cranium with the trephine is performed as follows: the centre-pin of the instrument, having been made to project moderately beyond the level of its teeth, and securely fixed by turning the screw, is to be applied to the central point of the circle of bone, which it is judged advisable to remove. The circumstances, which should guide us in choosing the place for the trephine in examples of pressure on the brain from blood or matter, accumulated on the surface of the dura mater, have been explained in the foregoing section of this work. (See Injuries of the Head.) When the case is a depressed fracture, the centre-pin, the use of which is to steady the trephine, until the teeth have formed a groove, is to be placed on an unyielding part of the cranium, with the crown in a situation, where the perforation will enable the surgeon to elevate, or remove altogether, the depressed portion of bone. As soon as the centre-pin has been fixed in the bone, the surgeon turns the crown alternately to the right and left by the prone and supine movements of his hand, observing to make steady, but moderate, pressure with the instrument, until a sufficient groove is formed. The centre pin, which is no longer of any use, and whose projection would soon injure the dura mater, is now to be withdrawn, and the action of the trephine more cautiously continued by semicircular movements of it, made alternately to the right and left. The sawing may go on briskly at first; but we are not to depend upon our being able to distinguish the arrival of the teeth of the instrument in the diploe, as a criterion of the external table having been divided, and of the necessity of now proceeding with greater circumspection and slowness. At all events, it is only in the middle period of life, that the texture of the cranium is likely to afford a difference of sensation and sound on the division of the external table being completed. Whether the arrival of the instrument in the diploe can be perceived or not, it should be worked with great caution after the groove is of a certain depth, its movements being executed with briskness in the direction of the teeth, but with little or no pressure. In this stage of the operation, the groove is to be frequently examined with a tooth-pick, the flat end of a probe, or a small thin piece of steel for the purpose, usually contained in every case of trephining instruments. If the perforation is found to be complete in any portion of the circular groove, the action of the trephine is then to be strictly limited to the parts, where the division of the inner table has not yet been carried far enough. This is done by inclining the instrument, as it works, to the undivided portion of the circle.

The cranium having been sawn to a sufficient depth, the next business consists in removing the circular portion of bone. In the previous stage of the operation, the surgeon will be likely to injure the dura mater, if he aim at dividing very completely the inner table at every point with the trephine; and therefore, as soon as the piece of bone seems loose, it is safer to remove it with an elevator, or a pair of forceps, and to break its slight remaining connections to the rest of the cranium, than run any risk of lacerating the dura mater with the teeth of the saw. Any irregu-

larities at the edge of the perforation, likely to irritate the same membrane, are then to be removed with the lenticular knife.

If the case be one of pressure on the brain, from blood extravasated on the dura mater, the surgeon will now have to consider, whether the first opening made will suffice for the removal of such blood; if not, another, or even a third perforation, may be necessary. The same occasion for additional perforations will not so often present itself when purulent matter is lodged under the inner table, as it always escapes more readily than blood, and is generally less diffused.

When there is a depressed fracture, an elevator is to be introduced under the part of the bone which is below its proper level; and a fulcrum having been obtained either on the edge of the adjoining portion of the cranium, or on the fore finger of the surgeon's left hand, the depressed fragment is to be raised. Frequently it is advisable to remove it entirely, which, as I have already explained, can often be readily done with one of Hey's saws, and then all occasion for the removal of bone with the trephine is obviated. If the case be what is termed a *punctured* or *stellated fracture*, the whole of the depressed piece of the skull may generally be included within the circle of the trephine, and thus be easily removed.

In compound fracture with depression, *unattended*, however, *with symptoms of pressure on the brain*, the bone may be raised to its proper level with an elevator; but, according to the principles inculcated in my remarks on Injuries of the Head, trephining would not always be advisable.

After the operation, the flaps of the scalp should be laid down, and light simple dressings applied. For the prevention or cure of inflammation, bleeding, the application of cold evaporating lotions to the scalp, and the exhibition of calomel, tartarised antimony, and saline purgative medicines, will frequently be necessary.

When, on the exposure of the dura mater, blood or other fluid seems confined under it, and the membrane presents a dark-coloured, livid, or yellowish colour, and a tense prominent appearance, it should be cautiously punctured. In one instance, where matter was suspected to be more deeply lodged, Dupuytren introduced a bistoury more than an inch into the substance of the brain, and discharged the abscess.

In very young subjects, the opening made with the trephine is sometimes gradually, but only in part, repaired by osseous matter. In the museum of University College is the skull of a person, who had been extensively trephined forty years before he died; and, in this example, nature has filled up almost the whole of the deficiency with osseous matter. Repair to this extent demands a great deal of time. In persons who have lived ten, twenty, or fifty years after loss of portions of the cranium, the slow restoration of the bone appears to have been progressive for the whole period. In fifty years, a trephine hole is nearly closed by the shelving growth of bone from the margin towards the centre.*

### EXTIRPATION OF THE EYE.

Cancer, medullary tumours, and melanosis, are the three diseases sometimes occasioning the necessity for the operation, for which the patient should be prepared by regulation of his diet and the exhibition of aperient

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* See Mayo's Outlines of Human Pathology, p. 8. 8vo. Lond. 1835.

medicines, so as to lessen the risk of inflammation, and of the extension of it to the brain and its membranes.

The patient should be placed in the recumbent position, with his head properly raised on a pillow, and held by an assistant. When the extension of the disease to the eyelids makes their removal necessary, the mode of operating differs from that which is adopted when those parts are to be preserved: in the first case, two semilunar incisions are to be made, the upper one corresponding to the line of the superciliary ridge of the os frontis, and the lower to the inferior border of the orbit, so as to detach the eyelids and allow them to be taken away with the rest of the disease. If, however, they should be merely adherent to the diseased eyeball, and not themselves affected with malignant disease, they should never be cut away, but only separated from their connection with the globe of the eye.

*First stage.* — Supposing the state of the eyelids will admit of their being saved, the first step consists in making an incision at least an inch in length through their external commissure, in the direction towards the temple. The eyelids are then to be turned back, so as to uncover, as it were, the base of the orbit, both above and below the front of the diseased eyeball.

*Second stage.* — In this, the conjunctiva is to be cut through at its reflexion over the globe from the eyelids; and this should be done very completely at every point of the circumference of the orbit: indeed, some operators aim at more than this in the second stage of the operation, and introducing the knife at the greater angle, with its edge turned downwards, they carry it close to the os ethmoides nearly to the optic foramen, and then convey it in a semicircular direction across the whole extent of the lower half of the orbit, thus dividing the inferior oblique muscle, the conjunctiva at its reflexion, and some fat and cellular tissue. Next, the knife is introduced again at the nasal extremity of the wound, with the edge turned upwards; the superior oblique muscle or trochlearis is cut through; and, if possible, the lachrymal gland separated, as the incision is passing along the roof of the orbit. These two cuts are to be semilunar, and to meet at their extremities.

*Third stage.* — As the roof of the orbit is naturally thin, and sometimes is rendered still thinner by long-continued pressure, the knife, if used incautiously, might penetrate to the brain. To avoid this risk, in the division of the parts at the upper part of the orbit, the eye should be drawn downwards with a ligature, or tenaculum, passed through the diseased mass. The eyeball is now only retained by a kind of pedicle, composed of the four recti muscles and optic nerve, which are to be divided either with a pair of curved scissors or a curved bistoury. As the external side of the orbit slants from without inwards, while the internal goes directly backwards, this step of the operation is most easily accomplished by introducing the instrument at the external side, as recommended by Désault and Lawrence. The surface of the orbit should now be carefully examined with the finger; and if the lachrymal gland, or any portion of the disease has been left behind, it should be removed.

The bleeding from the ophthalmic artery is profuse, but generally ceases of itself. If it should continue in an alarming degree, a dossil of lint should be held and pressed upon the vessel for a little time, after which there will be no further hemorrhage. Filling the orbit with sponge, lint, &c. is objectionable, as producing irritation and inflammation; effects highly perilous, as Mr. Lawrence justly observes, in conse-

quence of the direct connection between the sheath of the optic nerve, the periorbita, and the dura mater, and the immediate contiguity of the brain. The commissure of the eyelids is to be united with a suture; and soft rag, dipped in water, laid over the part.

### REMOVAL OF THE SUPERIOR MAXILLARY BONE.

The superior maxillary bone is liable to several diseases, which begin either in the mucous membrane of the antrum, in the bony parietes of this cavity, or in the fangs or sockets of the teeth. Sometimes the mucous membrane inflames, and, becoming thickened, blocks up the opening, naturally establishing a communication between the antrum and the nasal fossæ: the result is an accumulation of the mucus in the antrum, a case which, as well as abscesses, has been already described in the foregoing section of this work. On other occasions, the lining of the antrum secretes a concrete substance, presenting the characters of adipocere. From the interior of the antrum, polypi, fibro-cartilaginous, medullary, and vascular erectile tumours *, may grow; or its bony parietes may be the seat of caries, necrosis, and exostosis.

The operation of removing the superior maxillary bone is sometimes rendered advisable by the growth of a fibro-cartilaginous tumour within it, or of a medullary tumour, when this is entirely restricted to the antrum, and the patient's general health good. According to Mr. Syme, medullary tumours are more frequent in the upper jaw bone, than fibrous ones; and as their removal from any part of the body is often followed by a return of the disease in the part, or its development elsewhere, a guarded prognosis should be delivered respecting the success of the operation. The removal of the upper jaw for fibrous or fibro-cartilaginous tumours, on the other hand, has generally been followed by a permanent cure.

The methods of operating are various; but, whichever is selected, the patient is to be placed on a firm seat, with his head supported on an assistant's breast, who is to employ his hands in steadying the head, and, if necessary, in compressing the trunk of the facial artery.

M. Gensoul, principal surgeon of the Hôtel Dieu, at Lyons, claims the merit of having first extended to operations on the superior maxillary bone the approved principle in surgery, that amputation should always be performed in the sound parts, and not in the diseased.† This principle led him not to be content with taking away a part of the diseased bone, as he contends had been done by all his predecessors, inclusive of Dupuytren, but induced him to aim at the removal of the whole of it. M. Gensoul was further encouraged to perform this operation by considering attentively the anatomy of the face. He saw that the superior maxillary bone was only firmly fixed to the other bones of the head at three points: —

1. At its nasal or ascending process, and the junction of its orbitar plate with the os unguis and os planum of the ethmoid bone.

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* See Lettre Chir. sur quelques Maladies du Sinus Maxillaire, par Th. Gensoul, p. 33. In the case here referred to, no return of the disease had taken place five years after the operation. "For erectile tumour, occupying the maxillary sinus (Mr. Liston observes), the ligature of the common carotid of the corresponding side, would be the proper practice." Practical Surgery, p. 267.

† Lettre Chirurgicale sur quelques Maladies graves du Sinus Maxillaire et de l'Os Maxillaire Inférieur. Paris. 8vo. 1833. p. 4. &c. When M. Gensoul was lately in this country, I had the pleasure of becoming acquainted with him, and of receiving from him this interesting publication.

2. At the orbitar margin of the malar, as far as the spheno-maxillary fissure; or, as Mr. Guthrie more clearly explains, the superior maxillary bone, on the outside, is "attached firmly to the malar bone by its malar process, orbitary edge, and plate, as far back as the spheno-maxillary sinus; but as in general the os malæ should be more or less removed, its ascending orbitar process, forming the outer edge of the orbit, should be well considered." *

3. At the junction of the two superior maxillary bones, and that of the two palate bones.

4. The fourth point of connexion, which is through the medium of the ascending portion of the palate bone and the pterygoid process of the sphenoid, readily gives way on depressing the superior maxillary bone towards the mouth.

M. Gensoul reflected, that no large vessel would necessarily be wounded; that the trunk of the internal maxillary artery might be easily avoided; and that, if it were injured, it might be tied, after the bone had been removed.† In the event, however, of the hemorrhage being profuse during the operation, he conceived, that it might be commanded by pressing the common carotid against the spine. As for nerves, he calculated that the superior maxillary was the only trunk of importance exposed to injury; and had he not seen that it admitted of being cut through, he would have renounced the idea of operating, rather than tear that nerve away.

*Gensoul's Method.* — A vertical incision is made from the great angle of the eye to the upper lip, which is cut through opposite the canine tooth. From the middle of this first incision, or rather from the point of it on a level with the base of the nose, a second incision is made to within four lines of the lobe of the ear. A third incision is next carried from a point, five or six lines on the temporal side of the external angular process of the os frontis, down to the termination of the second wound. The prolongation of it much lower down over the masseter would divide the parotid duct, and perhaps occasion a salivary fistula. The two flaps are then reflected; one upwards, the other downwards. The superior maxillary bone being thus exposed, the angular process of the malar bone is detached from the external angular process of the frontal bone, by means of a sharp chisel and mallet, and the division thus extended into the spheno-maxillary fissure. The zygomatic process of the malar bone is next divided; and the superior maxillary bone being thus loosened on its outer side, a broadish chisel is applied below the internal angle of the eye, and the lower part of the os unguis and orbitar plate of the ethmoid bone are divided. The ascending process of the superior maxillary bone is now to be detached from the corresponding os nasi with the same instruments. The surgeon then divides with a bistoury all the soft parts connecting the upper jaw to the ala of the nose; and after extracting one of the incisor teeth, severs the two superior maxillary bones from one another at their symphysis below the nostrils with a sharp chisel. Lastly, in order to detach the superior maxillary bone from the connexion which it has with the pterygoid

* See Lond. Med. Gaz. for 1835, p. 316.

† In one of Gensoul's operations, the pterygoid branch of the internal maxillary was wounded; and so it was in Mr. Guthrie's operation, which was performed in the manner advised by the former surgeon. In one example, in University College Hospital, the trunk of the internal maxillary bled; but was secured with the utmost facility.

processes of the sphenoid through the palate bone, and to break some connections which it may yet retain to the ethmoid bone backwards, the chisel is plunged obliquely into the tumour from the orbit, so as to cut through the superior maxillary nerve, which ought never to be lacerated; and the instrument is then passed deeply enough to serve as a lever for depressing the tumour into the mouth. This having been accomplished, all that remains to be done is, with a pair of curved scissors, or a scalpel, to cut through the attachments of the palate bone to the soft palate.

Any vessels, requiring ligatures, are now to be tied; and the flaps laid down, but not united with the twisted suture, till an hour or two have elapsed, within which period the force of the circulation will have revived, and it will be seen whether any other vessels need ligatures. In this country, instead of employing the chisel and mallet, surgeons generally use Hey's saws, and a pair of pliers with long powerful handles.* The division of the malar bone, in the first instance, is preferred by M. Gensoul, because productive of no material bleeding, and of none that falls into the throat.

*Second, or Mr. Liston's, Method.* — Supposing the malar bone to be involved, incisions must be made, so as to expose freely the tumour and bones where it is proposed to 'cut them. One of the central incisors is first to be extracted. The point of the bistoury is entered over the external angular process, and the incision is carried down through the cheek to the corner of the mouth. A second incision is made along the zygoma, so as to meet the first. Then the knife is pushed through the integument to the nasal process of the superior maxillary bone, the cartilage of the ala of the nose is detached from the bone, and the lip is divided in the mesial line. The flap thus formed is quickly dissected up, and held by an assistant. The attachments of the soft parts to the floor of the orbit, the inferior oblique muscle, the infra-orbital nerve, &c. are cut, and the contents of the cavity supported and protected with a narrow bent copper spatula. With the cutting bone-forceps, the zygoma, the junction of the malar and frontal bones at the transverse facial suture, and the nasal process of the superior maxilla, are cut in succession. Then a notch being made with a small saw in the alveolar process, the cutting forceps are placed with one blade in the nostril, and the other in the the mouth, and the palatine arch clipped through. The tumour is now shaken so as to loosen its connexions, and the remaining attachments divided with the knife, as the swelling is turned down. The velum palati is to be carefully preserved, and, if possible, the palatine arch of the palate bone. During these latter proceedings, the assistant, if required, is to compress the trunk of the carotid. "Perhaps," observes Mr. Liston, "no vessel may require ligature; the branches of the internal maxillary are elongated, and torn from the tumour in bringing it down; in fact, if the mass is large, there is no possibility of reaching them with the knife." The void is then filled with lint, and the edges of the wound brought together with the interrupted or twisted suture, but no dressings are to be applied. In twenty-four hours some of the sutures may be taken out, and replaced by narrow strips of plaster. At the end of forty-eight hours, the other stitches are cut, and the pins withdrawn. When the

* Messrs. Weiss have invented cutting bone-forceps, the construction of whose handles multiplies the power of the blades on a different principle from that of the length of the former parts.

opening in the palate has become as much diminished, as it is likely to be by nature, a plate of metal, or of sea-horse bone, may be adapted to it.*

If the malar bone should not require to be taken away, its connexion with the upper maxilla is to be divided with one of Hey's saws, and, of course, the incision along the zygoma would be unnecessary.

*Third Method*, or that of Professor Regnoli.†—With an ordinary convex-edged bistoury an incision is made over the middle of the swelling beginning near the external angle of the eye, and extending obliquely downwards and inwards to the commissure of the lips. If the facial artery be compressed as it ascends over the base of the jaw, this first wound will occasion but little hemorrhage. The soft parts on each side of the incision are then to be detached from the surface of the tumour, the lateral cartilage and ala of the nose being included in the internal flap, while the external comprehends all parts situated between the line of the first incision and the junction of the superior maxillary bone with the zygoma. By means of a strong knife, which is struck with a hammer, the surgeon divides in succession the base of the nasal process, the lower border of the orbit, the superior maxillary canal and nerve, the junction of the zygoma with the malar bone, the connexion of this with the superior maxillary bone, and then the alveolar process. The use of the bistoury is now resumed, and the membrane of the palate divided with it as far back as the velum pendulum palati; after which the strong scalpel is driven with the hammer between the two middle incisor teeth, in the direction of the middle line, as far back as the palate bones. The remaining slight connections of the superior maxillary bone are then easily overcome by moving it alternately upwards and downwards, and by means of a few touches of a curved bistoury. The bleeding is suppressed with ligatures, or, if necessary, the actual cautery and the sides of the wound are brought together with the twisted suture. As Professor Regnoli makes only one incision through the cheek, there is less disfigurement of the face after this operation, than after the other methods.

If a great deal of pain and inflammation were to follow any of the above-described operations, the patient ought to be freely bled, and put under antiphlogistic treatment. Erysipelas is one of the consequences most to be apprehended.

That Mr. Liston's plan of operating is, in every respect, the most eligible, is a fact that admits of no question.

### REMOVAL OF THE LOWER JAW BONE, OR OF PART OF IT.

Cancer of the lip, extending its ravages to the body of the inferior maxillary bone, is specified as one case requiring the excision of more or less of the latter part; but, I believe, the opportunity of operating under these circumstances, with a prospect of benefiting the patient, will seldom present itself, because, when the disease has attained this degree, the absorbent glands under the jaw and in the neck will commonly be implicated. However, if these glands were free from disease, and especially if, with this condition, the gums and alveolary process were the only parts manifestly invaded, in addition to the lip and soft parts near it, the excision of the diseased portion of bone, together with the cancerous affec-

* See Liston's Practical Surgery, p. 264. 8vo. Lond. 1837.

† Sulla Estirpazione della Quasi Totalita dell' Osso Mascellare Superiore Sinistro. Pisa, 1832. When Professor Regnoli was in England, about two years ago, he was so obliging as to present to me this and several other publications.

tion of the other textures, would be an advisable measure. A patient in this state was referred to me by the late Dr. Blicke, of Walthamstowe: I recommended the operation, but believe that it was never submitted to.

Sometimes the necessity for removing a portion of the lower jaw is occasioned by an epulis assuming a malignant character, and involving the alveoli or even a greater extent of the bone. Tumours, originating in the sockets of the teeth, and presenting an indurated fungous texture, with a tendency to bleed, may also make it necessary to take away a part of the bone. But the diseases, for which the most considerable portions, and even the whole of the lower jaw, have been sometimes taken away, are certain fibrous tumours, commencing in the cancellous structure of the bone; and others of a medullary character, beginning in the same situation. At the present day, however, when medullary sarcoma is regarded as an affection rarely limited to one part, and often followed by a relapse, many surgeons would decline to operate, if the disease were known beforehand to be of this unfavourable description. At the same time, it would not be difficult to find instances of the removal of part of the lower jaw for medullary tumours, where the patients afterwards continued free from the disease. As for tumours of a fibrous structure, expanding the bone, and destroying its texture, they are cases where the operation generally frees the patient permanently from the grievances under which he is labouring. A disease of this kind will sometimes produce a tumour, reaching from the molar teeth of one side to the ramus of the opposite side of the jaw, pushing back the base of the tongue, and throwing out a fungus, wherever ulceration of it is excited by the pressure of the teeth of the upper jaw. A sanious, excessively fetid discharge takes place. The lower jaw is of thrice its natural size, and even greater, the fibrous mass occupying very deeply its more or less disorganised texture, and at the same time filling the aperture of the mouth, protruding beyond it, and sometimes keeping the mouth as widely open as the articulation of the lower jaw will allow. The cheek or cheeks may also become enormously distended, by other projecting portions of the disease. The introduction of food into the mouth, perhaps, can only be effected by drawing one of the commissures of the lips towards the ear; and, together with all these grievances, there is profuse ptyalism, while respiration, mastication, and the pronunciation of words, are all seriously interrupted.

Whether the disease be a medullary, or a fibrous tumour, or an osteosarcoma, it cannot be destroyed without a surgical operation, which varies according to the situation and the extent of the swelling. The prospect of a radical cure in the first of these examples is much less favourable than where the structure of the tumour is fibrous. In all the following operations, the patient is to sit on a firm chair, with the head thrown back, and supported on the breast of an assistant, who can also compress, if necessary, the facial arteries as they ascend, in front of the insertion of the masseter muscles, or push them backward, by which means wounding them may sometimes be avoided in removing a central portion of the body of the lower jaw bone. The places, where the bone is to be sawn through, should always be determined beforehand, and the teeth in those situations removed on the day preceding the operation.

*First Operation.*—When the *disease* is *confined* to the *alveolary process*, a perpendicular division of the gum with the knife, and a similar perpendicular division of the alveolary process with a small saw, are to be made on each side of the disease. Then the diseased portion of bone may be

broken off with a strong pair of forceps, or divided with a pair of cross-cutting forceps, as recommended by Mr. Liston. The bleeding, which is copious, is to be stopped by pressing lint on the part, and, if necessary, dipping the lint previously in the tinctura ferri sesquichloridi.

*Second Operation. — Removal of the middle part of the body of the bone.* —Two methods are usually described. In one, particularly recommended where the integuments are healthy, a perpendicular incision is made through the centre of the lower lip, and carried down through the skin as low as the os hyoides. In order that this first perpendicular cut may be skilfully made, an assistant takes hold of the left portion of the lip, while the surgeon fixes the right between the index and middle fingers of his left hand, and, with the bistoury in his right, makes the incision through the lip and the integuments down to the os hyoides. The right facial artery being now pressed back by the assistant, who supports the head, the point of the knife is to be introduced just in front of the vessel, and a transverse cut made forwards along the base of the jaw, till it meets the first perpendicular incision. The same proceeding is next followed on the left side. The four flaps, resulting from the three incisions, are then to be detached and raised from the bone, which, according to Dupuytren, may thus be sawn as far back as the angle on either side, without injury of the facial artery. As the detachment of genio-hyoid, and genio-hyo-glossi muscles, is apt to be followed by retraction of the tongue into the pharynx, and a sudden interruption of respiration, perhaps it is best not to divide their insertions until the bone has been sawn through on each side. Or, if they are to be first divided, the displacement of the tongue into the pharynx must be guarded against by passing a ligature through the anterior part of the frænum.

The bone is to be partly divided with a metacarpal saw, or one of Hey's saws, at a point beyond the limit of the disease on each side, and the division completed with one stroke of a pair of cutting forceps, the handles of which should be long, so as to give the operator power. In using the metacarpal saw, he will obtain more room for its action by placing himself behind the patient; but, when Hey's saw is employed, this direction is not of any importance.

The central portion of the bone having been thus sawn through on each side of the disease, is now to be drawn forwards and depressed by an assistant, while the surgeon cuts through the membrane of the mouth and other soft parts behind the chin, with the knife kept close to the attachments of the muscles in that situation. At the instant when the genio-glossi are divided, some surgeons recommend the apex of the tongue to be taken hold of with the intervention of a piece of rag, in order to prevent this organ from being so forcibly retracted by the glosso-pharyngei muscles, so as to close the glottis and bring on the risk of suffocation.* A ligature, passed through the frænum, is a surer plan.

*Dupuytren's first Method.* — An assistant supports the head on his breast, and compresses the facial arteries against the rami of the bone. The surgeon, standing in front of the patient, takes hold of the right side

* With respect to the improvement of this operation, it seems to me, that with the advantage of the transverse wound, it is unnecessary to extend the perpendicular incision so low down as the os hyoides. If, on the division of the genio-hyo-glossi, the tongue were to be forcibly drawn back by the glosso-pharyngei, and the glottis closed so as to threaten instantaneous suffocation, tracheotomy should be done without the least delay, — the measure successfully resorted to by Lallemand, whose patient had fallen senseless on the floor.

of the lower lip with the left hand, while an assistant does the same to the left side, so that the part may be tense. An incision is then made through the centre of the lip, and extended perpendicularly nearly down to the os hyoides. The two flaps are reflected to the right and left; and the bone, having been completely denuded, and fixed, is sawn through on each side with a hand-saw, at the distance from the symphysis prescribed by the extent of the disease. This part of the operation would be more conveniently accomplished by making a groove with one of Hey's saws, and then completing the division with a strong pair of cutting forceps. The central portion of the bone, having been thus detached from the rest of it, is to be pressed downwards and forwards; and then the lining of the mouth, and the muscles connected with the posterior part of the body of the bone, and to the mylohyoid line, can be readily separated from their attachments with the knife kept close to the bone. On cutting through the origin of the genioglossi muscles, means must be taken to prevent the tongue from being powerfully retracted by the glosso-pharyngei, so as to close the glottis and bring on a stoppage of respiration. By proceeding in the above manner, Dupuytren was able to saw through the bone on each side within an inch of the angle, and to remove a diseased mass weighing a pound and a half.*

*A third Method of removing the central part of the bone, applicable to cases in which the integuments are so diseased as not to admit of preservation.* — An incision is to commence on each side of the jaw, at such a distance from the symphysis as will insure the removal of the whole of the diseased mass. These incisions are to be carried down to the os hyoides, where they meet at an angle. The soft parts are then to be dissected back from the bone on each side, and the rest of the operation completed according to directions already given. The sides of the wound are next to be brought as near one another as circumstances will admit; and, if the loss of skin is not too considerable, they may be put in apposition, and united with the twisted suture.

*Fourth Operation, applicable to cases in which the disease occupies a considerable extent, including part of the ramus of the jaw.* — Such teeth, as would interfere with the division of the bone, are to be previously extracted. The *first* or *anterior* incision passes from the vicinity of the commissure of the lips, to a little below the *base* of the jaw.

The exact points, however, where both the *first* and *second incisions* ought to begin, will depend upon the extent of the disease in the directions forward and backward. Sometimes, when a suspicion is entertained that it may be necessary to take away the condyle, it is right to let the *second incision* commence as far back as a point in front of, and a little above, the lobe of the ear, and to continue it down to the angle of the jaw along the posterior edge of the ramus.

The *third* or *horizontal incision* may run from the termination of the second incision, along the base of the jaw, so as to join the first at its inferior extremity. The facial artery is now to be secured. If it has been necessary to make the second incision far back, no sooner has the flap been raised, than a portion of the parotid gland, lying under a prolongation of the cervical fascia, is exposed, and, with the parotid duct itself crossing the masseter, should be left uninjured. The masseter

* See Leçons Orales de Clinique Chirurgicale, par M. le Baron Dupuytren, t. iv. p. 640.

having been separated from the outside of the ramus, the next thing is to convey the knife close along the inside of the bone, so as to cut through the membrane of the mouth, and attachments of the muscles in that situation. In detaching the mylo-hyoideus from the oblique ridge below the molar teeth, and the internal pterygoid muscle from the inside of the ramus of the jaw, the knife is to pass close to the bone, in order to avoid injuring the lingual branch of the fifth pair of nerves.

A perpendicular groove is now to be made, with Hey's saw, in the outer surface of that part of the body of the jaw which it is intended to divide, and the division is to be completed with a strong pair of cutting forceps. The ramus is then to be partly divided with Hey's saw, but, instead of exposing the lingual branch of the fifth pair of nerves to injury by sawing too deeply, I recommend the anterior part of the bone to be pressed outward, whereby the ramus will be easily broken off at the groove. If any difficulty be experienced, the groove should be made deeper with Hey's saw, or the cutting forceps cautiously applied.

It appears to me that, in this operation, the division of the lip can hardly ever be needed, and, as leading to disfigurement, should be avoided. As Mr. Liston directs, the incision may terminate in the mesial line, about an inch from the free edge of the lip. His plan is to make a semilunar incision along the base of the jaw, the horns of the incision pointing upwards, and passing over the spaces which were occupied by the extracted teeth.

*Fifth Operation, or that required when the bone is to be removed at the articulation.* — Here particular care must be taken to begin the posterior incision in front of, and a little above, the lobe of the ear, in order that it may reach over the articulation. A good method is that of commencing the wound at the point just above the articulation, and carrying it first downward to the angle, and then horizontally towards the chin, where it is to ascend again; thus having a semilunar shape, as practised by Mr. Liston*, and Professor Regnoli, of Pisa.† The main difference of this operation from that, in which only a portion of the ramus is removed, consists in the proceedings necessary for the disarticulation of the condyle. The anterior division of the jaw having been accomplished according to directions already given, the end of it is to be forcibly depressed, so as to bring the coronoid process below the zygoma, and to enable the surgeon to cut through the attachment of the temporal muscle. The bone then becomes much more moveable, and can be used as a lever for pressing the condyle against the anterior and external part of the capsular ligament. This is to be opened at its fore part, the external lateral ligament descending downwards and backwards from the root of the zygoma to the neck of the condyle divided, and the condyle itself then twisted out.‡ The latter part is then to be completely detached by passing a blunt-pointed narrow-curved bistoury cautiously round the joint, so as to divide the rest of the capsule, the internal lateral ligament, and the external pterygoid muscle. By cutting the parts in the manner

* "An incision is made from the condyloid process, down the posterior border of the ramus, and along the lower margin of the bone, and terminates above the point of the chin, in the mesial line, at about an inch from the free edge of the lip." See Liston's Practical Surgery, p. 270.

† Intorno l'Amputazione di Quasi la Meta della Mascella Inferiore, p. 13. Pisa, 1834.

‡ Liston's Elements of Surgery, p. 228. part 2d.

here directed, all risk of wounding the internal maxillary artery, whose course is a little lower down, almost in contact with the inside of the neck of the bone, will be avoided. Neither will the lingual branch of the fifth nerve be injured, if, in detaching the internal pterygoid muscle, the edge of the knife be kept as closely as possible to the inner surface of the ramus. If, after the first division of the jaw, the bone were found to be so weakened by disease as not to admit of being used as a lever, it might be necessary to divide the ramus, and then to take hold of the end of the bone and depress it with a strong pair of forceps, while the temporal muscle is detached from the coronoid process. * The same mode of proceeding would be called for, were the surgeon, after the removal of a portion of the body and ramus, to find that the extent of the disease rendered disarticulation advisable.

The arteries wounded, and often requiring ligatures, after operations of the preceding description, are the facial and labial, but more frequently the submental, and necessarily some branches of the temporal and lingual arteries. When the bleeding is profuse, and comes from numerous points, Mr. Liston prefers passing a ligature under the common trunk of the internal maxillary and temporal arteries, at the point where it emerges from beneath the digastric muscle to tying all the branches which pour out blood. With regard to tying the common carotid artery, as a preliminary measure in the operation of removing any part of the lower jaw, it is completely superfluous. Were it on any occasion necessary to check the flow of blood through the carotid, it might be done by pressing the artery against the transverse processes of the cervical vertebræ with an assistant's fingers or thumb.†

Amongst the accidental consequences of the operation of removing part of the lower jaw, I may mention, 1. Secondary hemorrhage. 2. Severe inflammation about the face, neck, and throat. 3. Inflammation of the glottis, and effusion of serum under its lining; a case in which the patient sometimes can be saved only by making an opening into the respiratory tube. 4. A difficulty of deglutition, from the division of the attachment of the genio-glossi muscles.‡ 5. Erysipelas. 6. Tetanus.

### BRONCHOTOMY,

Or, the operation of cutting into the air tubes, is termed *tracheotomy*, when the opening is made in the trachea; but *laryngotomy*, when the incision is made in the larynx.

The following are some of the circumstances calling for the performance of one or the other of these operations: —

1. Foreign bodies which have accidentally fallen down the glottis into the trachea, as a cherry-stone, a bean, a small coin, a bead, an acorn, &c. In such cases, provided no doubt exist about the presence of the foreign body in the respiratory tube, the operation ought to be done without delay, and this notwithstanding there may be now and then a remission of the symptoms. A patient, mentioned by M. Louis, seemed so well that he was considered out of danger, yet he died in three weeks; and another, who lived several years with a louis d'or in one of the bronchi, was destroyed by it in the end. The practitioner should remember, that

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* See Hargrave's Operative Surgery, p. 180.

† See Liston's Elements, part 2d. p. 229. — G. Regnoli, Intorno l'Amputazione di Quasi la Meta della Mascella Inferiore Brevi Cenni, pp. 13. & 20. 8vo. Pisa, 1824.

‡ Dupuytren, Leçons Orales, tom. iv. p. 653.

a temporary cessation of the difficulty of breathing, cough, and general disturbance of the system, arising from the foreign body, is usual, and he should not suffer himself to be deceived by it. On the other hand, let him not resort to the operation, unless there be sufficient evidence of the foreign body having really descended through the glottis, and that it has not been coughed up again. The movements of the foreign body in the air-passage frequently cause a kind of rattling, which may be heard. In cases of doubt, the stethoscope should be employed.

2. Polypi, fibrous tumours, and other organised growths in the larynx, causing dangerous interruption of the breathing.

3. Foreign bodies in the pharynx or œsophagus, occasioning by their pressure a perilous impediment to respiration, and not admitting of being immediately either extracted or pushed down into the stomach.

4. An urgent interruption of respiration from a chronic thickening of the membranous lining of the larynx, and a consequent diminution in the diameter of the glottis.

5. The same urgent state, resulting from acute inflammation of the same part. This case, however, much less frequently requires an operation, because the disease in its early stage generally yields to bleeding, mercury, and other efficient means, and, in its advanced stage, mostly proves fatal, whether the trachea be opened or not; not only this tube being blocked up with fibrine, but the bronchi themselves similarly obstructed, and the lungs participating in the effects of the inflammation. At the same time, it deserves attention, that, even with these facts admitted, the performance of the operation is sometimes vindicable, as being the only means of enabling the patient to breathe, and gain a little time for the further trial of remedies calculated to subdue the disease; provided there be reason to believe that the inflammation has not descended beyond the first division of the bronchi, in which case the operation would be useless. M. Bretonneau is an advocate for opening the trachea freely, and, besides placing rather a wide cannula in the wound, to promote the escape of the layers of fibrine from the trachea, he introduces calomel, either in a dry or moistened state, into that organ, for the purpose of expediting the absorption of the fibrinous deposit. Several cases are recorded, in which M. Bretonneau adopted this practice successfully. Velpeau refers to a case under M. Trousseau, who, after performing tracheotomy, and putting a cannula into the wound, introduced into the bronchi twenty drops of a solution of ʒj. of nitrate of silver in ʒj. of distilled water, every six hours, for three days and a half. Twenty drops of a tepid decoction of marshmallows were introduced every hour, and the cannula withdrawn and cleaned three times a day. The child, aged six years, continued for four days to void considerable portions of fibrine through the tube. On the tenth day, the air began to pass very well through the larynx, and, by the twenty-fifth, the wound in the trachea had healed.* The value of the practices here alluded to, I leave to the judgment of the physician, and merely advert to them as connected with the present subject.

6. Various cases, in which suffocation is urgently threatened by the mechanical pressure of swellings on the larynx or trachea, provided such pressure cannot be immediately removed, as it often may be by discharging the contents of abscesses. In this last manner, I saved a child under Dr. Campbell, of Camden Town, which was on the point of

* Nouveaux Elémens de Méd. Opératoire, tom. ii. p. 202.

suffocation from the pressure of a collection of matter formed around the thyroid gland.

7. For the purpose of inflating the lungs in some examples of suspended animation, like that resulting from hanging; for the plan is at present nearly abandoned with reference to cases of drowning. It appears, also, to promise no success, where life is suddenly extinguished by the azotic principle of certain gases.*

8. Disease of the larynx from syphilis, threatening suffocation.

9. Dangerous obstruction of respiration from the effects of inflammation of the lining of the glottis, excited by swallowing boiling water.†

10. Complete interruption of respiration by retraction of the tongue into the pharynx, occasionally taking place on the division of the attachment of the genio-glossi muscles in the removal of the body of the lower jaw.

In performing *tracheotomy*, the surgeon should recollect the relative anatomy of the trachea; especially its having the œsophagus behind it; its inclination rather to the right side of the neck; its being covered, first, by the common integuments, — secondly, by the cervical fascia, — thirdly, by the transverse slip of the thyroid gland, connecting the two lobes of this body, near the cricoid cartilage; and lower down by a plexus of veins, some lymphatic glands, and the middle thyroid artery, when it exists, — fourthly, by the sterno-hyoid and sterno-thyroid muscles, which lie towards its side. The inferior laryngeal nerves are behind it, and the common carotid at its outer side. Occasionally it is crossed by one of the inferior thyroid arteries, which then passes from one side of the neck to the other. In children, the arteria innominata generally lies over the front of the trachea, till the latter tube is completely out of the chest, so that the right carotid artery then quits the innominata very high up, and may be easily wounded in the operation. Velpeau has known the left carotid come from the right side, and cross the trachea to reach its usual situation.‡ Mr. A. Burns has a cast, showing an instance of the right carotid crossing the trachea, two inches and a quarter, above the top of the sternum.§

The trachea, which is superficial above, becomes more and more deeply situated below, where the front of it is sometimes more than an inch from the integuments. So very moveable is it likewise, that, if care be not taken, the surgeon, as he is attempting to cut into it, may push it towards the side of the neck, and the knife injure the common carotid artery.

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* Enlargements of the tonsils and tongue can never require tracheotomy or laryngotomy, as diseased tonsils can be removed, and the enormous swelling of the tongue from inflammation may be quickly reduced by making two or three free incisions along its dorsum.

† Dr. Burgess, in Dublin Hospital Reports, vol. xxxi. p. 379. — Hargrave's Operative Surgery, p. 328. In University College Hospital, tracheotomy has been performed in several instances of this kind; but, generally, without success. One or two children under me recovered under the free use of calomel.

‡ Nouveaux Elémens de Méd. Opératoire, tom. ii. p. 209. For a description of some anomalies of the arteries in this part of the body, the reader is referred to Tiedemann's Tabulæ Arteriarum; but a more complete account of the varieties in the origins and course of arteries, I hope, will soon be laid before the public by my friend and colleague Mr. Quain, whose collection of preparations, illustrative of this subject, so interesting to the practical surgeon, is, I believe, the best in England.

§ See Dublin Journ. of Med. Science, vol. iv. p. 111.

The head is to be kept backward, with pillows placed under the scapulæ. The surgeon is to be on the patient's right side, in order that he may with his left hand feel the larynx, and with his right more conveniently make the incision from above downwards in the mesial line of the neck. The precise situation of the cricoid cartilage having been ascertained, an incision is to be made through the integuments and superficial fascia, from just below the transverse slip of the thyroid gland downwards to the extent of at least two inches and a half, or to a point a little above the first bone of the sternum. In children, the wound should not extend so far down. The operator is then to cut between the two sets of sterno-hyoid and thyroid muscles, till he comes to the deep cervical fascia, which is next to be freely divided, and the front of the trachea itself exposed. The sterno-thyroid muscles are then to be pushed a little aside, and the trachea is to be prevented, by the pressure of the surgeon's left fore-finger, from suddenly shifting its place, while he cautiously makes an opening in the trachea towards the lower end of the external wound, with a sharp-pointed scalpel, with its edge turned upwards, and the point directed by the nail of the same finger. Frequently, when respiration is carried on with difficulty, and the patient struggles, the completion of the latter object is attended with more difficulty than the inexperienced might expect; so rapid and convulsive, as it were, are the motions of the trachea. In a child, indeed, the difficulty of the operation is great, not merely from these causes, but the struggles of so young a subject, the depth of the trachea from the fat in the neck, and the small diameter of the trachea itself. Hence the plan, now usually followed, of drawing forward the trachea of a child with a tenaculum, in order to make an incision in it, as originally suggested by Dr. James Murray, and particularly recommended by Mr. Carmichael, I consider a great improvement of this operation. A puncture, or small incision, having been made in the tube, it is to be enlarged to the requisite extent by cutting from below upwards, either with the same scalpel, or a curved probe-pointed bistoury. The knife must not be carried to the right or left, in order to avoid the risk of wounding the carotid artery; and never too near the first bone of the sternum, a deviation from which rule might endanger the left subclavian vein, and, in children, even the arteria innominata.

If the bleeding from the plexus of thyroid veins were to be copious, some of them might require ligatures, previously to the trachea being opened, because the blood would otherwise insinuate itself into that tube, and seriously increase the patient's distress. In general, however, the venous hemorrhage will soon stop of itself, and the surgeon can then safely proceed to open the trachea. However, if the case admitted of no delay, either the veins must be tied, or, what seems preferable, the trachea opened at once, and the patient directly afterwards placed on his side. Were there a middle inferior thyroid artery ascending over the front of the trachea, it would almost certainly be divided; and, in this event, it should be immediately tied.

Whether tracheotomy be performed to enable the patient to breathe, or for the extraction of foreign bodies, it is advisable to make rather a free opening in it; because, in the first class of cases, the cannula *

* The ingenious cannula, described by Mr. Wood in the Med. Chirg. Trans., deserves attention; and so do those of M. Bretonneau. Every surgical practitioner should have a

introduced into the trachea should be of ample diameter; and, in the second, nothing will so materially facilitate the passage of the extraneous substance outward as an incision of proper extent. Frequently, when the sides of the wound are separated, the foreign body is propelled out with the breath, and, if this does not happen, instruments must be gently introduced, and the attempt made to extract it: here a free opening is absolutely indispensable. In many examples, the foreign body will be found not towards the bronchi, but the larynx. If not easily detected, the surgeon should not irritate the lining of the tube too much by the repeated introduction of the forceps: various cases prove, that the foreign body will often be discharged spontaneously after a little while.

### LARYNGOTOMY.

The patient's head having been thrown back to render the pomum Adami prominent, an incision is to be made through the skin and superficial fascia, beginning over the thyroid cartilage, and extending down to the inferior border of the cricoid cartilage, or a little lower. While the edges of this wound are held apart, the surgeon proceeds to make an incision in the same direction, precisely in the interval between the two sets of sterno-thyroid and crico-thyroid muscles. The crico-thyroid membrane will thus be exposed. The surgeon is now to try whether he can feel the pulsation of the small artery, sometimes named the crico-thyroid, and, if he can, the opening in the membrane should be made above or below it in a perpendicular direction, with the edge turned away from the vessel. In most cases, however, the cut should be directed towards the cricoid cartilage, because the small artery, referred to, generally runs along the lower edge of the thyroid cartilage.

When the purpose of the operation is merely to let a tube be introduced to enable the patient to breathe, a transverse incision in the crico-thyroid membrane will suffice; but when the removal of a foreign body from the larynx is the object, the incision should be made according to the foregoing description, and its edges be separated to let the extraneous substance escape with the breath, or be removed with the forceps.

Writers, who give the preference to laryngotomy, offer the following considerations in its favour: the only parts cut are the skin, cellular tissue, cervical fascia, and crico-thyroid membrane; the little risk of hemorrhage, — a few small veins, and the crico-thyroid artery, being the only vessels exposed to the knife; and the greater facility with which the larynx is fixed, than the trachea, which is also more deeply situated.

As to the question, which operation is most suited to the objects in view, Bichat endeavours to prove, that laryngotomy always answers as well as, and sometimes better than, tracheotomy. If the design were merely to make an opening for the air, one situation, he argues, would

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set of three tracheotomy tubes of different sizes: they should be curved, and furnished with rings, and a rim around their outer end. It is important that they should gradually increase in breadth from the extremity, which is introduced into the trachea to the rim, because, with this conical shape, they are adapted to fill and distend the incision in the trachea, so as to hinder blood, &c. from entering the trachea. In the infirmary of the Fleet Prison, I lately lost a patient, on whom I performed tracheotomy, from not being able at the moment to procure any but a cannula of wrong construction. Mr. Lawrence, instead of the use of a cannula, is in favour of removing a slip of the edge of the wound in the trachea; but this is objected to by Velpeau, as likely to cause, after the opening is finally healed, an irremediable diminution in the diameter of the trachea. Elém. de Méd. Opératoire, tom. ii. p. 214.

do as well as the other; but if the extraction of a foreign body from the rima-glottidis, or ventricles of the larynx, were required, laryngotomy would be the most advantageous.

While Ferrand was surgeon of the Hôtel Dieu, a man was brought to it with urgent symptoms of suffocation, caused by a stone that had fallen into the glottis. Tracheotomy was performed, but merely a little blood and mucus was discharged. The patient died, and, on examination, a triangular stone was found, two angles of which were lodged in the ventricles of the larynx, while the other projected at the glottis. In this example, laryngotomy would have saved the man's life. When a foreign body in the trachea is loose, it is mostly at the upper part of it; but, if it happen to be fixed, and lower down, the advocates for laryngotomy assert, that it may even then be readily extracted, by extending the cut through the cricoid cartilage, and using a pair of curved forceps. Notwithstanding these arguments, tracheotomy is usually preferred for the extraction of foreign bodies, and, as I think, justly, because laryngotomy will not give the advantage of the free and well-placed opening obtained by tracheotomy.

Whatever differences of opinion may be entertained, respecting the advantages of laryngotomy for foreign bodies in the larynx, none can exist about the preference which should be given to tracheotomy where respiration is dangerously obstructed by the pressure of some kinds of tumours on the trachea; by that of a large foreign body in the œsophagus; or by the swelling sometimes following severe wounds of the throat. I also agree with Flajani, in disapproving of laryngotomy in croup, because the wound should be made away from the principal seat of inflammation.*

Surgeons should remember, that in old persons the cartilages of the larynx are frequently ossified, and difficulty would then be experienced in dividing them; and also, that the thyroid cartilage cannot be slit open in any person without risk of injuring the chordæ vocales.

## PARACENTESIS THORACIS,

Or, the operation of making an opening into an chest, for the purpose of discharging blood, pus, a serous or sero-purulent fluid, or air, confined in the cavity of the pleura, cannot frequently be undertaken with much prospect of benefit.

Whether *blood* be *effused* from an intercostal artery, or from more deeply seated vessels; whether the bleeding arise from a wound, or a spontaneous rupture of vessels; and whether it be arterial or venous; the cessation of the hemorrhage can only be brought about through the formation of coagula, and pressure. But if, instead of remaining confined in the chest, the blood passes out through an opening in the parietes of the chest, coagula will be less likely to form, and the hemorrhage in all probability only terminate with the death of the patient. Hence, instead of dilating wounds of the chest, as the old surgeons sometimes did, the moderns make it a rule to close them. If the quantity of effused blood be moderate, it is usually absorbed; and if very copious, the stoppage of the internal hemorrhage can only be accomplished on the principles above explained, assisted by antiphlogistic treatment. It is manifest, then, that the making of any incision or puncture into the chest can never be advisable for a recent extravasation of blood occasioned by a penetrat-

* Flajani, Collezioni d'Osservazioni e Riflessioni di Chirurgia, t. iii. p. 241.

ing wound. At a later period, however, when the vessels have had time to become obliterated, if nature should not prove competent of herself to remove the effused blood, and the symptoms caused by its presence were urgent, it might then be necessary, and only under such circumstances, to make an opening for its discharge.*

With regard to a *collection of pus* in the chest, or the case termed *empyema*, paracentesis often fails to be of service, because in general the empyema is not the principal, nor the original, disease. If the cause were a tuberculated lung, combined with vomica, or any other incurable organic disease of the lung; or any serious disease of the pleura, still going on; the making of an opening into the chest would only hasten the patient's death. On the contrary, if the suppuration were the consequence of simple inflammation of the lungs, the operation, as M. Velpeau observes, might be proper, if there were nothing in the general condition of the patient prohibitory of it.

As for a *collection of serous fluid*, this is another case in which an opening has sometimes been made, though mostly without success, because hydrothorax is rarely the sole or original disease. It is also remarked by Velpeau, that, in this disease, when the fluid has been discharged, the lung is incapable of expanding, and the whole sac of the pleura becomes filled with air. Still, if it were not certain, that hydrothorax depended upon some incurable organic disease, and the quantity of fluid dangerously obstructed the breathing, the performance of paracentesis would be justified by the results of certain cases on record.

*Collections of air* within the pleura may arise from wounds of the air-cells, from decomposition of fluids, as is conjectured, or, from the simple exhalation of gas from the capillary vessels. Although cases of this description may be attended with circumstances vindicating the puncture of the pleura, the result is generally only temporary relief, because pneumo-thorax is usually combined with organic disease in the chest, effusion of blood, or empyema. If the air in the pleura were in moderate quantity, and the cause a wound of the air-cells, were the patient to live a day or two, the breach in the lungs would be closed by the adhesive inflammation; no more air would escape from it; and what had been already effused in the pleura would gradually be absorbed.

Whether the effusion in the chest be a serous fluid, or pus, the case will present certain symptoms common both to hydrothorax and empyema; especially short and difficult respiration, the lungs of the affected side being compressed by the collection of surrounding fluid. In both cases, also, expiration is even more difficult than inspiration, on account of the weight of the fluid, which strongly opposes the elevation of the diaphragm. Sometimes, when the patient moves in bed, he distinctly feels the undulation. If the fluid be contained in only one cavity of the chest, he cannot lie on the opposite side, because the fluid compresses the other lung. The ribs on the affected side are more arched than is natural, because the fluid resists their depression. When no symptoms of suppuration have occurred, the case may be suspected to be hydrothorax. The face, the integuments of the chest, and lower extremities, are frequently œdematous, and sometimes also the arm on the side affected, especially when the quantity of fluid is copious. Sometimes dropsy of the chest is joined with the same general affection of the whole body. All these symptoms, however, may indicate empyema, when preceded by

* A. L. F. Velpeau, Nouveaux Elémens de Méd. Opératoire, tom. ii. p. 250.

the usual signs of inflammation and suppuration in the chest. When symptoms of acute peripneumony have taken place, and when rigors have occurred at the termination of the inflammatory fever, just before the commencement of the above kind of symptoms, it is rational to infer that the case is empyema. I remember a man in St. Bartholomew's Hospital, whose heart was pushed completely to the right side of the chest, by an abscess in the left bag of the pleura. The preceding inflammation in the chest, the occurrence of rigors, the great difficulty of breathing, and the palpitation of the heart, quite on the right side of the sternum, made the nature of the case sufficiently evident. When the left cavity of the chest was opened after death, an enormous collection of matter was discovered. Of late, the writings of Avenbrugger, Corvisart, Laennec, and Piorry, have thrown great light on the mode of ascertaining, not only the presence of fluids in the chest, but their precise situation. For obtaining correct information on these points, the stethoscope and percussion should be resorted to. The most eligible place for the operation is between the fifth and sixth, or the sixth and seventh true ribs, at the point just in front of the indigitations of the serratus magnus, or midway between the anterior and lateral parts of the chest. In France, paracentesis thoracis is usually performed between the third and fourth ribs on the left side, and between the fourth and fifth on the right. An apprehension of wounding the liver and diaphragm by operating lower down is the chief reason for this practice. The French aim at making the incision at the junction of the posterior third with the two anterior thirds of the pectoral region. Here the opening can be made just in front of the latissimus dorsi, between the indigitations of the serratus magnus, and those of the external oblique muscle; and here the intercostal artery is still in the subcostal groove, not having yet divided into two branches.

An incision, two inches and a half long, should be made through the integuments, which are first to be drawn to one side, if it be intended to close the wound immediately after the operation. The intercostal muscles are next to be cautiously divided, and, as soon as the pleura costalis is exposed, a small puncture is to be carefully made in it. In dividing the intercostal muscles the edge of the knife should be kept close to the upper edge of the lower rib, in order to avoid all risk of wounding the intercostal artery, which runs for some way in the groove in the lower edge of the upper rib.

In emphysema, a small puncture will suffice; in hydrothorax it may be somewhat larger; and, in empyema, the matter must have an opening of sufficient size to allow the fluid to escape freely through a cannula, which, both in this disease and hydrothorax, may be furnished with a stopper, which is to be withdrawn as often as it is deemed advisable to give issue to the fluid in the pleura.

### REMOVAL OF A DISEASED BREAST, AND TUMOURS IN GENERAL.

The manner of removing encysted tumours has been already described. When the breast is affected with any disease of an incurable nature, the whole of the diseased parts may sometimes be removed with a knife, the wound healed, and the patient's life prolonged, or freed from great suffering and annoyance. The circumstances, under which the operation should be undertaken, are noticed in the remarks on cancer.

If the disease be a scirrhus, some particularity in the mode of operating is requisite. In this case, the surgeon, instead of merely removing parts which are palpably and visibly diseased, should make it a rule to take

away a certain quantity of the substance in the immediate circumference of the disease. Every experienced man is fully aware of the great propensity of the skin to be affected, and the frequent extension of white or yellowish morbid bands into the surrounding adipose cellular tissue. These facts clearly show the propriety of making a free removal of the skin, whenever it is in the least discoloured, puckered, adherent to the swelling, or in any way altered, and of taking away a good deal of the fat, in which scirrhous tumours are involved. On the contrary, if the disease be a mere chronic growth, or swelling of the breast, not of a cancerous nature, the removal of the skin is not necessary on this principle, though it may be so on others, viz. the superfluous quantity of it, when the tumour is very large, and the difficulty and tediousness of the proceedings for the removal of such a swelling when an attempt is made to preserve the whole of the integuments. When cancer recurs, the integument is the first part in which it usually makes its appearance, and the skin of the nipple in particular. Hence, many surgeons always make it a rule to remove the latter part, when it is judged proper to take away any of the integuments. As Sir Astley Cooper has observed, it is not sufficient to remove the tumour, but the gland, from the nipple to the tumour, must be removed, and the surrounding parts, to some extent, taken away.*

The patient is frequently operated upon in the sitting posture, but the recumbent has advantages, particularly when any gland in the axilla is to be taken away, or the patient is likely to faint. If the sitting posture be chosen, the pectoral muscle may be rendered tense by an assistant keeping the arm back, which state of the muscle will facilitate the dissection of the tumour from its surface.

When the case is not of a malignant character, and no part of the integuments is to be removed, a straight incision may be made through them; the tumour is to be regularly dissected on every side from the circumjacent parts; and, lastly, its base is to be detached, from above downward, till the whole is separated.

If the outer incision has been made more or less transversely, the lower half of the swelling should be separated from its surrounding connections, before the dissection of the upper portion is begun; by which means the surgeon will not be incommoded by the blood falling into the lower part of the wound, before the detachment of the adjacent portion of the tumour is effected. As soon as the lower half of the circumference of the swelling is separated from its connections, the surgeon is to undertake the dissection of the upper half. Lastly, he is to detach its base from the subjacent textures.

Such are the modes of removing all simple tumours, which are not of a malignant nature, nor of immense size.

When the tumour is malignant, and adherent to the skin and pectoral muscle, the operator is to remove at least an inch or two of the fat on every side of the disease. The portion of the skin, intended to be taken away, must be included in two semicircular incisions, which meet thus () at their extremities; and when the base of the tumour is to be detached, the surface of the pectoral muscle, wherever it is adherent to the tumour, is also to be removed. The advantage of making the incision, in the preceding manner, obviously consists in enabling the surgeon to bring the

* Lectures, vol. ii. p. 199.

edges of the wound together after the operation, so as to form a straight line, and admit of union by the first intention.

The mere magnitude of a tumour frequently renders it highly judicious to take away a portion of the skin: if some were not removed, the dissection would be tedious; and, after the operation, the loose skin would lie in folds, and form, as it were, a large pouch for the lodgment of matter.

In the extirpation of a diseased breast, the direction of the external incision must, in some measure, be determined by the shape of the tumour: Desault thought there were advantages in cutting as much as possible transversely, when circumstances would allow it; and he believed that, as the integuments were more yielding upwards or downwards, than in a cross direction, especially near the sternum, the transverse wound could be more expeditiously united. These advantages seemed to him of higher importance, than the ready escape of matter at the depending angle of the wound; the reason generally assigned in favour of the perpendicular direction of the incision. At the present day, these arguments do not sway surgeons to any great extent; but the direction of the wound is usually made obliquely downwards and forwards, and the base of the tumour cut from the pectoral muscle in a similar direction, the detachment being first accomplished at the upper and outer part of the wound, and then regularly extended to its lower and anterior end.

The tumour having been removed, the surgeon should examine the interior of the wound, in order to ascertain that no indurated part is left behind; and if any hardness be detected, it ought also to be removed. He should also examine the surface of every scirrhous tumour, immediately it is taken out, and see whether any of the white bands, shooting into the surrounding fat, have been divided; for, in this case, some portion of those bands must have been left behind, and ought to be taken away. Their situation may be known, by considering the position of the tumour before the operation.

When a tumour of the breast has been entirely detached, and the chief bleeding vessels tied, which are usually at the outer part of the incision, the arm is to be brought forward. Then, if there be any diseased gland in the axilla, the patient should lie down on the opposite side, and the arm be raised, so that the arm-pit may be completely exposed to the light. For this purpose, the first wound, if the outer and upper end of it be near enough to the axilla, may be extended over the gland about to be taken away; and the latter part, having been separated from its surrounding connections, may either be cautiously dissected from the subjacent parts, or, its base tied with a bit of strong silk. The latter method has been adopted by some distinguished operators, in consequence of the brisk hemorrhage which takes place from the short arterial branch distributed to the gland from the thoracic. As the axillary vein has occasionally been wounded in dissecting a diseased gland out of the axilla, and this by skilful and experienced operators, the plan, now mentioned, which was generally adopted at St. Bartholomew's by the late Sir Charles Blicke, deserves to be remembered.

Mr. Liston lays down one excellent rule in operations for the removal of tumours. In all cases (says he), the incisions ought to commence at the point where the principal vessels enter; in this manner, they are divided at the outset, can be readily secured by ligature, or by the fingers of an assistant, and the dissection is continued without risk of further hemorrhage. If the opposite course be pursued, the vessels will

be divided several times during the operation, numerous ligatures will be required, and a considerable loss of blood take place.*

In the removal of tumours in general, one rule is, to make a free external incision, which will materially facilitate and expedite the subsequent dissection, and save the patient from the pain and other ill consequences of a tedious and protracted operation. For the same reason, if a fascia cover the tumour, it should be freely divided, so as to make, as it were, an outlet for the morbid mass.

In dissecting out tumours, another good general maxim is, to cut as much as possible in the direction of the muscular fibres.

### PARACENTESIS ABDOMINIS.

This operation consists in making an opening into the cavity of the peritoneum, for the purpose of discharging the fluid collected there in dropsical cases. The proper instrument for this is a trocar, with a cannula through which the fluid can readily escape.

Not many years ago, it was the invariable practice to introduce the instrument at the central point of a line, drawn from the umbilicus to the anterior superior spinous process of the os ilium, and on the left side, in order to avoid all risk of injuring the liver. Modern practitioners usually prefer making the puncture in the linea alba, for several weighty reasons. The first is, that, in the other method, no surgeon can be sure of introducing the instrument in the exact situation of the linea semilunaris, and consequently may unnecessarily wound the thick muscular parietes of the abdomen, instead of merely a thin tendinous part. Another reason is, that, in the attempt to tap in the linea semilunaris, the epigastric artery has sometimes been wounded by surgeons of high repute. In dropsical cases, the rectus muscle is frequently much broader than in a healthy subject; and, as it always yields to the distension of the fluid in a greater proportion than the lateral layers of muscles, the above measurement is not unlikely to cause the wound to be made near the course of the epigastric artery.

When the operation is to be performed in the linea alba, the instrument should be introduced about two or three inches below the navel; or, as is usually directed, at the mid point between the umbilicus and the pubes. As soon as the trocar meets with no further resistance, it is not to be pushed more deeply, without any object, and with a possibility of injuring the viscera. The stilet is now to be withdrawn, the cannula pressed a little further into the opening, and the fluid discharged through it.

In consequence of the sudden removal of the pressure of the fluid from the viscera and diaphragm, patients are disposed to swoon, and even become affected with dangerous symptoms. In order to prevent these unpleasant occurrences, the abdomen is to be compressed with a bandage or belt, during the discharge of the fluid, and afterwards covered with a flannel compress and roller.

In cases of ovarial dropsy, the tumour generally inclines more towards one side of the abdomen than the other, so that the puncture cannot always be made with safety in the linea alba. Here the custom is to make the puncture at the point where the swelling is most prominent, due care being taken, however, to avoid the epigastric artery. If, how-

* See Liston's Elem. of Surgery, part 1. p. 222.

ever, the ovarial cyst be of great size, it will frequently admit of a trocar being introduced into it through the linea alba with perfect safety. I have tapped many ovarial cysts in both ways.

### REMOVAL OF A DISEASED TESTIS.

In considering the propriety of castration, nothing can be wiser than the general maxim, not to employ the knife, if there be any traces of disease in the viscera: it may be inferred, that the operation will not answer when the patient has frequent attacks of colic pains, a pallid leaden-coloured countenance, indigestion, loss of appetite, frequent purging, a hard belly, or any distinct and separate indurations about the abdomen. In cases of medullary cancer of the testis, in consequence of the natural course of the lymphatics of this organ to the lumbar glands, the absorbent glands in the course of the external iliac and common iliac arteries, and near the aorta, are frequently implicated. Sometimes these form a tumour as large as a child's head, and perceptible with the hand, especially when the abdominal muscles are relaxed. The kidneys also often partake in the disease; and hence, the prudence of always making careful inquiry into the state of those organs, before venturing to propose the operation. It is to be recollected, however, that the weight of the enlarged testis frequently produces in the loins extremely painful sensations, which might be mistaken for symptoms of diseased kidneys, if the difference were not indicated by the pain always diminishing, when the scrotum is well supported in a bag-truss, or the patient keeps himself in the recumbent posture. In such cases, the state of the urinary secretion would also afford useful light. If the scrotum be diseased, there may be enlarged glands in the groin, which are highly unfavourable whenever the disease of the testis consists of any species of tumour characterised by malignancy and a disposition to extend to other organs.

Attention should be paid to the state of the thoracic viscera; for experience proves, that various complaints of the chest frequently precede or follow the origin of medullary cancer of the testis, and seem to have a connection with it. In fact, in such cases, the structure of the lungs is often found interspersed with pulpy, medullary tumours. Hence, when the patient has a troublesome dry cough, shortness of breath, and irregular pain in the chest, and especially when these symptoms attend a medullary tumour of the testis, the operation is unadvisable. The success of castration materially depends upon the state of the spermatic cord; for here it is a point of the first-rate importance to remove every particle of the disease — every thing which appears unsound and indurated. This can easily be accomplished when the disease is confined to the testis and epididymis, the cord being unaffected. But when, as often happens, the latter part is in the same state as the testis, hardened and enlarged, the operation is improper. If the disease of the cord, however, were not to extend quite up to the ring, and its upper portion were still sound, it would yet be practicable to remove all the parts affected by cutting the cord through where it is quite healthy, and the operation be justifiable.* But it is not to be denied that, in such a case, the

* A few years ago, I removed a very large testis for medullary cancer; in the portion of the spermatic cord taken away were small particles, not larger than millet seeds, apparently medullary. Yet the patient had had no return of the disease four years after the operation. A section of the testis, with the cord, is in the possession of Sir Astley Cooper.

event is subject to great uncertainty, not so much on account of the commonly feared danger of cutting the cord through near the ring, as because the extension of the disease up the cord is always a ground for apprehending, that the complaint will return either in that part, or in the loins.

However, unless the case be medullary cancer, or fungus hæmatodes, it is only when the cord is truly scirrhous, that is to say, thickened, hardened, knotty, and painful, that it becomes an impediment to the operation; and, when its enlargement is owing merely to a varicose dilatation of the veins, or an effusion of fluid in the cellular tissue of the part, the circumstance should not prohibit the use of the knife. Both these last states of the spermatic cord may be distinguished from the scirrhous alteration of the cord by their greater softness, and their diminishing when the patient keeps himself in a horizontal position.

The circumstance of the scrotum being diseased is sometimes deemed nearly as unfavourable to the success of the operation, as disease of the cord*, on account of the distemper being likely to recur in the skin. However, there is this difference, that we always have it in our power to cut away every part of the scrotum which may be affected, while, in the case of scirrhous affection of the cord, it is sometimes impossible to follow the disorder to its highest point.

Castration is one of the most simple, and yet one of the most painful, operations in surgery, especially when practised according to the old method, in which it was the custom to include in the ligature all the vessels and nerves of the spermatic cord. At the moment of doing this, the patient was put to excruciating torture; such suffering, indeed, as few could endure without complaint, however great their fortitude.†

The hair having been removed from the pubes and scrotum, the first thing is the incision through the integuments: it should commence a little above the abdominal ring, and be continued down nearly to the bottom of the scrotum. Two advantages result from extending the cut down to this point: lodgments of matter, which often seriously retard the cure, will be prevented; and the testicle can be more easily taken out. The first incision through the integuments will commonly divide the external pudic artery, which arises from the crural; and if it bleed profusely, the best plan is to secure it at once with a small silk ligature, the ends of which may be cut short, in the manner practised by M. Roux.‡

The second object is to cut through the sheath of the cord, and separate the latter part, by making a short incision on each side of it at the point where it is intended to divide it. When its detachment is sufficiently completed to allow it to be taken hold of, and lifted up, between the thumb and forefinger of the operator's left hand, this second step of the operation is accomplished. It is a business which should never be done in a careless way; for a portion of omentum and a hernial sac may put on somewhat the appearance of thickened cellular

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* Sir C. Bell, Operative Surgery, vol. i. p. 223.

† Le Dran appears to have entertained a just aversion to this painful and unnecessary plan: "Of the several parts of the cord (says he), none but the artery will bleed; why then should the cremaster muscle, the vas deferens, and the nerve be tied with it? We are sensible, that convulsive motions have ensued from this method of making the ligature upon them all." Operations in Surgery, p. 147. transl. by Gataker, edit. 2d.

‡ See Sketches of the Medical Schools of Paris, by John G. Crosse, p. 141. 8vo. Lond. 1815.

tissue, and the protruded part be liable to injury, or the hernial sac might even be cut through at the time of dividing the cord.*

The third object is the division of the cord; in doing which, the incision should always be made through it higher than the extent of the disease; for, if this rule be neglected, the patient will derive no effectual relief from the operation, and the wound will either not heal up at all, or, if it heal at first, will break out again. Aware of the inutility and pain of including the vas deferens in the ligature, and of the facility with which this vessel can be distinguished at the back of the cord by reason of its firm feel, some operators pass a ligature between it and the rest of the cord, over the front of which the knot is made, and they then cut through the cord below the ligature. The agony, however, created by the inclusion of all the spermatic nerves, is not only severe, but absolutely unnecessary in a proceeding, the sole aim of which should be the security of the patient from hemorrhage. A far better plan is to apply no ligature in any way to the spermatic cord previously to its division; but the surgeon should hold the part between his left thumb and fore-finger, just above the point where it is to be divided, and, as soon as it has been cut through, the spermatic artery, and that of the vas deferens, should be taken up with a tenaculum and tied. Desault's method consisted in dividing the cord in the preceding manner, and then holding the upper end of it between the thumb and fore-finger of his left hand, while, with the forceps or tenaculum in his right hand, he immediately proceeded to take up the mouths of the spermatic arteries, and afterwards continued the dissection of the diseased testis from the scrotum.†

The fear of a retraction of the remnant of the cord into the inguinal canal before the arteries have been secured, has had a great deal of influence over the conduct of many surgeons in this part of the operation; and their alarm has been increased by Mr. B. Bell's having seen the thing happen twice in his practice, when both the patients were lost by hemorrhage. But, had the operator, in these unfortunate examples, been careful to take firm hold of the upper portion of the cord, before he ventured to divide it, the retraction could not have happened; and, when it did happen in consequence of this neglect, had he had discernment enough to know what ought then to have been done, neither of his patients would have fallen a victim to bleeding. In short, had he considered the course which the cord takes obliquely upward and outward, it would have been easy for him to have followed the bleeding part with perfect safety, within the inguinal canal, even to the origin of the cremaster muscle.‡ The retraction of the upper portion of the cord within the ring must be more likely to happen, when the extension of the disease upwards obliges the surgeon to divide the part higher up than will well allow the retraction to be securely prevented by the thumb and fore-finger of the left hand. In cases of this description, it has been proposed to avert the accident, by separating the cord into two fasciculi,

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* "After the operation was completed, and the wound dressed, the patient being seized with a fit of coughing, to the astonishment and dismay of the surgeon, the dressings were forced off by the protrusion of several convolutions of small intestines." Sir Astley Cooper once removed a diseased testis, which was accompanied by a hernia. The bowels were first reduced, and the cord was then separated by dissection from the back portion of the sac. In Guy's Hospital, he also removed a diseased testis, to which the omentum adhered. Obs. on the Structure, &c. of the Testis, p. 164.

† Œuvres Chir. de Desault, par Bichat, tom. ii. p. 451.

‡ See Operative Surgery, by C. Bell, vol. i. p. 229.

and, with the aid of a needle, putting a double ligature betwixt them, before the part is cut through. The design of this ligature is to draw down the cord, while the surgeon is taking up the mouths of the vessels; or, if he cannot thus stop the hemorrhage, one portion of the double ligature is recommended to be tied over the front, and the other over the posterior part, of the cord.* Another plan consists in raising the exposed cord by passing under it the left fore-finger, and then, instead of cutting the part through at once, leaving the posterior third of it undivided. The first incision will divide the principal artery and its branches, which are to be taken up singly, while the weight of the testis hinders the part from retracting. Then the vas differens is to be cut, and, if its artery be not large enough to require a ligature, the rest of the cord is to be divided. I have usually directed the end of the cord to be taken hold of with a tenaculum, until its vessels have been secured.

That part of the operation, which has for its object the taking of the diseased testicle out of the scrotum, whether it precede or follow the division of the spermatic cord, is extremely simple. It merely consists in dividing the loose cellular tissue which connects the testicle with the inside of the scrotum; and in performing this easy task, it is proper to incline the edge of the knife towards the tumour, which, after the division of the cord, may be considered as dead, and destitute of sensation.

When the diseased testicle is much enlarged, it is advantageous to remove a part of the distended scrotum, because a redundant quantity of loose skin would otherwise make it difficult to put the edges of incision evenly together, and is apt to serve as a lodgment for matter.† The manner of executing this object consists in including the portion of the scrotum that is to be taken away in two elliptical incisions, the length and interspace of which must be regulated by the magnitude of the swelling. Then the spermatic cord having been divided, and the arteries secured, the diseased organ is to be dissected out, the incisions being extended on each side from the elliptical cuts already made.

Also when a part of the scrotum is ulcerated, thickened, or adherent to the testis, two semilunar, or elliptical incisions are to be made, which meet together above and below, and include the diseased part of the skin, which is not to be separated from the swelling, but taken away with it.

When the diseased testicle is of considerable size, it may lie so close to the sound testicle and the penis, that, if attention be not paid to the circumstance, and the knife be too freely used, both these parts may be injured. Sometimes, a part of the tumour is close to the urethra, and, without care, this passage might be wounded. Frequently the swelling presses closely against the septum scroti, which is then liable to be wounded, and the tunica vaginalis of the sound testicle opened; an accident which may produce a good deal of inflammation, and therefore ought to be attentively avoided. Former surgeons had great apprehension of wounding the septum scroti, and the common warning, vociferated in the operation, used to be, "take care of the septum scroti:" but the truth is, if it were not for the chance of laying open the opposite tunica vaginalis and doing mischief to the sound testicle at the same time, a wound of that part, which is merely condensed cellular tissue, would be

* Sir C. Bell, vol. cit. pp. 225. 228.

† See Sharp's Treatise of the Operations, p. 51. edit. 3.; Bertrandi, Traité des Opérations de Chirurgie, p. 209. Paris, 1784.

of trivial importance. There is no surer way of avoiding the foregoing inconveniences, than being particularly attentive, in the dissection of the diseased testis out of the scrotum, always to incline the edge of the scalpel towards the swelling.

The most troublesome bleeding after castration proceeds, not from the spermatic artery, but from vessels within the scrotum, which quickly retract amongst the loose cellular tissue; and though for a time they may cease to bleed, they often begin to pour out blood again, directly the force of the circulation returns. The artery of the septum scroti, which, in cases of diseased testicles, is often of greater size than the spermatic artery itself*, or that of the vas deferens, should be sought for and tied. In short, as Sir Astley Cooper advises, the surgeon should "secure every vessel of the scrotum which continues to bleed, or which has been observed to bleed freely during the operation."† The ligatures, here used, should be made of common brown thread, or fine dentist's silk, and cut short after their application, because the wound always suppurates more or less, and the small fragments of thread or silk contained in it will come away with the discharge, without the slightest inconvenience.

The operation being finished, the patient should be carried to bed, and the part then merely covered with lint, wetted with cold water, till all apprehension of bleeding has ceased. After this, the wound should be more completely closed with two or three stitches and a few strips of adhesive plaster. A compress of lint may be laid over each side of the incision, and the whole supported with a T bandage. Union by the first intention is here attempted under unfavourable circumstances; for it is difficult to maintain the edges of the wound in exact contact, and the scrotum, deprived of the enlarged testis, forms a cavity, in which it is hardly possible to hinder suppuration. Some French surgeons, therefore, deny the advantage of the above mode of dressing, and pursue the old plan of filling the scrotum with charpie, and letting the parts suppurate and granulate.‡ It is true, complete union by the first intention is seldom or never accomplished, yet, by attempting it, the wound is much diminished, and the cure is rarely delayed later than three or four weeks; whereas the wound, when stuffed with lint, is usually not healed in less than seven or eight weeks.§

Sometimes, after the patient has been put to bed, hemorrhage takes place; and frequently, when the wound is opened, no particular bleeding point can be discovered. I have generally found the application of cold water to the scrotum, by means of wet linen, placed over the adhesive plaster, and making the T bandage somewhat tighter, the best way of checking the bleeding. Should this plan be unavailing, however, the dressings must be taken off, and the vessels looked for, and tied. Such hemorrhage from the arteries of the scrotum may proceed to a serious degree, without being suspected; for the blood sometimes flows out of the lower angle of the wound into his bed, while the outward dressings are perfectly dry and unstained.

When severe inflammation follows castration, venesection, leeches, and other antiphlogistic remedies are indicated; while much disorder of the nervous system, great pain in the wound, spasms, restlessness, &c. will

* Flajani, Collezione d'Osserv, tom. ii. p. 151.

† See Obs. on the Structure and Diseases of the Testis, p. 163. 4to. Lond. 1830.

‡ Roux, Paralléle de la Chirurgie Angloise avec la Chirurgie Françoise, p. 120, &c. 8vo. Paris, 1815.

§ J. Green Crosse, Sketches of the Medical Schools of Paris, &c. p. 144.

require opium and emollient poultices. Tetanus, retention of urine, convulsions, incessant vomiting, tension and swelling of the belly, peritonitis, abscesses in the course of the cord, delirium, and incurable fits of epilepsy, were more common after castration in former times, when it was the custom to include the whole of the spermatic cord in the ligature, than they are are at the present day.

After the operation, the upper part of the spermatic cord occasionally swells so considerably, that it becomes strangulated by the abdominal ring, and vast suffering is the consequence; a case which may require a division of that aperture.*

### AMPUTATION OF THE PENIS.

Cancer and mortification †, of the penis, are sometimes specified as the two cases, for which this operation is required. That the first disease is frequently a proper reason for amputating the penis, is unquestionable; but that mortification is so, every reflecting surgeon will deny. The mortified part will separate, and the living surface cicatrise afterwards, fully as well, as if the patient were to submit to a painful operation. I am glad to have it in my power to adduce, in support of the foregoing remark, the authority of Loder, who declares, that, in examples of mortification, he would never undertake the operation. When the gangrenous mischief, says he, is spreading, amputation will be of no use, because it will not stop the disorder; but if the mortification has ceased to extend itself, the operation will be superfluous, as nature herself will throw off the dead parts.‡

When the case is a scirrhous, or cancerous disease, the prospect of a perfect cure will greatly depend upon the testicles, skin about the pubes, and glands in the groin, being free from induration. I have seen this operation performed three times, and, in the first instance, the disease had extended to the testicles and inguinal glands; so that though the patient got rid of the disease, situated on the penis, the disorder continued to increase in the groin and scrotum, until life was exhausted.

As the serious mistake has sometimes happened, of amputating the penis for a disease, which, on further examination, appeared to be of a very simple and curable nature, surgeons cannot be too cautious in the investigation of the circumstances of the complaint for which the operation is proposed. In particular, they must carefully distinguish the cancerous disease of the penis from the more common warty excrescence. "I have seen (says Sir Charles Bell) a man just about to lose his penis,

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* Bertrandi, Traité des Opérations, p. 209. Instead of removing a diseased testis, M. Maunoir tried the plan of exposing the cord and tying the spermatic artery; but, as he found it sometimes fail, he afterwards had recourse to the method of cutting the cord completely through, after the artery and its branches had been secured. Another suggestion is that of simply removing a portion of the vas deferens. The object of such proceedings is to bring about the absorption of the diseased testis, but they are not yet regarded as established practices; and, I apprehend, that their frequent failure will hinder them from being so.

† In mortification from paraphimosis, or other causes, the operation is recommended both by Heister (Institut. Chir. 816.) and B. Bell (Syst. of Surgery, vol. i. p. 538.). Richter deems the operation unnecessary for the separation of the sloughs; but thinks the knife may sometimes be requisite for making the end of the stump equal, when it has healed with inequalities. However, beauty seems to me a subject here not worth considering, at least, in a surgical point of view.

‡ Chir. Med. Beobachtungen, p. 79.

on account of a combination of phimosis with these warty excrescences from the glans, and which had burst through the prepuce with a very malignant-like distortion. But the prepuce being freely cut open, the luxuriant crop of harmless warty excrescences started forth." *

It is certainly true, also, that the penis has been cut off, when the prepuce or integuments were the only diseased parts. According to the investigations of M. Lisfranc, when cancer is situated in the body of the penis, at its root, or even on the scrotum, it commences in the skin, and the subjacent fibrous textures long impede its progress more deeply. Hence, in many instances, the possibility of saving the organ by merely removing the integuments.† What are commonly termed *venereal* warts, are well described by Sir Charles Bell: they have a spreading, mushroom-like top, and slender base; and if the intermediate parts can be seen, they retain their natural appearance. A tubercle, formed on some part of the prepuce, is often the beginning of cancer of the penis; it is at first, as Sir Charles Bell remarks, an irregular warty excrescence, with a broad base in the substance of the prepuce, or on the frænum. In a more advanced and ulcerated stage, the sore is of a dark red colour, covered with a sanious discharge; its bottom is solid, and deep excavations, and irregular cauliflower excrescences, present themselves. The neighbouring skin, of a purple colour, indurated, swelled, and tuberculated, stands out from the sore, while its irregular edge is turned inwards. The discharge has a peculiar smell, being highly offensive; and when the urethra is ulcerated, the urine gushes out from preternatural openings.‡

Cancer may also commence upon the glans, as happened in the first case, in which I had an opportunity of seeing amputation of the penis performed. Here also the disease usually begins in the form of a wart, or small, not very troublesome, induration, which gradually changes into a most painful ulcerated excrescence. Sometimes, as Richter informs us, the greater part of the penis is covered with such excrescences, the cancerous nature of which is particularly indicated by the deep extension of their bases into the substance of the parts from which they grow, the parts appearing for some depth to be converted into a similar hardened mass to themselves. I have seen the whole glans, and part of the corpora cavernosa §, changed, in this manner, into a firm incompressible substance, which had been gradually extending itself for years, the glands in the groin being also diseased in the same way.

Sometimes, after the prepuce has been slit open for the relief of a congenital phimosis, a large irregular fungus sprouts out from the extremity of the penis, and continues spreading until it has occupied all that part of the organ, which naturally projects beyond the scrotum. Frequently, in these circumstances, neither the prepuce, nor the glans, can be distinctly perceived; but the whole projecting part of the penis forms a confused mass of irregular granulated flesh, discharging a very fœtid matter.‖ It would appear, from several of the cases recorded by Mr. Hey, that tubercles, or excrescences, actually existed within the prepuce before the

* Operative Surgery, vol. i. p. 130. 8vo. Lond. 1807.

† See J. F. Malgaigne, Manuel de Méd. Opératoire, p. 639. 12mo. Paris, 1834.

‡ Op. cit. vol. i. p. 131.

§ See case in Hey's Practical Obs. in Surgery, p. 463. edit. 2. A specimen of this kind, taken from a patient under me at the Bloomsbury Dispensary, is placed in the Museum of University College.

‖ See Hey's Practical Obs. in Surgery, p. 461. edit. 2.

operation, and were found there as soon as the phimosis was cut.* What is likewise remarkable, is the great frequency with which the cancerous disease of the penis seems to be attended with, or preceded by, a congenital phimosis. Mr. Hey found this to be the case in seven out of nine examples which fell under his notice, and (says he) "where I had an opportunity of seeing the disease in an early stage, the phimosis evidently appeared to have been caused by an unnatural formation of the internal membrane of the prepuce; and this formation seemed also to have given rise to the cancerous affection." The facts brought forward by this gentleman tend to prove, that this malignant affection mostly commences upon the prepuce; and that, in its earliest stage, the whole lining of that part is studded with minute tubercles, or inequalities, which change into the worst kind of disease.

According to Mr. Travers, a malignant ulceration of the prepuce and penis, following phimosis, and requiring amputation, may be brought on by an indiscreet perseverance in the use of mercury during the period of inflammation.†

Whenever excrescences on the penis have a narrow base, they may be cured by cutting them off, and the amputation of that organ is totally unnecessary, and, of course, improper. ‡ This I consider more judicious treatment than applying to them a solution of bichloride of mercury and opium for their cure, under the idea of their being venereal. Also, when the wart or excrescence is of a malignant kind, but limited to the prepuce, a cure may generally be effected by a removal of the part, without touching the glans or body of the penis itself. § Lastly, it is to be recollected, that diseases of this organ, which put on a malignant appearance, are sometimes cured by the carrot-poultice ||, and the internal and external use of arsenic.

In the operation, the plan of saving as much of the penis, and also of the glans, as circumstances will allow, with due regard to the entire removal of every particle of the disease, is undoubtedly entitled to commendation; because the longer the stump is left, not only the more conveniently will the urine afterwards be discharged, but even the faculty of generation be more likely to be preserved. In confirmation of the latter point, the testimony of Heister might be adduced, and Loder mentions one example, in which the patient retained the power of propagating after amputation of the whole of the glans. ¶

Amputation of a cancerous affection of the penis often brings about a cure, relapses being much less frequent than after the generality of operations for the removal of cancerous parts. In the three first cases published by Mr. Hey, the cure after the operation was permanent.** In order to insure this success, however, it is essential not to defer the use of the knife until the disease is no longer local, and the whole of it cannot be taken away. Hence, before determining to operate, it is a rule with surgeons carefully to examine whether the disease has extended to other parts, especially the glands in the groin. When they are indurated and enlarged, many good practitioners decline the operation altogether,

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* See Cases, Op. cit. pp. 463. 473. &c.
† Surgical Essays, part i. p. 152.
‡ Richter, Anfangsgr. b. vi. p. 183. Göttingen, 1802.
§ See case in Hey's Practical Obs. p. 473. edit. 2.
|| Gibson, in Med. Obs. and Inquiries, vol iv.
¶ Loder, Chirurgisch-Medicinische Beobachtungen, b. i. p. 81.
** Hey's Practical Obs. in Surgery, p. 478. edit. 2.

the event of which is then always to be regarded as doubtful. Thus, in one instance, in which the glands of the groin were much tumefied, Mr. Hey ventured upon the operation, because the swelling of the glands did not exist before escharotics had been applied to the disease of the penis, and consequently it was dubious whether their enlargement was truly cancerous or not; but the patient died from a relapse. The inguinal glands lessened for a time, but afterwards increased considerably: there was, however, never any fresh ulceration.* Sometimes the only part affected, in addition to the penis, will be the integuments covering the ossa pubis, in which situation a hard tumour is perceptible. In one case of this description, operated upon by Mr. Hey, a permanent cure ensued, care having been taken to cut out the swelling at the pubes: the wound here remained for some time foul; but, on applying to it red precipitate and burnt alum, it assumed a better appearance, and afterwards healed. † When the cancerous disease does not extend beyond the glans, immediately behind which the incision can be safely executed, there is no objection to the method of cutting through the whole of the penis, with one stroke of the knife. However, in order to cover the ends of the corpora cavernosa with integuments, the plan is sometimes followed of first drawing them towards the pubes, before the incision is made, or else of merely making at first a circular cut through the skin, which is next pushed a little way up towards the pubes, and the rest of the penis divided in a line with the edge of the retracted skin. This last way of operating, however, is not approved of by the generality of modern surgeons; for it is slower, and more painful, than a direct incision through the whole organ; it does not shorten the cure, and is liable to inconveniences. If, indeed, the preservation of skin for covering the end of the stump were any real advantage, the surgeon would always have enough for this purpose by cutting straight through the part, because the corpora cavernosa constantly shrink towards the pubes as soon as they are cut through, and leave the integuments projecting. But the truth is, no benefit is derived from the redundance of skin: in one case, Mr. Hey made an attempt to heal the wound by the first intention, and, with that view, brought the integuments over the divided corpora cavernosa; and, that he might make the integuments lie over the end of the penis without puckering, or covering the orifice of the urethra, he made a longitudinal division of them at the inferior part of the penis, and introduced a small silver cannula into the urethra. "I was disappointed," says he, "in my design of healing by the first intention; for the integuments would not adhere to the extremity of the corpora cavernosa. These spongy bodies, when divided, do not readily throw out granulations; but have usually for some time an ill-conditioned appearance."‡ An objection to amputation of the penis by the double incision is, that the superfluous flap of skin, further augmented by the natural retraction of the divided corpora cavernosa, renders it more difficult to secure the blood-vessels, which become concealed under it, and are disposed to retract, on account of the loose cellular substance with which they are surrounded. At all events, if the surgeon choose to save the skin, let him not prolong the patient's sufferings by two formal distinct incisions, with an intermediate dissection of the integuments from the corpora cavernosa, as it will be quite sufficient

* See Hey's Practical Obs. in Surgery, p. 470. edit. 2.
† Op. cit. p. 463. ‡ Op. cit. p. 469.

to draw the skin a little way towards the pubes, when the amputation may be completed with a single stroke of the knife.

When the penis is to be amputated near the symphysis of the pubes, less skin should be taken away, because the retraction of the corpora cavernosa is in proportion to the length of the portion of them left. Sometimes, however, their extremities in this situation lie so deeply concealed within the integuments, that the surgeon cannot discover, nor take up, the bleeding vessels. In one example, says Richter, the arteries shrunk so far under the pubes, that they lay two inches within the extremity of the skin.*

As the hemorrhage after amputation of the penis is profuse, and often cannot be effectually restrained, unless the larger arteries are secured with ligatures, it is a matter of great importance to perform the operation in such a manner as will enable the surgeon to get at these vessels with the least difficulty; and hence the utility of abandoning the project of saving skin for the purpose of covering the stump. Without this precaution, as a modern surgeon has remarked, while the tedious business of getting the ends of the corpora cavernosa from beneath the integuments by which they are concealed, and of finding out the arteries, is going on, the continued bleeding often reduces the patient to the lowest state of weakness, and the practitioner is at last compelled to have recourse to compression, styptic applications, cold water, or the cautery. Nor are these means always capable of stopping the hemorrhage in time, or in a permanent manner, the effusion of blood ceasing only for a little while; and their irritation always increases the inflammation of the stump, and protracts the cure. Thus, in one example, where the hemorrhage was considerable, the blood flowing not only from many conspicuous arteries, but oozing largely from the divided corpora cavernosa, Mr. Hey took up one artery on the dorsum penis, and one in each corpus cavernosum. The bleeding, which still continued, seemed then to be a general oozing from the wound, on which account he applied sponge to it. But this would not do; for, about an hour after the patient had been put to bed, the bleeding burst out again, and Mr. Hey was therefore obliged to remove the dressings, and take up three other arteries. A fourth vessel, which passed near the urethra, bled a little; but, as its extremity could not be clearly seen, a piece of sponge was laid upon it. On the third day, a fresh hemorrhage came on, which made it necessary to remove the last portion of sponge, and take up the vessel under it, which now bled freely.† In another example, Siebold could tie only one artery, the others having shrunk so deeply, that they could not be discovered. After the patient had fainted, the bleeding stopped; but it broke out again, and was at length checked with cold water. The weakness from loss of blood was such, however, that the patient was a month in recovering his strength, and his feet continued for some time œdematous. ‡ Joerdens saw a case in which the stump became retracted under the pubes, and a violent hemorrhage ensued, which nearly proved fatal, and could hardly be restrained in half an hour, by tying three arteries, and having recourse to compression, and a styptic liquor. § B. Bell was still more unfortunate, for he ventured to trust entirely to pressure, without taking

* Anfangsgr. b. vi. pp. 185, 186.
† See Hey's Practical Obs. in Surgery, p. 465. edit. 2.
‡ Chir. Tagebuch, p. 52.
§ Loder's Journal, 3 b. 1 st.

up any of the vessels; the consequence was, that so copious a bleeding came on, a few hours after the operation, that the patient lost his life.* In another case, the surface of the stump, which had been treated with compression and styptics, was long ill-conditioned, pale, and indurated; nor did the wound begin to diminish at all before the thirteenth day †, in which space of time, another instance, treated differently, had completely healed. ‡

Certain cases prove, that the corpora cavernosa sometimes have a great tendency to retract, when cut through towards the pubes; and that even when care has been taken to amputate more of the integuments than of them, their extremities will still frequently be deeply concealed, and the taking up of the arteries be difficult. Nor will the plan of encircling the stump with a tight piece of tape here avail in obviating the disadvantage of the retraction of the corpora cavernosa, and the immediate danger of hemorrhage, as the stump is short, and the band therefore liable to slip off. Even if the band could be fixed tightly on the part, it would only serve as a temporary means of stopping the bleeding, which would be renewed immediately the band was loosened for the purpose of enabling the operator to see the points from which the blood issued. § This plan, however, has been adopted with success in Germany ‖, and Mr. Hey assures us, that, in one of his cases, he found great advantage from having applied some tape round the sound part, as he was thereby not only enabled to divide the integuments more easily and correctly, but was furnished with an useful kind of tourniquet, which kept the divided vessels from bleeding, till he was prepared to take them up with the tenaculum and ligature. ¶

Were a case to present itself, in which the mouths of the arteries could not be taken up, the practitioner would be compelled to resort to means, which experience proves to have occasionally succeeded under similar circumstances; as, for instance, compression **, with agaric, sponge, or lint dipped in powder of gum arabic, ice-cold water††, and the actual cautery‡‡, a circular band, strip of plaster, or tourniquet, &c. The uncertainty of all these methods, however, is generally acknowledged.

The arteries, requiring ligatures, are those of the dorsum and corpora cavernosa.

In order to prevent a closure of the urethra, as well as to enable the patient to make water easily, and keep the urine from coming into contact with the wound, some surgeons, as soon as the operation is finished, introduce a short silver cannula, or an ordinary catheter, into that canal. If the short cannula be chosen, it must be made with little rings, so that it may be conveniently fastened in its situation. Were the amputation about to be done towards the pubes, a silver catheter should be introduced before the operation, because here the retraction of the parts is such, that the introduction of the instrument afterwards might be found difficult, if not impracticable.

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* Syst. of Surgery, vol. i.
† Schmalz, in Loder's Journ. 1 b. s. 622.
‡ See Schreger's Chirurgische Versüche, b. i. p. 243.
§ Ibid. p. 247.
‖ Ollenroths, in Hufeland's Journ. 3 b. s. 56.
¶ Hey's Practical Obs. on Surgery, p. 478. ed. 2.
** Dolignon, Journ. de Médecine, t. lxxxiii.
†† Siebold, Chir. Tagebuch, p. 52.
‡‡ Sabatier, Médecine Opératoire, t. ii. p. 306. Ollenroths, Hufeland's Journ. 3 b.

With respect to the introduction of any tube, either before or directly after the operation in ordinary cases, surgeons are not unanimous upon the subject. I have seen the operation done very well without it, and the parts favourably healed, a bougie having been passed a little way into the urethra once a day, after the removal of the dressings, to hinder the contraction of the orifice of the urethra. This was Mr. Hey's practice.

An elastic catheter, as creating less irritation, is preferable to a metallic one. The irritation of the wound by the urine, and the necessity of hindering the orifice of the urethra from closing, will probably always lead many practitioners to pass a catheter. The instrument, however, should be large; for otherwise the urine, by getting out between it and the urethra, and wetting the dressings, irritates and frets the wound. Le Dran mentions a case, in which, from the neglect to pass a catheter, the orifice of the urethra became impervious, so that the urine could not be discharged.* Bertrandi cites another case, where, on this account, it became requisite to enlarge the orifice of the urethra by an incision.

### PUNCTURING THE BLADDER.

The fifth, sixth, and seventh days, from the commencement of the total obstruction, are those on which the urine is likely to escape from the bladder; hence, Sir Charles Bell recommends an outlet for it to be made on the fourth day.†

Although I am an advocate for not delaying the operation, after milder methods have decidedly failed, I believe that these will almost always prove successful in skilful hands, and that it may generally be avoided. At the present day, the necessity for paracentesis is frequently superseded by the excellent practice of making an opening in the membranous portion of the urethra, which, in cases of bad stricture, is generally dilated behind the obstructed part of the canal.

The bladder may be punctured, either in the perineum, above the os pubis, or through the rectum. Of the first operation I shall say nothing, for it is now generally relinquished. I allude to the old method of opening the bladder with a trocar, between its neck and the insertion of the ureter; because cases frequently present themselves, in which letting out the urine by an incision in the perineum is much more advisable, than either puncturing the bladder from the rectum, or above the pubes. But the operation to which I refer, is not a hazardous thrust of a trocar at a point between the neck of the bladder and the insertion of the ureter, a point which can never be hit with certainty; but a simple incision in the dilated membranous portion of the urethra. In retentions of urine from strictures, not admitting relief by other means, Sir Astley Cooper prefers making an opening in the urethra to the practice of puncturing the bladder, which, in male subjects, he considers hardly ever necessary. In them, retention of urine mostly arises either from strictures or disease of the prostate gland. Of the latter, Sir Astley has never seen a case, in which a catheter, of proper form and size, could not be passed.‡ "If," says Sir Charles Bell, "a man have a stricture in the urethra, and the surrounding parts be indurated, so that there is no immediate hope of removing it by the caustic, or the bougie; if, with this, there has occurred

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* Operations in Surgery, p. 158. ed. 2.

† Operative Surgery, vol. i. p. 315.

‡ Surgical Obs. vol. ii. p. 61. 8vo. Lond. 1818. If the urethra has already burst, and effusion taken place, only free external incisions seem necessary.

a sudden obstruction, and the bladder has risen and has lost its action, and there remains no expectation of spontaneous relief, or of ease from lesser remedies, then I apprehend it is better to open the urethra in the perineum behind the stricture. And this is to be immediately done, if the symptoms indicate a rupture of the urethra, and effusion of urine." *

In University College Hospital, I had a case, where a diseased prostate gland rendered the included portion of the urethra perfectly spiral, so that only a smallish flexible catheter was capable of passing through it; and at length the point of this entered the substance of the prostate, a part of which was found after death to be exceedingly soft. Had it gone a quarter of an inch further, it would have reached the cavity of the bladder. As the symptoms were urgent, I punctured the bladder above the pubes, and drew off a considerable quantity of urine. The man did not recover, and, on examination of the parts after death, it seemed that a small quantity of urine had insinuated itself between the cannula and sides of the wound, and excited inflammation, which had extended to the peritoneum. The preparation, which is preserved in the museum of University College, shows the track of the trocar completely below the reflection of the peritoneum, and the enlargement of the prostate gland has the peculiarity of being principally directed towards the rectum.

### PUNCTURE ABOVE THE PUBES.

Some surgeons make a perpendicular incision, about two inches in length, through the integuments and fat covering the lower part of the linea alba. Were the bladder thickened and contracted, or the patient corpulent, this preliminary incision would be proper; but, if the distended bladder can be plainly felt, the trocar may be at once introduced through the parietes of the abdomen into that viscus. A trocar, the diameter of which should be such as will afford a very ready outlet for the urine, and the curvature form a segment of a circle seven inches in diameter, is to be passed through the integuments and linea alba into the bladder. It is to be held with its convexity towards the patient's navel, and pushed obliquely downward and backward in the axis of that viscus. Sir Astley Cooper, who uses a straight trocar, directs it towards the basis of the sacrum, and not so low down as I have mentioned; his reason is, that the risk of the instrument slipping between the pubes and the bladder may be avoided. † At all events, it is necessary to guard against this accident, which has sometimes happened. A curved instrument of this kind is much less likely, than a straight trocar, to penetrate the back part of the bladder, and wound the rectum; besides, having this advantage, that, when the urine is evacuated and the bladder collapses, the cannula will be less disposed than a straight one to be separated from that organ. Here we may discern another reason for making the puncture immediately above the pubes, and not an inch or two higher up, as Sharp and B. Bell recommend: the bladder, which rises up between the peritoneum and recti muscles, descends again, when the urine is discharged, and, consequently, must be more liable to slip from the cannula, the higher the puncture is made. ‡

* Lectures, vol. ii. p. 315. It seems that Sir Astley Cooper is entitled to the merit of first reviving this forgotten but valuable practice, of which I find traces in the valuable work of L. L. Petit, entitled Traité de Mal. Chir. 3 tomes. 8vo. Paris, 1790.

† Lectures, vol. ii. p. 309.

‡ Richerand, Nosographie Chir. tom. iii. p. 499. By the employment of a long straight trocar, of course the objection here specified might be removed; but the cannula

When the operator perceives, from the want of resistance, that the point of the instrument is in the bladder, he is to take hold of the cannula, and push it further in, while he withdraws the stilet. After the urine has been discharged, some practitioners, amongst whom is Sir Astley Cooper, pass an elastic catheter, duly shortened, into the bladder through the cannula, and then take the latter out.

Since an elastic catheter does not fill the wound, the urine is discharged, not only through it, but also between its outer surface and the track of the wound; so that the chance of the urine becoming diffused in the cellular tissue is not guarded against, as it is by allowing the cannula of the trocar to remain in the wound two or three days, until inflammation has agglutinated together the surrounding cellular substance. In some examples, the cannula, after having been kept a few days in the wound, was taken out, and readily introduced again as occasion required.*

Still, I do not feel authorised to recommend this proceeding; because it has happened, that the tube could not be replaced, and the urine became confined again, so that a repetition of the operation would have been absolutely necessary a third time, had not Schreger succeeded in procuring an evacuation through the urethra, by distending this canal with warm water, injected with some force into the passage by means of a syringe and a cannula, introduced as far as the stricture would allow.†

Long, straight, silver cannulæ have been known to form a communication between the bladder and rectum, in consequence of ulceration, or sloughing, produced by the pressure of their points on the back part of the bladder. Mr. Sharp saw this accident ‡; and a modern author informs us, that in a case where a common trocar was used, he dissected the parts; "the bladder fell on the sharp edge of the trocar, this produced inflammation of the bladder and peritoneum, which occasioned the death of the patient." §

The outlet thus formed for the urine is, of course, merely designed as a temporary one, until the impediment in the natural passage has been removed. In one case, seen by Sir Astley Cooper, where the latter object had not been accomplished, twelve months after the puncture, a female catheter was yet worn in the opening. ‖

This operation has the advantage of being generally done at a distance from the diseased parts, and without risk of injuring any organs of

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of such an instrument has sometimes pressed against the opposite side of the bladder, and caused an ulcerated opening in it. In consequence of the bladder having slipped away from a short cannula, a repetition of the puncture became necessary in a case under Professor Schreger. See Chirurgische Versüche, b. i. p. 212. Nurenberg, 1811.

* See Bohn über Harnverhaltung and Blasenstich, Leipzig, 1794; Noel in Desault's Journal de Chirurgie, tom. ii.; Turner in London Med. Journal, vol. xi.; Journal de Médecine, tom. lxxxiii.

† Versüche Chirurgische, b. i. p. 216. 8vo. Nurenberg, 1811. In cases of retention of urine, from calculi lodged near the neck of the bladder, Schreger employed the same artifice with success. It is this principle of distending the urethra with fluid, that was once so strongly recommended by Mr. Arnott in various affections of that canal.

‡ See a Critical Inquiry into the Present State of Surgery, p. 127. ed. 4.

§ See a History of the High Operation for the Stone by Incision above the Pubes, and an Account of the various Methods of Lithotomy, by J. C. Carpue, p. 176. 8vo. Lond. 1819.

‖ Lectures, vol. ii. p. 310.

importance.* The possibility of the urine getting out of the bladder into the wound, was exemplified in the case under me in University College Hospital, and this notwithstanding the cannula was not withdrawn and exchanged for an elastic catheter, till the end of two days from the period of the puncture. When the cannula happens to slip out of the bladder, it is alleged that the puncture becomes impervious. In fact, this happened in Schreger's case, where the tube slipped out twice; viz. on the evening of the day on which the bladder was first tapped, and again on the third night from the second performance of the operation; for, after each displacement of the cannula, no probe could be passed into the bladder, no urine escaped, and that receptacle became enormously distended again. When a smallish trocar is used, this closure of the puncture by the mucous coat would perhaps generally be likely to take place for a day or two after the operation; but, in a later stage, it would be less likely to occur: it did not happen in the example related by Schreger himself, in which he took out the cannula of the trocar on the thirteenth day, and put in another †; and it is therefore not to be regarded by any means as an invariable consequence of the tube slipping out. The displacement of the cannula, the possibility of not being able to get in another, and of an extravasation of urine, therefore, may still be considered objections to this method of operating. Another disadvantage is, that the opening is not made in a depending situation, and consequently the whole of the urine cannot be readily discharged. I once saw Mr. Abernethy attempt this operation in St. Bartholomew's Hospital; but the trocar did not enter the bladder. No urine was discharged, and the patient died the following day.

### PUNCTURE THROUGH THE RECTUM.

The patient is to be put in the posture recommended for lithotomy. An assistant is to make pressure on the abdomen, just above the pubes, in order to render the prominence of the bladder more distinct to the surgeon's finger in the rectum. A curved trocar, with the point of its stilette drawn within the cannula, is to be introduced with the right hand, and under the guidance of the left forefinger first passed into the rectum so as to feel the base, or posterior part, of the prostate gland. It should be kept exactly in the central line of the front of the rectum, and, as soon as the end of the cannula is beyond the prostate gland, its handle should be depressed, and the stilette pushed into the bladder, through the anterior part of the intestine, as nearly as possible in the middle of a small triangular space, bounded at the sides by the vasa deferentia and vesiculæ seminales, which converge to the prostate gland, and behind by the line at which the peritoneum is reflected from the bladder to the rectum. If the puncture be made in the centre of this space, just beyond the base of the prostate gland, while the bladder is distended, there will be no danger of wounding the vasa deferentia, vesiculæ seminales, or peritoneum.‡

After the urine has been discharged, the cannula should be fixed in its

* The preparation in the Museum of University College, exhibiting the track of the trocar, proves that Mr. King's statement of the peritoneum being necessarily pierced twice by the trocar, before the bladder is reached, is a mistake. See Lithotrity and Lithotomy compared, by Thomas King. 8vo. Lond. 1832. p. 31.

† Versüche Chir. b. i. p. 225.

‡ Sir Astley Cooper, Lectures, vol. ii. p. 311. Also J. F. Malgaigne, Manuel de Méd. Opératoire, p. 682. 12mo. Paris, 1834.

place, by means ef two pieces of tape passed through its rings, and fastened in front and behind to a bandage round the waist. It is to be closed with a stopper, which may be taken out as occasion requires, and may be further secured with a compress and T bandage. As soon as the obstruction in the urethra is removed, the cannula is to be withdrawn: or, in some cases, it may be withdrawn in from twelve to twenty-four hours, and the urine allowed to pass through the new opening. The reason in favour of this plan is, to get rid of the annoyance of the cannula in the rectum: the reasons against it are, the possibility of the opening closing prematurely, and of the urine causing inflammation, ulceration, and sloughing of the rectum. Sir Astley Cooper objects to this operation, on the ground, that the irritation of the urine is likely to bring on inflammation and disease of the rectum, as happened in a case under Dr. Cheston. When the prostate gland is enlarged, it is manifestly inapplicable.

### LITHOTOMY.

The generality of vesical calculi are originally formed in the kidney, whence they descend into the bladder through the ureter, but are either too large to be voided through the urethra, or are prevented from entering the latter passage by the projection of an enlarged prostate gland.* When, however, any foreign body remains in the bladder, it soon becomes incrusted with other matter deposited on it from the urine, and thus forms the nucleus of the calculus.

The composition of calculi is various: — 1. Lithic acid. 2. Oxalate of lime, or mulberry calculi, which are of a dark colour, very hard, and have a rough, irregular surface. 3. Triple phosphate of ammonia and magnesia. 4. Phosphate of lime. Calculi, composed entirely of this, are rarely met with in the bladder; and when they are, the researches of Dr. Prout tend to prove, that they are derived, not from the urine, but from the secretions of the bladder itself. 5. Calculi, consisting partly of the triple phosphate of ammonia and magnesia, and partly of the phosphate of lime, blended together. 6. Lithate of ammonia, seldom met with except in children. 7. Lithate of soda, exceedingly rare. 8. Cystic oxide. 9. Carbonate of lime. A calculus, composed altogether of this substance, is very rare, though a small quantity of it is often commixed with other matters. 10. Xanthic oxide. 11. Fibrous calculus. The two latter, first described by Dr. Marcet, are uncommon.† Children and elderly persons are well known to be more liable to calculi, than persons of the middle periods of life. In the poor classes, children are afflicted with remarkable frequency; but, in the higher, the disorder is more common in old than young subjects.

The museum of University College affords abundant evidence of the great liability of patients with diseased prostate glands to the formation of calculi. Their bladders can never be completely emptied; and, as Sir Benjamin Brodie correctly remarks, if a small calculus from the kidney find its way into the bladder, it cannot escape by the urethra, and remains and increases. Lithic acid, and particles of phosphate of lime, or any thing else which can act as a nucleus, becomes also, under these circumstances, the foundation of a stone in the bladder. In cases of

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* Sir Benjamin Brodie on Diseases of the Urinary Organs, ed. 2. p. 209. 8vo. Lond. 1835.

† On this subject, consult the writings of Brande, Marcet, Prout, Henry, Yelloly, and Brodie.

diseased prostate gland, the mucous membrane of the bladder sometimes becomes inflamed, and the mucus secreted by it deposits phosphate of lime in small masses, and each of these becomes the nucleus of a calculus; but such calculi may unite and form larger ones.

While a stone in the bladder is of trivial size, smooth, and not angular in its figure, little inconvenience may result from it; but, when it is above a certain weight, rough, and of irregular figure, it always produces more or less suffering. The symptoms, however, seem to be influenced by the quality of the urine, which may be unusually acid, or alkaline, depositing the triple phosphate. As Sir Benjamin Brodie has remarked, in either of these cases it will be too stimulating, and the symptoms produced by the stone will be aggravated. The state of the bladder itself also makes considerable difference, nothing augmenting the severity of the symptoms so much as inflammation of the mucous membrane. While this exists, a small calculus will cause infinitely greater distress than a large one under ordinary circumstances. * Another reason, assigned by him for the increased severity of the symptoms, when the urine is alkaline, is, that the state of the general health, which causes alkaline urine to be secreted, is attended with a morbid sensibility of the nervous system in general. A dull, annoying pain is felt at the extremity of the penis, and hence, children are continually pulling the prepuce, and it often becomes remarkably lengthened. A sense of weight is experienced in the perinæum; there is a frequent desire to make water, and sometimes uneasiness about the rectum, tenesmus, or, in children, even prolapsus ani. In consequence of a small stone falling on the inner orifice of the urethra, the stream of urine is apt to be suddenly stopped, although the bladder yet contains a considerable quantity. The evacuation is attended with pain, especially towards the conclusion of it, when the inner surface of the bladder embraces, as it were, the foreign body.

The urine contains a good deal of mucus, which forms a sediment, and, when the patient takes exercise, sometimes blood. In an advanced stage, ulceration of the inner coat of the bladder occurs, and then the urine has an offensive smell, becoming putrid and ammoniacal, and depositing a mixture of mucus and pus, more or less blended with blood. After a time, the symptoms of disease of the bladder and kidneys are added to those of stone; the patient loses his appetite, becomes hectic, and the urine albuminous. Frequently, the patient, if not relieved by operation, falls a victim to inflammation of the bladder, already much diseased. Occasionally, large abscesses form in the cellular tissue of the pelvis. Together with these symptoms, there may be numbness in the thighs, and the testicles are often painful and retracted. In the case of a gentleman, lately attended by Mr. Bransby Cooper, Dr. Rigby, and myself, and who died of stone, one kidney was much enlarged, and the left ureter, whose communication below with the bladder was obliterated, was as wide and capacious as one of the small intestines.

An enlarged prostate gland is attended with symptoms more or less similar to those of stone; but, with this difference, that riding in a coach, or on horseback, does not augment the grievances, when the prostate gland is affected; while, in cases of calculi, it does so in an intolerable degree, bringing on likewise a discharge of bloody urine. The fits of pain from a calculus in the bladder generally come on at intervals;

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* Sir Benjamin Brodie on Diseases of the Urinary Organs, p. 225. ed. 2.

whereas the pain from a diseased prostate gland is neither so unequal, nor so acute.

As the symptoms of stone in the bladder bear a strong resemblance to those of several other affections, surgeons never pronounce a decided opinion on the nature of the disease, until they have introduced a metallic instrument (called a sound) into the bladder, and actually touched the stone itself. But a judicious practitioner, who may not be able to feel the calculus, will be cautious not to say positively, that there is no stone in the bladder; for the next time the patient is sounded, its position may be different, and it may be distinctly hit with the instrument. In relation to this part of the subject, I admire the candour of Sir Astley Cooper, when he says: "I have myself sounded, and not detected a stone at one time, which I have afterwards felt. I have sounded, and not discovered a stone, which another surgeon has afterwards perceived. I cut a patient, and extracted thirty-seven stones from his bladder, who had been sounded, and declared not to have a stone."*

### OF SOUNDING, OR SEARCHING FOR THE STONE.

The instrument, expressly calculated for this purpose, is denominated a sound, which is not hollow like a catheter, but solid, and made of the best steel. As a stone is generally carried by its own weight to the lowest part of the bladder, the sound is less curved, and somewhat longer than a catheter, in order that it may reach behind and below the neck of that viscus. Being only a particular kind of probe, the chief use of which is to convey information through the medium of the organ of touch, its handle should be highly polished, so that as many points of it may be in contact with the fingers as possible. The mode of introducing it is the same as that of passing a silver catheter.

When its extremity is in the bladder, it is first to be inclined downwards, for the purpose of ascertaining whether the stone occupies its most frequent situation, beneath the extremity of the instrument. If the calculus cannot be felt in this direction, the end of the sound may be gently turned, first to one side and then the other; and, in the event of the calculus not being now touched, the handle of the instrument is to be depressed, and its extremity inclined upwards and forwards, in order to learn whether the foreign body may not lie more towards the fundus of the bladder. Frequently, the stone cannot be felt before the whole of the urine has been voided, and the bladder is contracted; and sometimes the sound cannot be made to strike the calculus, unless this body be first raised up by a finger passed into the rectum, in doing which the surgeon may occasionally feel the stone, if it be large, through the intervening coats of the bowel and bladder. As, however, this method is seldom requisite, except when the calculus is smallish, the practitioner must not always expect to feel it with his finger through the bowel; nor is it a matter of any practical importance, because the information thus obtained is more liable to be fallacious, than what the sound affords, and, if the stone cannot be felt with this instrument, any kind of feel, communicated to the finger within the rectum, would not warrant the making of an incision into the bladder.

When the stone is smallish, and lies on one side of the neck of the bladder, it may not admit of being readily hit with the sound. Also,

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* Sir Astley Cooper's Lectures, vol. ii. p. 248.

when, from repeated attacks of inflammation, hardened folds, or, from other causes, distinct cysts have been formed within the bladder, the calculus sometimes lies within a depression, or cavity, and cannot be felt with the instrument. Under such circumstances, before the sound is introduced, the patient should hold his water, until the bladder is quite full, and, if possible, until it is so distended as to efface, or diminish, its preternatural excavations. Then the patient should stand up, and make water, with his body inclined forwards, whereby the calculus will be carried towards the neck of the bladder, and admit of being struck with the instrument.* I have known several cases, where the calculus could be touched with a silver catheter, but not with a sound. Instruments of different curvatures and lengths should be tried, when the symptoms are strongly marked, yet the calculus cannot be felt. Whenever the surgeon cannot readily touch the stone, the patient is to be sounded in different attitudes.

In sounding, how possible it is to mistake a thickened, indurated bladder for a stone in that organ, may be well conceived, when it is considered that Cheselden, with all his judgment and experience, actually cut no less than three patients, none of whom had any stone in the bladder at the time of the operation. On the other hand, the case of the celebrated French surgeon, La Peyronie, exemplifies most convincingly, the possibility of failing to discover a stone even of considerable size, though the sound be repeatedly passed.

There are three methods of treating calculous patients generally considered by writers; one is that of attempting to dissolve the stone; a second, that of palliating the symptoms; and the other aims at the removal of the calculus from the bladder by a surgical operation. In women, the latter object may often be performed by dilating the meatus urinarius, without using any cutting instrument †; but, in the male sex, the great length, narrow diameter, winding course, and considerable irritability, of the urethra, make the extraction of calculi through it, and even the getting hold of them in the bladder with any instrument introduced through the passage, more difficult. However, the success which Sir Astley Cooper, Sir Benjamin Brodie, and others have had in extracting calculi of moderate size from the bladder with the urethral forceps constructed by Messrs. Weiss, and the efficiency with which lithotrity is frequently resorted to for reducing larger stones to small particles, capable of discharge with the urine, have already made due impression on every practitioner, desirous of lessening the frequency of one of the most painful and fatal operations in surgery. At the same time, when the calculus is above a certain size, or the bladder is diseased, and incapable of bearing the irritation of the fragments, lithotrity is likely to prove even more fatal than lithotomy. When the kidneys are diseased, the chances of recovery after either operation must be hopeless.

Though the calculus may have been felt with a sound, at some period or another previously to the time fixed upon for the operation, it is an established maxim in surgery, *never to perform lithotomy, unless the stone*

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* Richter, Anfangsgr. b. vii. p. 103.

† Notwithstanding the many respectable advocates for this practice, some men of considerable eminence object to it, as being more tedious and painful, and more likely to be followed by an incontinence of urine, than the use of a cutting instrument. Of this sentiment is the experienced Klein, who has tried both methods, and in 1816 had cut for the stone 79 patients. See Practische Ansichten der Bedeutendsten Chirurgischen Operationen, auf eigene Erfahrungen gegründet von D. C. Klein, p. 21. 2tes Heft, 4to. Stuttgart, 1816.

*can be plainly struck with a sound, or staff, immediately before the operation.* A man may have a stone in the bladder to-day, and the surgeon may strike it so manifestly with the sound, as to make the circumstance perceptible to the ears of the by-standers, as well as to his own fingers; but to-morrow, the stone may protrude between the fasciculi of the muscular fibres of the bladder, carrying along with it a pouch, formed by the lining of this viscus, and, in this circumstance, the stone is no longer in the cavity of the bladder; consequently, it can neither be felt with the sound, nor extracted by the operation of lithotomy.

An interesting case is recorded by Sir Benjamin Brodie, where a calculus was included in a sac, composed of the muscular, as well as the mucous coat, and used to create severe pain whenever it passed, as it sometimes did, out of the sac into the cavity of the bladder.

In many instances, there is only a single calculus in the bladder; in others, several; and sometimes thirty or forty. When their number is greater than one, their rubbing against each other generally gives them a smooth surface.

### OPERATION.

As one of the principal dangers of lithotomy is inflammation of the bladder and peritoneum, I think the common principles of surgery teach us, that it must be a matter of prudence to remove, if possible, beforehand, any state of the constitution known to promote the access of inflammation. A low regimen, for a few days previously to the operation, and a dose or two of mild aperient medicine, are generally advisable. The rectum should be emptied with a clyster a few hours before the patient is cut, as its distension would expose it to injury.

Many surgeons deem it advantageous to let the bladder be somewhat distended with urine when the patient is cut; and hence, he is usually directed to avoid making water for an hour or two before the operation. This advice I consider well founded, particularly when a gorget is to be thrust into the bladder, which, in an empty state, must be more liable to be wounded at its posterior part; but, in operating with a knife, whether this organ contain urine or not, cannot be a matter of importance, unless the escape of the urine, when the instrument enters the bladder, is to be considered as useful information. Klein, who is in the habit of using a common scalpel, never gives himself any concern about the bladder being empty or not.*

The patient should be placed upon nearly a flat surface, where it is much easier to introduce an instrument in the direction of the axis of the pelvis, than when the table slopes considerably, which would also oblige the operator to kneel down to gain the advantages which he fully has sitting down at his ease, before a table that has nearly a straight horizontal surface.† The table should be high enough to bring the perineum on a level with the surgeon's breast. The buttocks should be somewhat more raised than the abdomen; the patient lie upon pillows conveniently placed; and the nates project rather beyond the edge of the table.‡

In arranging the posture of the patient, the chief objects to be attended

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* Chirurgische Bemerkungen, p. 26.

† Ibid. p. 23.

‡ C. J. M. Langenbeck über eine einfache und sichere Methode des Steinschnittes mit einer Vorrede von Dr. J. B. Siebold, p. 44. Wurzburg, 1802.

to are, first, to let the buttocks be exactly even ; to take care that neither of the assistants draws the thigh too much towards his own side ; and that the parts, situated between the raphe of the perineum and the ascending ramus of the ischium, be stretched, in which condition the requisite incisions can be performed with more facility.*

A staff is then to be introduced into the bladder. Two strong garters or ligatures, each about two yards long, are then to be doubled, and placed by means of a noose round the patient's wrists, who is next to take hold of the outside of his feet with his hands, the fingers being applied to the soles. The two ends of the ligature are then to be carried in opposite directions round the ankle, over the back of the hand, and under the foot, where they may be tied in a bow. The hands and feet being thus securely connected together, the knees and feet are to be supported, kept steady, and held apart by the assistants.

The staff should be introduced before the patient's hands and feet are bound together; first, because, if the calculus cannot he felt with this instrument (which being now used for the sound, saves the patient the pain of a double introduction through the urethra), it will not be necessary to tie up the patient at all, as the operation must not be attempted; secondly, because, while the patient is unbound, the instrument is more easy of introduction, and in searching for the stone, a change of posture is often necessary.

A curved director, the groove of which serves to guide a cutting instrument into the bladder, is an exact definition of a staff. It is shaped like a sound, or catheter, so that it may pass through the whole of the urethra. Its handle, instead of being smooth, like that of a sound, should be rough, in order that it may be held with greater steadiness. The groove, which is to be deep and wide, should terminate in a short conical beak. The diameter of the staff should be as great, as can easily be passed into the urethra; for, the larger the size of the staff, the more easily can it be felt in the perineum, the more distended the membranous part of the urethra becomes, and the more regular the incision in it is likely to be made. That the instrument is fairly in the bladder, may be known by its handle sinking towards the ground, without the least impediment.

In the first stage of the operation, the staff is to be held by an assistant, who also raises the scrotum with his left hand, and gives the surgeon a complete view of the perineum. Some operators are anxious, that the convexity of the instrument should project distinctly in the perineum, for which purpose, the assistant is desired to hold the handle perpendicularly to the patient's trunk, and to propel the whole staff gently towards the part, where the first incision is to be made into it. The manner of holding the staff, in the first stage of the operation, differs, however, with different operators. Sir Benjamin Brodie and many other surgeons prefer that position of it, in which it is nearly perpendicular, with the handle a little inclined towards the patient's right groin, so as to cause the convexity of the instrument to project slightly on the left side of the perineum.† Scarpa, Dupuytren, Liston‡, Syme§, and others, deem it better to raise the concavity of the staff towards the arch of the pubes, and to hold it

* Langenbeck, op. cit.

† On Diseases of the Urinary Organs, p. 271. ed. 2. Sur une Manière Nouvelle de pratiquer l'Opération de la Pierre. fol. Paris, 1836.

‡ Liston's Elements, part iii. p. 197. § Syme's Principles, p. 511.

firmly there, the handle being exactly perpendicular, without any inclination of it to the right or left, or any projection of the instrument in the perineum. After the presence and probable size of the stone had been ascertained with the staff, Dupuytren gave to the latter a vertical direction, so that the straight part of the instrument formed a right angle with the axis of the body, while the curve was kept somewhat elevated towards the symphysis pubis, rather than pressed downwards and backwards upon the rectum. A steady assistant retained it precisely in this position. "Its curved part is drawn up closely under the arch of the pubes in order to prevent its pressing too much downwards upon the rectum." However, some of the advocates for the latter plan make use of a staff, the groove of which, as it passes towards the bladder, runs in the interval between the convexity, and right side of the instrument. "The groove being placed upon the side of the staff enables the surgeon to cut into it more easily, and also to give that direction to his knife, by which he divides the neck of the bladder and the prostate on the left side." *

The patient having been secured in the proper position, and the staff held perpendicularly, with the groove directed a little towards the left side of the perineum, the surgeon traces with his left forefinger the descending ramus of the pubes, and the ascending ramus and the tuberosity of the ischium, and then makes his first incision through the integuments and superficial fascia, beginning it in an adult an inch and a quarter above the anus, close to the left side of the raphe, and carrying it obliquely downwards and outwards, about three inches, to a point, situated one third from the inner side of the tuberosity of the ischium, and two thirds from the anus. † The knife should be pushed in fully one inch deep; and, as it is carried downwards to the termination of the incision, it is to be gradually withdrawn from its deep position, in order to avoid the rectum. ‡ By extending the cut in this manner to a point nearer the ischium than the anus, the edge of the knife, in the future steps of the operation, can be more conveniently and surely directed away from the rectum. In a full-grown person, the beginning of the first incision should never be more than about an inch and a quarter above the anus, because laying open a greater extent of the urethra, towards the bulb, will have no more effect in facilitating the extraction of the stone from the bladder, than if the whole of the urethra were divided. Besides, when the external incision is made too high up, and the internal completed, the former is likely to be placed too high in relation to the opening in the bladder. The consequences are, that the same impediment to the extraction of the calculus is experienced, as if the wound were too small; and the urine, not finding so ready an outlet from the bladder after the operation, is more likely to become effused.

The first incision is made through the integuments, fat, and superficial fascia. The second divides the lower fibres of the accelerator urinæ, the transverse muscle and artery of the perineum, and a part of the levator ani and deep perineal fascia. Then, the surgeon feels for the staff in the upper part of the wound with his left forefinger, and, cutting into its

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* See Morton on the Surgical Anatomy of the Perinæum, p. 72.

† See a paper on Lithotomy, in Med. Chir. Trans. vol. viii.; and E. Stanley, on the Lateral Operation, p. 5. 4to. Lond. 1829.

‡ Sir Charles Bell's Great Operations of Surgery, p. 117. Th. Morton, op. cit. p. 73.

groove, opens the membranous part of the urethra. In accomplishing these objects, the principal things for avoidance are cutting the bulb of the urethra, endangering the great pudic artery, wounding the rectum, and opening the urethra too high up. Next, supposing the operation to be finished with a scalpel that has no beak, the point of it is to be raised, the handle depressed, and its edge directed downwards and outwards towards the lower angle of the wound. The point having now been securely placed in the groove of the staff, with the back of the blade turned upwards and inwards, the rest of the membranous portion of the urethra, and the left side of the prostate gland, are to be cut through by pushing the knife inwards, along the groove of the staff, guided, as it were, and followed by the left forefinger into the bladder.

In dissecting down to the membranous part of the urethra, and in laying it open, as well as in cutting deeply towards the prostate gland, the surgeon should never direct the edge of the knife straight downwards, because he would thus cut the lower part of the rectum; neither should he cut horizontally, for the great pudic artery would be endangered. While the surgeon is completing the deeper incisions, he should endeavour to depress the rectum towards the right side with his left forefinger.*

If a beaked knife, or a gorget, is to be employed for the division of the prostate gland, the operator, as soon as the membranous part of the urethra has been laid open, is to place the beak of the knife or gorget in the groove of the staff, and, being sure that this is effected, he is to take hold of the handle of the staff himself; bring it forwards, so as to elevate the further portion of its groove away from the rectum; and then push the beak of the knife or gorget along the groove into the bladder. The gorget divides the prostate gland as it enters, and so will a knife of broad construction; but when a narrow beaked scalpel is used, the division is made as the instrument is withdrawn. Whatever instrument is employed, its edge is to be directed downwards and outwards.

When lithotomy is performed with a knife, it seems to me, that there is great advantange in letting an assistant hold the staff throughout the operation, because the operator's left forefinger is then of considerable use to him as he is making the requisite incisions. As a staff nearly straight, like that of Mr. Aston Key, will admit of being readily introduced through the whole of the urethra, and it is much easier to pass a gorget, or knife, along a straight groove than a convex one, it may be asked, why such a staff is not generally preferred? One objection made to it is, that it occupies the surgeon's left hand, while the section is made, instead of leaving it at liberty to press aside the rectum, and ascertain when the incision has been carried far enough. "In children," says Mr. Syme, "where the prostate is easily divided, and where, from the necessarily small size of the instrument that is introduced, the difficulty attending a curved direction of the groove is greatest, the straight staff may be preferable." †

When a knife is used in an adult subject, it should be, with the handle, about seven inches long; for the distance of the bladder from the surface of the perineum is sometimes such, that a shorter instrument would be disadvantageous. When the prostate gland is enlarged, the neck of the bladder is occasionally found to be elevated considerably away from the perineum, as is well shown in one of the plates of Mr. Stanley's Treatise

* See Morton's Surgical Anatomy of the Perinæum, p. 73.
† Syme's Principles, p. 511.

on the Lateral Operation. "In subjects of an advanced age," he remarks, "a deep perineum, as it is termed, is frequently met with. This may be occasioned either by an unusual quantity of fat in the perineum, or by an enlarged prostate, or by the dilatation of that part of the rectum which is contiguous to the prostate and bladder. Under either of these circumstances, the prostate and bladder become situated higher in the pelvis than naturally, and consequently, at a greater distance from the perineum." In such cases, Mr. Stanley prefers the gorget; while, for a young subject, a thin adult, or a case where the bladder is closely contracted on the stone, he expresses a preference to the knife.

When the knife or gorget has entered the bladder, — a circumstance, indicated by the discharge of urine from the wound, — and the requisite section of the left lobe of the prostate has been made, and the knife or gorget has been withdrawn, the surgeon is to pass his left forefinger into the bladder, along the staff, which is then to be removed. With this finger, the position of the stone is ascertained, and the forceps directed accordingly. The finger should bear against the posterior wall of the incision, in order to prevent the possibility of the forceps being passed between the bladder and rectum, which accident has been known to occur.* If the surgeon cannot immediately feel the stone with his finger, he should then introduce the forceps, and use this instrument as a probe for detecting the exact place of the calculus.

Some years ago, the forceps used to be made too thick and clumsy, the inside of the blades being frequently furnished with teeth, intended to keep the stone from slipping. These were exceedingly objectionable; first, because they often broke the calculus before it was out of the bladder; and, secondly, because those situated towards the back part of the blades, when the stone happened to be grasped there, had the effect of increasing the expansion of the instrument so considerably, that it could not be drawn out.† The teeth have also a bad effect in preventing the stone, when it is grasped with its long axis across to the wound, from turning, as the forceps are drawn out, into a better position. However, though teeth are not to be commended, the inside of the blades ought to be somewhat rough.

The surgeon should always be provided with several pairs of forceps, of different sizes. The handles should be two thirds of their length, and the blades one third. The blades of some ought to be flat, for the extraction of small calculi, or fragments; while the blades of others should be curved, to reach calculi behind the pubes, or prostate gland.‡

In attempting to get hold of the stone with the forceps, the operator should not expand the instrument as soon as it has arrived in the bladder, without knowing where to direct it; but he should first make use of it as a kind of probe for ascertaining the precise situation of the stone. If this be lodged at the lower part of the bladder, just behind its neck, and be distinctly felt below the blades of the forceps, the forceps may be opened immediately over the stone, and, after the blades have been depressed a little, they are to be shut. Certainly, it is much more scientific to imitate Cheselden, and use the forceps, at first, merely to ascertain the position of the stone; for, when this is known, the operator is far

* Dupuytren, Mém. sur l'Opération de la Pierre; publ. par. L. J. Sanson. Fol. Paris, 1836.

† Langenbeck über eine einfache und sichere Methode des Steinschnittes, p. 43.

‡ Sir A. Cooper's Lectures, vol. ii. p. 253.

more able to grasp the extraneous body, in a skilful manner, than if he were to open the blades of the instrument immediately, without knowing where they ought next to be placed, or when shut. No man can doubt, that the injury which the bladder frequently suffers from reiterated and awkward movements of the forceps, is not an uncommon cause of a fatal inflammation of it and the peritoneum.

If the calculus cannot readily be felt, the forceps should not be roughly moved about, so as to bruise the bladder, and put the patient to insufferable agony: on the contrary, they should be taken out, and the forefinger gently introduced, with which the situation of the calculus may generally be felt. If the stone cannot be felt with the finger, on account of the great depth of the perineum, nor laid hold of with the forceps, on account of its lying deeply behind the prostate gland, in the bas-fond of the bladder *, the stone should be raised up, and brought within the grasp of the forceps by means of the left forefinger passed into the rectum. When the place of the calculus has been ascertained, the blades of the forceps are to be separated, and the stone received between them: this must be done with great gentleness. If the extraction be violently resisted, the stone should be quitted, the forceps withdrawn, the position of the stone examined with the finger, and, if necessary, its long axis made to correspond to that of the bladder. Stones are often broken, which might be removed whole, if the surgeon were less violent, and more cautious. The mode of preventing a calculus from being broken is, after it has been taken hold of, to put the thumb, or finger, between the handles, so as to hinder them from being forcibly closed.† The forceps should always be withdrawn from the bladder in the direction of the external wound, with a wriggling motion, and towards the lower angle of the incision, because here the space between the ossa ischii is greatest.

When the stone is so large, that, turned in any position, it cannot be extracted from the wound without violence and laceration, the surgeon must either break it with a strong pair of screw forceps, or enlarge the wound with a probe-pointed curved bistoury, introduced under the guidance of the left forefinger. To the employment of the knife in this circumstance, I must express my decided preference; because breaking the stone creates a risk of fragments being left behind, and, consequently, of a return of the disorder. Some operators, instead of enlarging the wound, so as to divide the bladder, prefer making a cut through the opposite side of the prostate gland.

If the stone is broken, as many of the fragments are to be taken out with forceps as can be readily removed, and the surgeon is then to feel with his finger, whether any others still remain. If they do so, gentle attempts must be made to extract them with the scoop. Lukewarm water is also sometimes injected, with the view of washing them out.

Directly the calculus has been extracted, it should be examined; if it be rough, it is a presumptive sign that it is the only one; if smooth on one side, and rough on the other, or excavated at any surface, there may be other stones. But, in every instance, the forefinger should be introduced, to obtain decisive information on this point; for it would be unpardonable to put the patient to bed while another calculus remains.

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* See Morton, Op. cit. p. 74.

† Sir Astley Cooper's Lectures, vol. ii. pp. 254—262.

### DANGERS OF GORGETS.

The disastrous accidents, which occasionally result from the employment of gorgets, have induced many judicious surgeons to prefer finishing the operation with a knife, or, at all events, some kind of cutting instrument, not suddenly thrust into the bladder, like a common gorget, with a risk of slipping away from the staff, and doing the most fatal mischief. From mistakes and unskilfulness in this part of the operation, I have known of two cases, in which the urethra was entirely severed from the bladder, and the patients, after suffering excruciating torture upon the operating table, died from the injury done, with the stone unextracted, the bladder not having even been opened. I have known the gorget slip between the bladder and rectum, and patients lose their lives with the stone unremoved. I have seen patients opened after this operation, in whom the gorget had injured the opposite side of the bladder. I recollect other cases, in which the gorget slipped between the bladder and pubes, and, of course, the calculus never had an opening made for its extraction. In one or two cases, I have known the rectum to be cut more than the bladder itself. Now, when it is further considered, that besides such mischief, arising from the slipping or unskilful use of a well-made gorget, a broad, badly constructed, or an ill-directed one, may cut the pudic artery *, it must be confessed, that there is great cause for wishing that lithotomy could always be performed with an instrument attended with fewer dangers.

According to Klein, than whom few have written more sensibly on lithotomy, that method of operating must be accounted the most advantageous, in which the surgeon is best enabled to make with certainty the right kind of incision; that is to say, in which the opening in the bladder may be made larger, or smaller, as may be judged requisite; in which also the fewest instruments are needed; the least irritation produced; the operation most expeditiously finished; and in which the instruments will serve for every age and sex, and for all cases, whether the stone be large or small. A scalpel of proper size is the only instrument possessing such recommendations, and with it the operation can be perfectly executed.

*Question, — Whether the opening should always be made large enough to let the stone pass out, without contusion and laceration of the prostate gland and adjoining part of the bladder.*

Le Cat and Scarpa † are in favour of a very limited incision, and they insist on the danger of carrying it at all beyond the base of the prostate gland; which method, they conceive, would expose the patient to the perils of an effusion of urine in consequence of the vesical reflexion of the deep perineal fascia over the prostate gland being divided. This doctrine influences the practice of many distinguished modern operators, amongst whom may be enumerated Dupuytren, Sir Benjamin Brodie, Mr. Anthony White, Mr. Liston, and Mr. Syme. After having partly divided the prostate gland, Sir Benjamin Brodie introduces a blunt gorget to dilate the wound, and split the undivided portion of the prostate.‡ His observations convince him, that an incision of the prostate, extending into

* In using Cline's gorget, Klein cut the pudic artery. See Chir. Bemerkungen, p. 15.

† Memoir on Hawkins's Cutting Gorget.

‡ On Diseases of the Urinary Organs, p. 278.

the loose cellular texture surrounding the neck of the bladder, is replete with danger. Such a division of parts he thinks never necessary where the calculus is of moderate dimensions, but cannot be avoided where it is of large size; and hence, the vast increase of danger in the latter examples.

On the other hand, Klein, one of the most successful lithotomists in Germany, lays down, as the basis of his method, the necessity of always dividing, not only the prostate gland carefully through, but also a portion of the bladder itself. "Upon this basis," says he, "rests the success of my operations; and hence I invariably make it a rule to let the incision be rather too large than too small, and never to dilate it with any blunt instrument, when it happens to be too diminutive, but to enlarge it with a knife, introduced, if necessary, several times."* My own observations lead me to believe, that though patients sometimes die of effusion of urine in the cellular tissue of the pelvis, such effusion only happens where the wound is not direct and free, the outer part of it being too high up in relation to the cut in the prostate gland. The inference, drawn by me from the many *post mortem* examinations which I have attended, is, that effusion of urine in the cellular tissue of the pelvis is not the usual cause of the fatal inflammation which ensues in the pelvis and abdomen, but the injuries of the bladder — sometimes a diseased one — from the protracted and rough manœuvres frequently exercised to get a calculus out of an opening of very insufficient size. The more easily the stone has passed out, the greater has appeared to me to be the success of the operation. I am therefore an advocate for letting the incision be proportioned to the size of the stone, and avoiding all laceration and contusion of the parts. The wound, of whatever size, should always be direct: this will materially obviate the risk of effusion of urine, and all occasion for the use of a tube to conduct the urine from the bladder through the wound, — a practice now and then adopted, and, I believe, chiefly recommended, in the Edinburgh schools.

As the questions, Whether a free incision through the prostate gland should be made? or, Whether this should be avoided as dangerous, and dilatation and even laceration be preferred as safer? are of the highest practical importance, and by no means definitively settled, each view of the matter being supported by good authorities, the present state of surgery appears to demand, that very correct information should be collected on these contested points. In particular, it seems desirable to ascertain more fully, whether, in fatal cases, where a *free* and *direct* incision has been made, a common cause of death be really effusion of urine in the cellular tissue of the pelvis?

No dressings are necessary directly after the operation; but a folded napkin, or sheet, is to be placed under the nates, and changed whenever it becomes wet.† Sir Astley Cooper does not consider it necessary to keep the patient always on his back; but says, the patient will derive great relief from lying sometimes on his side. The scrotum, he observes, should always be supported with a bandage, so as hinder it from being irritated by the urine.‡ The patient may drink freely of barley-water, and afterwards of lemonade. Sir Astley Cooper gives his patients at first large quantities of linseed tea, or barley-water with gum acacia in

* Practische Ansichten der Bedeutendsten Chirurgische Operationen, p. 27. Cheselden and Martineau, who had greater success, perhaps, than any other surgeons, also made a free opening.

† Sir A. Cooper's Lectures, vol. ii. p. 269. ‡ Vol. cit. p. 268—270.

it; and when the danger of inflammation is over, beef-tea, broth, or gruel. Klein gives an opiate, as soon as the patient is put to bed; and on the second day, the bowels are opened with a clyster, or gentle purgative. Sir Astley Cooper sanctions the exhibition of opium, if the patient be very irritable; but, unless absolutely necessary, dispenses with it, as it checks the action of the bowels. When the wound suppurates, Klein dresses it with dry lint, and never finds any other application requisite, except sometimes a little caustic towards the end of the case.* In proof of the success of his method, he tells us, that in 1816 he had cut into the bladder seventy-nine times, and not one patient had died, unless where the prostate gland, bladder, kidneys, or ureters, were diseased. Notwithstanding the free division of the bladder, most of the patients got well in from eight to fourteen days; a few in a month; and one alone was three months in recovering. Though the sphincter of the bladder was divided, no paralysis of it was the result. Except when the calculi were large, or something unusual happened, the operation was completed in thirty seconds, or a minute.† When the wound begins to granulate, Sir Astley Cooper ties the legs together: if this be done too soon after the operation, he says, it hinders the free escape of blood and urine from the wound.‡

### OF WOUNDS OF THE RECTUM.

Unless the operator cut very carelessly, and turn the edge of the knife directly downwards, instead of obliquely sideways, the rectum cannot be injured. With a gorget, however, there is really more danger of such an accident, when the instrument slips out of the groove of the staff. Also, when the rectum is distended with feces, it is more exposed to injury; but, why should the surgeon ever operate, without having previously emptied that intestine? I once saw a case, in which the rectum was wounded with a lithotomy knife; but the cut in the bowel healed, and never gave any trouble.

### OF WOUNDS OF THE PUDIC ARTERY.

No doubt, some of the profuse bleedings, which have taken place in lithotomy, have not proceeded from the pudic artery itself, but either from the artery of the bulb, when the incision was made too high up, or, in other cases, from the trunk of the perineal artery. I am surprised, however, that M. Roux§ should assert, that, in directing the incision too far laterally, there is no risk at all of wounding the pudic artery. This is an observation which is entirely erroneous, and might encourage the admirers of broad, long-edged gorgets to persevere with their instruments, until they had learned from experience, that lithotomy can never be done with safety, unless the incision be made, not only of sufficient size, but in a proper direction. Klein twice had the ill luck to wound the trunk of the pudic artery; the first instance was in a child four years of age; the hemorrhage was suppressed by introducing into the wound a piece of sponge, which was removed on the fifth day; the part was healed in a fortnight, but, for nine weeks, an incontinence of urine continued, which

* Chirurgische Bemerkungen, pp. 37—48.
† Practische Ansichten der Bedeutendsten Operationen, pp. 28, 29.
‡ Lectures, vol. ii. p. 269.
§ Rélation d'un Voyage fait à Londres en 1814; ou Parallèle de la Chirurgie Angloise avec la Chirurgie Françoise, p. 322. 8vo. Lond. 1815.

was ascribed to the pressure of the sponge.* The second case happened in a patient, twenty-six years of age, from cutting too much sideways with Cline's gorget. After the extraction of the calculus, the wound was distended with a linen tent and a piece of sponge; and the patient kept quiet on the operating-table twenty-four hours, during all which time the assistants relieved each other alternately in making pressure on the wound. The patient lost four pounds of blood in the operation; his pulse was exceedingly feeble, and rapid; his countenance cadaverously pale; and his strength so much reduced, that the greatest fears were entertained for his life.

When the trunk of the pudic artery is wounded, the calculus should be taken out, and the wound distended with sponge.† If it were practicable to tie this artery, it would not be advisable, previously to the extraction of the stone, the passage of which outwards would inevitably force the ligature off the vessel.‡ In one case, operated upon by Sir Everard Home, Sir Benjamin Brodie passed a ligature round the pudic artery with a small, flexible, silver needle. The patient was a very thin subject.§ Pressure on the artery, where it crosses over the spine of the ischium, was found useful in stopping an alarming hemorrhage from a phagedenic ulcer of the penis, in a case under Mr. Travers ‖: the same plan might also be worth trying for the stoppage of the bleeding after lithotomy.

### OF INFLAMMATION WITHIN THE ABDOMEN AFTER THE OPERATION.

The majority of patients, free from visceral disease previously to the operation, who die in consequence of lithotomy, perish of peritoneal inflammation. Hence, on the occurrence of any tenderness, pain, and tension over the abdomen, with great restlessness, thirst, heat of the skin, and a small quick pulse, copious venesection should be put in practice. At the same time, twenty or thirty leeches should be applied to the hypogastric region. Much benefit will also be derived from the warm bath, fomentations, blisters, the exhibition of oleum ricini, and emollient clysters.

I have seen several old subjects die of the irritation of a diseased, thickened state of the bladder, continuing after the stone had been extracted. They had not the acute symptoms, the inflammatory fever, the general tenderness and tension of the abdomen, as in peritonitis; but they referred their uneasiness to the lower part of the pelvis; and, instead of dying in the course of two or three days, as those usually do who perish of peritoneal inflammation, they, for the most part, lingered for two or three weeks. In such cases, opiate clysters, and blistering the hypogastric region, are proper.

In some instances, collections of matter form in the vicinity of the neck of the bladder. Gangrene of the scrotum from the violence used in the extraction of the stone, and an extravasation of urine in the cellular tissue, are most likely to be avoided by making a direct opening into the

* Chirurgische Bemerkungen, p. 11.

† A cannula should be passed through the sponge, for the easy evacuation of the urine. See C. J. M. Langenbeck über eine einefache und sichere Methode des Steinschnittes, p. 58. 4to. Würzburg, 1802.

‡ Klein, Op. cit. pp. 12—21.

§ Sir B. Brodie on Diseases of the Urinary Organs, p. 299. ed. 2.

‖ See Harrison's Surgical Anatomy of the Arteries, vol. ii. p. 101., and Morton's Surgical Anatomy of the Perinæum, p. 52.

bladder, and not beginning the incision too high up towards the scrotum. With the same view, many operators avoid carrying the incision in the prostate gland beyond its base.

## AMPUTATION.

Amputation of limbs is performed either in the continuity of them, or in one of the articulations; each of which modes, however, cannot always be practised indifferently — the choice depending upon the situation, extent, and nature of the disease, or injury, for which the removal of the part becomes indispensable. In all amputations at joints, it is the general practice to make a flap of flesh for covering the end of the bone; but when the operation is performed at another part of the limb, it is frequently at the option of the surgeon, whether the method adopted be *amputation with one or sometimes two flaps*, or *amputation by a circular, or an oval, incision*. In this metropolis, the circular incision is more common than flap-amputation, which, however, has now many advocates, because, it is more quickly performed, and consequently less painful, than the circular incision; the parts are cut smoothly, and left in a state favourable to union; and a better covering is afforded to the bones, than can be obtained from any modification of the other operation.*

That it is the quickest method of amputation, and that it forms an excellent covering for the ends of the bones, I believe is generally admitted; but some of the most experienced surgeons in London, amongst whom is Sir Astley Cooper, are of opinion, that a stump after a flap amputation is generally followed by more copious suppuration, and less frequently unites by adhesion, than another formed by the circular incision. This is a point of importance, open to the observation of the profession at large, who have now abundant opportunities of coming to a sound decision. It seems to me, that the quickness and facility of flap amputation, the certainty with which the soft parts are smoothly cut, and the greater frequency with which the protrusion of the end of the bone is avoided, are its principal advantages. In particular cases, it is decidedly the only method applicable to circumstances; in others, the surgeon may make his choice.

Before proceeding to the description of the methods of taking off limbs, let me just remind the reader of one of the best fundamental rules for our guidance in the performance of amputation: "as little of the flesh should be cut away as possible; but the more bone is removed, the better."†

### CIRCULAR AMPUTATION OF THE THIGH.

The thigh should be amputated as low as the disease will allow. The patient is to be placed on a firm table, with his back properly supported by pillows, and assistants, who are also to hold his hands, and keep him from moving too much during the operation. The ankle of the sound limb is to be fastened, by means of a garter or handkerchief, to the nearest leg of the table.

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* See Syme's Principles, p. 198.

† "On doit couper des chairs le moins qu'il est possible, et des os, le plus qu'on peut." J. L. Petit, Traité des Maladies Chirurgicales, tom. iii. p. 150.

### TOURNIQUET.

If this instrument be used, its pad should be placed exactly over the femoral artery in as high a situation as can conveniently be done. When the thigh is to be amputated far up, a tourniquet is inconvenient, and, in this case, an assistant is to compress the femoral artery, as it passes over the os pubis, with his fingers or thumb, or any commodious instrument, having a round blunt end, adapted for making direct pressure on the vessel, without injuring the integuments.

In amputation, the greater number of surgeons in this metropolis still employ the tourniquet; but others prefer compression of the artery by a trusty assistant, when such is at hand. In University College Hospital, I have never seen the tourniquet employed in amputations. If the patient, however, were exceedingly reduced, I believe, that the tourniquet ought to be employed. Putting out of present consideration the assistant's liability to fail in regularly commanding the flow of blood through the artery, on account of the violent struggling of the patient, we are to remember that, besides this vessel, there are others concerned in supplying the thigh with blood, which are branches of the internal iliac, and come out of the openings of the pelvis; as, for instance, the arteria obturatoria, the glutea, and the ischiadica. Hence, pressure upon the femoral artery, below Poupart's ligament, can never stop the bleeding, but incompletely. My colleague, Mr. Liston, objects to the use of a tourniquet, because compression on all the circumference of a limb causes venous congestion in the whole of the member below such compression, and a rapid oozing from the veins on the face of the stump. "I would rather trust (says he) to no very efficient assistant, than put on a tourniquet." I fully coincide with him on one point, which is, that when a tourniquet is used, it should not be put on, till the moment when the surgeon is ready to begin the incisions.*

### FIRST INCISION.

The operator is to stand on the right side of the patient, whether the right or left limb is to be removed. By this means, he acquires the advantage of always having his left hand next the wound, so as to be of very essential assistance. This advantage more than counterbalances the inconvenience of having the right limb in the way of the operator, when the left thigh is to be amputated.

An assistant, firmly grasping the thigh with both hands, is to draw the skin and muscles upwards, while the surgeon makes a circular incision, as quickly as possible, through the integuments down to the muscles. When the integuments are sound in the place of the incision and above it, their retraction by the assistant before they are cut through, and a very slight division of the bands of cellular substance with the edge of the amputating knife towards the point, will generally preserve a sufficient quantity of skin for covering, in conjunction with the muscles cut in a mode about to be described, the extremity of the bone; and the painful method of dissecting up the skin from the fascia, and turning it back, previously to dividing the muscles, may be considered useless and improper in all amputations of the thigh, where the skin retains its natural moveableness and elasticity.

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* See Elements of Surgery, Part iii: pp. 361, 362.

It appears to Mr. Guthrie, that, in primary amputations, or those done at an early period after the receipt of a gunshot injury, while the part of the limb, where the incisions are to be made, is in the natural state, and the skin loose and moveable, "it will be sufficient to touch the thread of membrane, or fascia adhering below, with the point of the same (the amputating) knife, to give ample covering for an excellent stump, without putting the patient to the torture of having his skin pinched and dissected back, for the space of a couple of inches, for four or five minutes." At the same time, he particularly insists on the utility of dividing the fascia and integuments together, by which means, the latter can be retracted much further than would otherwise happen.

In operations, however, performed from the third to the twelfth day after the receipt of the wound, and near the injured parts, Mr. Guthrie admits of the propriety of dissecting the integuments a little way up from the fascia, as in these cases the retraction, effected by the assistant, and the natural elasticity of the skin, will not avail in saving enough of it to cover the surface of the stump well; yet even here he rightly disapproves of turning back the separated integuments, as is often done, like the top of a glove.

"In secondary amputations," says he, "with the exception of those, in which the operation is required in parts actually unsound, the integuments may be sufficiently retracted, without any formal dissection of them from the subjacent fascia." *

I have said, that the surgeon is to begin the operation by making an incision through the skin all round the limb. The generality of surgeons, rightly considering this as one of the most painful parts of the operation, do it with as much quickness as possible, and therefore carry the knife all round the member with one sweep, the hand, which holds the knife, being carried round under the limb until the edge can be placed perpendicularly on the skin covering the extensor muscles. Excepting the appearance of greater skill, and a little greater quickness, however, the foregoing mode of dividing the skin all round the limb with one stroke of the knife, has no particular advantage over the method of completing the cut with two sweeps of the knife.

### OF DIVIDING THE MUSCLES.

The ancient surgeons used to cut directly down to the bone at once, and the frequent consequence was a conical or sugar-loaf stump, extremely unfit for bearing any degree of pressure, and, therefore, kept healed with difficulty. The end of the bone, in fact, often protruded beyond the soft parts. At length, however, the improvement was made of cutting the integuments through first, and then the muscles: a method, well known amongst surgeons by the name of the *double incision.*

But, although the double incision enabled the surgeon to save skin, and saw the bone higher up, a conical stump, and projection of the bone, sometimes followed. The great innovations, which ultimately proved nearly effectual in the prevention of such tedious miserable cases, were, besides the saving of skin, the oblique division of the muscles, suggested by Alanson; the cutting of the loose muscles first, and the fixed ones afterwards, proposed by Louis; and the immediate closure of the wound,

* G. J. Guthrie on Gunshot Wounds of the Extremities, requiring the different Operations of Amputation, with their after Treatment, &c. pp. 84, 85. 8vo. Lond. 1815.

after the bleeding had been stopped, the great utility of which was first brought to light in the early trials of what are called flap-amputations.

M. Louis, for whose memory every admirer of surgical science ought to entertain sincere respect, first discerned the principal cause of the projection of the bone. He observed, that the muscles of the thigh became retracted in an unequal manner when divided; those which are superficial, and extend along the limb more or less obliquely, without being attached to the bone, becoming retracted with greater force than others which are deep, and, in some measure, parallel to the axis of the femur, and fixed to this bone throughout their whole length. Their retraction begins at the moment of the operation, and, for some time afterwards, continues unfinished. Hence, the effect should be promoted, and be as complete as possible, before the bone is sawn. With this view, M. Louis practised another kind of double incision: by the first, he cut, at the same time, both the integuments, and the loose superficial muscles; by the second, he divided those muscles, which are deep, and closely connected with the femur. On the first deep, circular cut being completed, M. Louis used to remove the band encircling the limb above the track of the knife, in order to allow the divided muscles to become retracted without any impediment, and he then cut the deep muscles, on a level with the surface of those which had been first divided, and which were now in a retracted state. In this way, he could evidently saw the bone very high up, and the painful dissection of the skin from the muscles was avoided.*

Alanson's mode of amputating was as follows: — The integuments having been divided by a circular wound, the knife was applied close to the margin of the retracted skin, upon the inner edge of the vastus internus, and, at one stroke, an incision was made obliquely through the muscles, upward in respect to the limb, and down to the bone: in other words, the cut was made in a direction which laid the bone bare, about two or three fingers' breadths higher than a perpendicular incision would have done. The operator now drew the knife towards himself, so that its point rested upon the bone, still observing to keep the instrument in the same oblique position, in order that the muscles might be divided all round the limb in that direction, by a proper turn of the knife. During the performance of this movement, the point of the knife was kept in contact with the bone round which it revolved.†

Many writers have objected to the difficulty of making the oblique

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* See Mémoire sur la Saillie de l'Os après l'Amputation des Membres; ou l'on examine les causes de cet inconvénient, les moyens d'y rémédier, et ceux de la prévenir. Also, Second Mémoire sur l'Amputation des Membres, *Mém. de l'Acad. de Chirurgie*, tom. v. p. 244. and 401. edit. in 12mo. And Nouvelles Observations sur la Rétraction des Muscles après l'Amputation de la Cuisse, et sur les Moyens de la prévenir. Op. cit. tom. xi. p. 63. edit. in 12mo. Baron Dupuytren's mode of amputating was as follows: — With one sweep of the knife he divided the integuments and muscles down to the bone, most frequently perpendicularly, but sometimes obliquely. The retraction of the soft parts by the assistant who grasped the limb, and the contraction of the muscles, instantly gave to the wound the shape of a cone. At the base of this cone, and on a level with the retracted skin and muscles, he applied the knife again, and cut through whatever soft parts presented themselves there. Thus he was enabled to saw the bone more than six inches above the first incision, and to complete the operation with surprising quickness. (See Leçons Orales de Clinique Chir. t. 4. p. 298.) By this method, the patient is saved from all the pain of dissecting the skin from the fascia, or the fascia from the muscles. It is as quick as a flap-amputation.

† See Alanson's Practical Obs. on Amputation, 2d ed.

incision exactly as Alanson has directed, and Mr. Hey even questions the possibility of the practice, without a different result from what was intended. It is evident (says Mr. Hey) that a conical incision through the muscles of the thigh cannot be made with a continued stroke, in the usual mode of amputating. For, supposing the edge of the knife to have once penetrated obliquely through the muscles, so as to be an inch higher, when arrived at the bone, than when it penetrated the surface; if the incision be continued with a flowing stroke, the knife must then cut the surface of the undivided muscles an inch higher than at the commencement of the incision.* How far it is actually practicable to keep the point of the knife in contact with an exact circle on the bone, during the oblique passage of the instrument all round the member, it is not for me to say, because, seeing its difficulty, I have never attempted it; nor can I suppose, that Alanson himself ever really did what he literally recommends. Of one thing also I am sure, that I have seen many surgeons, in their attempt to do this business after Alanson's directions, get so high up as to cut the reflected skin.

The late Mr. Hey is not the only, nor the earliest writer, who has pointed out the inaccuracy of Alanson's directions. Richter has offered several judicious criticisms upon them, which perfectly coincide with Mr. Hey's views. It is remarked, that when the knife, with its edge turned obliquely upwards, has reached the bone, a flap is actually formed on the side where the incision is practised: and the edge of the knife is now three inches higher than the cut in the skin. In this state, the surgeon cannot possibly continue the incision. The only thing which he can now do, is to place the knife on the opposite side of the thigh in the same manner, and make a flap there. The operation, says Richter, is then rather a flap-amputation, not done in the best way, than an operation really practised as Alanson thought possible. By following precisely his instructions, Richter thinks it would be quite impracticable to form a hollow stump, though perhaps it might be done by reiterated oblique strokes of the knife all round the limb. But, he exclaims, what a stump there would then be, and what a method of operating! He comments also on the difficulty of making a knife cut properly by mere pressure, as would be the case, were its point kept unremittingly against the bone, in carrying the incision round the member; on the preferable nature of amputation with a flap to this method, the wound left by which is longer in healing; and on the pain and delay of separating the skin to be saved, — a proceeding altogether unnecessary in amputating with a flap.†

Many excellent surgeons, whom I have seen operate, do not cut at once obliquely down to the bone, after the integuments have been divided and retracted; but so far adopt the principles of M. Louis, as to divide the loose muscles first, and lastly, those which are intimately attached to the bone, taking care, with a scalpel, to cut completely through the deep muscular attachments, about an inch higher up, than could be executed with the amputating knife itself. This last measure causes very little pain, and has immense effect in averting all possibility of a subsequent protrusion of the bone, or of a bad sugar-loaf stump. Such used to be the practice of Mr. Hey, who calls it the *triple incision*‡: and Mr.

* Hey's Practical Observations in Surgery, p. 529. ed. 2.
† Anfangsgr. der Wundarzn. b. vii. p. 187.
‡ Hey's Practical Observations on Surgery, p. 526. edit. 2.

Guthrie *, in his account of amputation of the thigh, is a decided advocate for a similar mode. In this method, however, the advantage of the oblique incision through the different layers of muscles, was invariably retained. I believe that, in the circular amputation of the thigh, a combination of the principles of Alanson with those of M. Louis, is the best. However, I am obliged to confess, that the attempt to divide the loose muscles first, and then the more fixed ones, is apt to make a hasty surgeon cut the whole, or a great part, of the same muscle through more than once; a fault, which deserves to be reprobated in the strongest terms.

### USE OF THE RETRACTOR.

Having cut completely down to the bone, a piece of linen, somewhat broader than the stump, should be torn at one end, along its middle part, to the extent of about eight or ten inches. This is called a retractor, and is applied by placing the exposed part of the bone in the slit, and drawing the ends of the linen upward on each side of the stump. Thus the retractor will evidently keep every part of the surface of the wound out of the way of the saw. In circular amputations, I have seen the saw do so much mischief, in consequence of neglecting to use the retractor, that when the amputation is performed with a circular incision, my conscience obliges me to censure the employment of the saw without a defence of the soft parts by this simple contrivance. I think no one will say, that the retractor can do harm; and I know, that many who have been with myself eye-witnesses of the mischief, frequently done by the saw in amputations, are deeply impressed with an aversion to the neglect of this bandage. I have often seen the soft parts skilfully divided; and the operators, directly afterwards, lose all the praise, which every one was ready to bestow, by their literally sawing through one half of the ends of the muscles, together with the bone. But, besides defending the surface of the stump from the teeth of the saw, the retractor will undoubtedly enable the operator to saw the bone higher up, than he otherwise could do.†

### OF SCRAPING THE BONE.

Another proceeding, not to be imitated, is the practice of scraping up the periosteum with the knife, as far as the muscles will allow. This is a sentiment, in which I must still continue to join the experienced and judicious Petit, notwithstanding a modern author ‡ has actually devoted a section of his book to the praise of what is here particularly condemned. The chief argument for the practice, urged by Brünninghausen, is, that, by scraping the periosteum upwards from the bone, a portion of the detached membrane will yet remain connected to the muscular fibres, thus pushed back, and afterwards admit of being brought down with them over the sawn bone. As, however, I have seen the bone

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* On Gunshot Wounds of the Extremities, &c. p. 86.

† J. L. Petit earnestly recommeds the employment of a linen retractor; when a surgeon once told him, that he did not use it, because the teeth of the saw were apt to get entangled in it, he answered: "Il est vrai que cela peut arriver lorsqu'on ne sait pas le placer; les meilleures manières d'opérer ont leur inconvénient, si on néglige les circonstances qui les font réussir." Traité des Maladies Chir. t. iii. p. 152. Dupuytren is another distinguished advocate for the use of the retractor. See Leçons Orales, &c., t. 4. p. 299.

‡ H. J. Brünninghausen, Erfahrungen und Bemerkungen über die Amputation, p. 67. Bamberg, 1818.

extensively scraped, without an exfoliation being a regular effect of the method, I do not consider, as Petit did, that a part of the bone must *inevitably* die, after the periosteum is thus freely scraped away; but I look upon the improper and useless separation of this membrane as one of the circumstances, which tend to produce the exfoliations that sometimes happen after amputations. At all events, it is a superfluous measure, as a sharp saw, such as ought to be employed, will never be impeded by so slender a membrane as the periosteum.* All that the operator ought to do is, to take care to cut completely down to the bone, round the whole of its circumference. Thus a circular division of the periosteum will be made, and here the saw should be placed.

### OF THE MANNER OF SAWING THE BONE.

As Petit justly remarks, this part of the operation is by no means easy to a person unaccustomed to handle a saw. The principal difficulty arises from the bone heing sawn up in the air (as it were); at least, the part is in general but very imperfectly fixed by two persons, who, however strong they may be, cannot resist the saw, and hinder the limb from being shaken, whereby the direction of the instrument becomes altered. Besides the two assistants rarely act so well in concert together as always to hold the limb in the same direction, and with an equal degree of strength. It is true, such irregularity is not of much consequence at first, while the bone is not half sawn through: but, as soon as the instrument has cut to this depth, the irregular movements of the assistants, who hold the limb, make the sawn surfaces come nearer together, and the saw is so pinched, or locked betwixt them, that it cannot stir, in one direction or the other.

A skilful surgeon (observes Petit) may obviate the difficulty by supporting the part with his left hand, as Mr. Liston actually prefers, and resisting or yielding at seasonable opportunities to such circumstances as impede the motion of the instrument. But the difficulty may depend upon the saw itself, when its blade is not duly stretched, the teeth not well turned alternately to the right and left, their points not in good order, their edges not sharp enough, or they are not filed obliquely, so that the bone-dust may be readily thrown off to each side. The latter object requires also, that the blade of the saw at the teeth part should be rather thicker than the rest of it, or else the fissure in the bone would be completely filled with the instrument, and the bony particles, not easily escaping, would obstruct the movements of the saw. In order to saw the bone as close to the flesh as possible, Petit says the nail of the index finger is to be placed on the point where the sawing is to begin. Many surgeons, however, find it more convenient to use the nail of the left thumb for this purpose. The flesh being retracted, the saw is now to be applied exactly at the angle formed by the nail and the bone; and the instrument is to be worked very gently, and with scarcely any more pressure than that of its own weight, until a groove is cut, from which it will not start: then the force is to be gradually increased.†

The saw should cut with both edges, whether the instrument be

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* Petit's opinion is thus expressed: "Si par trop d'exactitude, on dépouille trop en avant les os de leur périoste, l'exfoliation, qui devient inévitable dans ce cas, se fait long-temps attendre, et retarde beaucoup la guérison; je préfère donc de scier le périoste, avec les os; j'ai toujours éprouvé que cette méthode étoit moins douloureuse et qu'elle éviait souvent l'exfoliation." Vol. cit. p. 158.

† Petit, Traité des Maladies Chir. t. iii. p. 159, 160.

moved backwards or forwards, by which means, as a modern writer * has remarked, the operation will be expedited, and the splintering of the bone, when it is nearly divided, prevented, inasmuch as the surgeon, when he uses a saw which cuts in both directions, has it in his power to finish the latter part of the division of the bone entirely with backward sweeps of the instrument, which are always the most regular and gentle.

In order to form the groove for the saw, it is best to begin by drawing the instrument across the bone with a backward sweep, the teeth near the handle being first applied to the part close to the operator's left thumb or finger nail, and the whole extent of the edge is then to be steadily and briskly drawn back to the point. The movements of the saw should never be short and rapid, but every stroke of the instrument should at first be long, bold, and regular, without too much pressure. When about two thirds of the bone are cut through, the pressure and force must be lessened, and, towards the end of the business, two or three gentle movements of the saw backward will complete it, without risk of an extensive splintering. In the latter part of the sawing, the assistant who holds the leg, must be careful to avoid depressing the condyles of the femur, as it would inevitably break the bone, previously to its complete division. Indeed, it is difficult to say, whether this mismanagement, or the rough, unskilful mode of using the saw itself, is the most frequent cause of the latter accident. The assistant certainly has rather a delicate task to perform, because if he raises the limb too much, he pinches the saw; if he depresses it, he breaks and splinters the bone.†

If the bone should break, before the sawing is finished, the sharp projecting spiculæ, thus occasioned, must be removed by means of the bone nippers.

### OF STOPPING THE HEMORRHAGE.

After the removal of the limb, the femoral artery is to be taken hold of with a pair of forceps, and tied, without including the accompanying branches of the anterior crural nerve in the ligature. None of the surrounding flesh ought to be tied; but the ligature should be placed round the artery, just where it emerges from its lateral connections. Désault recommends tying the femoral vein, as well as the artery; because when the former remains open, and the bandage compresses the upper part of the limb too forcibly, the venous blood returns downward, and hemorrhage takes place.‡ Mr. Hey also met with a few instances of bleeding from the femoral vein, and therefore he generally inclosed it in the ligature along with the artery.§ The risk of bringing on phlebitis, however, should teach us to abstain from this practice, which is not necessary, because compressing the mouth of the vein a minute or two with the finger, will put an end to the bleeding from it, provided the tourniquet is re-

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* G. J. Guthrie on Gunshot Wounds of the Extremities, &c. p. 89.

† It is on this account that Mr. Liston insists upon the rule, that the management of the lower part of the limb should always be by the person using the saw. See Elem. of Surgery, Part iii. p. 364.

‡ Œuvres Chir. de Desault par Bichat, tom. ii. p. 550. Venous hemorrhage almost always ceases on the removal of the tourniquet, or any other tight bandage. At the present day, indeed, the practice of tightly bandaging stumps is completely abandoned in London.

§ Hey's Practical Obs. on Surgery, p. 530. ed. 2.

moved, and no bandage applied. The smaller arteries are usually taken up with a single or double tenaculum. After tying as many vessels as require it, one half of each ligature is to be cut off near the surface of the stump. The right qualities of ligatures, used for securing blood vessels, having been considered in the chapters on hemorrhage and aneurism, it is unnecessary now to return to that interesting topic; nor shall I here speak again of the proposal of removing both ends of the ligature, close to the knot.

When the large bleeding vessels have been tied, the tourniquet should be slackened, and the wound well cleaned, in order to detect any vessel, which may lie concealed with its orifice blocked up by coagulated blood; and, before the dressings are applied, the whole surface of the wound should be examined with the greatest accuracy. By this means, a pulsation may often be discerned, where no hemorrhage has previously appeared, and a small clot of blood may be removed from the mouth of a considerable artery.

As the lodgment of much coagulated blood would be unfavourable to the speedy union of the wound, the surgeon has an additional motive for being careful to make its whole surface clean with a sponge and water, before it is finally closed. The number of arteries, requiring to be tied, will depend very much upon the incision having been made in sound and uninflamed parts, or upon parts in a state of inflammation, swelling, and disease. This accounts for the truth of an observation, made by military surgeons, that, in amputations performed immediately, or soon after the receipt of an injury, there are fewer vessels to be taken up, than in what are termed secondary, or long delayed operations.*

I have occasionally seen examples, in which it was not necessary to take up a single artery. A young child was run over by a hackney coach, the wheel of which crushed the lower part of the leg, and rendered immediate amputation necessary. The operation was done by the late Mr. Ramsden without delay; no vessel was tied; and the stump healed without any subsequent bleeding. Some instances have also fallen under my notice, where arteries like the ulnar and anterior tibial, even in adults, required no ligature. The absence of hemorrhage is sometimes explicable by the clot of blood, formed in the large vessels in cases of gangrene. Thus, a modern surgeon tells us, that he amputated the arms of two Cossacks, four months after the limbs had been shot through above the elbow, and while they were affected with hospital gangrene: not a vessel was tied; no secondary hemorrhage arose; and the stumps healed in the most favourable manner.†

### OF DRESSING THE STUMP.

The skin and muscles are now to be placed over the bone, in such a direction that the wound may appear only as a line, across the face of the stump, with the angles at each side, where most of the ligatures are to be brought out, as their vicinity to either angle directs. The skin is commonly supported in this position, by long strips of adhesive plaster, applied from below upwards, across the face of the stump. Over these, and the ends of the ligatures, it is best to place some pieces of lint, spread with the unguent. cetacei, in order to keep them from sticking,

* See Guthrie on Gunshot Wounds, &c. p. 90.

† Klein, Practische Ansichten der bedeutendsten Chirurgischen Operationen, 1tes Heft. p. 62. 4to. Stuttgart, 1816.

which becomes a troublesome circumstance, when the dressings are to be removed. I am decidedly averse to the plan of loading the stump with a mass of plasters, pledgets, compresses, flannels, &c. I see no reason why the strips of adhesive plaster, and a pledget of simple ointment, should not suffice, when supported by two cross bandages, and a common linen roller, applied not too tightly round the limb, from above downward. The first turn of the roller, indeed, should go round the patient's body; and, being continued down, will fix the two cross bandages over the end of the stump. Here, as after all other operations, the dressings should generally be superficial, and make no compression: if the vessels have been properly secured, there is no risk of hemorrhage; and if they have not, it is not a little degree of constriction that will hinder bleeding. Besides, much pressure has the serious inconvenience of causing a tendency to bleeding depending on obstruction of the venous circulation; irritating the parts; exciting inflammation and suppuration, causing absorption of the cellular tissue, and a sugar-loaf stump.*

When the weather is not too cold, it is an excellent rule to dress stumps lightly, and to cover them with linen, or lint, wet with cold water. Mr. Liston commonly follows this plan, using two or three sutures, and no adhesive plaster, till the oozing of blood has entirely ceased, at the end of about six or eight hours. Then he has recourse to slips of oiled silk, rendered adhesive with a solution of isinglass in brandy. Interstices are left for the sutures and ligatures. These isinglass plasters do not irritate, and are not loosened by the discharge. After twelve or twenty-four hours, the sutures are cut and removed. If the case prove favourable, Mr. Liston finds no change of dressing requisite, till the stump is healed. It was the custom of Dupuytren to let more than an hour elapse before the stump was dressed, in order that he might not be obliged to take off the dressings again by the quick return of bleeding.† The part is kept cool, and the discharge, if it be sufficient to fall on the oiled cloth covering the pillow, on which the stump is laid, is wiped away from time to time.

If the common mode of closing stumps with adhesive plaster be adopted, the dressings should never be removed before the third day; but, in general, it is quite soon enough to change them on the fourth or fifth: when the weather is hot, and there is much discharge, they should be taken off earlier than under other circumstances. The favourable healing of a stump will depend very much upon the skill and tenderness with which the dressings are changed, more especially the first dressings. In order to facilitate the removal of the plasters, they should be first thoroughly wet with warm water, which is not to be rubbed upon them with a sponge, but allowed to drop, or flow over them. Each strip of plaster should be taken off, by raising its ends, and drawing them gently up together towards the extremity of the stump, by which means the surgeon will avoid pulling the recently united parts away from each other. During the change of the dressings, an assistant is always to support the flesh and keep it from being retracted; and for the more complete prevention of the same disadvantage, it is a good rule never to let every strip of plaster be off the limb at one time; but, as soon as

* Œuvres Chir. de Desault, t. ii. p. 552.

† Leçons Orales, &c. t. iv. p. 332. I believe, that we are now falling into the serious error of leaving stumps too long unclosed, so that the exposure of the wound leaves little or no chance of union of any part of it by the first intention.

some are removed, to put on others, before the rest are loosened and taken away. It is hardly necessary to add, that, when matter is collected within the stump, it should be gently compressed out with a sponge, in doing which the pressure should be so regulated, as not to force back the flesh.

At the end of five or six days, the surgeon may begin to try, in a gentle manner, whether any of the ligatures are loose. However, he should not use the smallest force, nor persist, if the trial create pain. One would hardly try, whether the ligature on the femoral artery were loose bofore the fourteenth or sixteenth day.

### FLAP-AMPUTATION OF THE THIGH.

Although this operation is not universally regarded as the best method for ordinary cases, its advantages, under particular circumstances, are generally acknowledged, and it is unquestionably a rapid and showy method. In Germany, flap-amputations seem to have numerous advocates; and, I believe, that whoever will take the trouble of inquiring into the actual state of surgery in that country, will find this method of operating quite as frequently practised as the circular incision.* Desault employed both modes on the thigh, or arm, indifferently; though he did not adopt flap-amputation in the leg, or fore-arm.† In England, where the latter method first originated with Lowdham, and where, at various periods, it has been strongly commended and improved by several men of great eminence, it has not retained so many advocates as in Germany and Scotland, where the successful manner in which it was practised by Mr. Liston, and the able remarks of Mr. Syme ‡ in its favour, made it the common method.

All British surgeons agree, however, that flap-amputations are generally the best, when a limb is to be taken off at a joint, and, also, in every instance in which the skin and soft parts are quite sound on one side of a member, while, on the other, they are diseased, or destroyed for a considerable extent upwards. Here, amputating with a flap will be the means of preserving more of the limb than could be saved by the circular incision, and becomes praiseworthy on the very same principle, which has sometimes been thought to render the latter method most eligible under ordinary circumstances.

As Mr. Hey has remarked, sometimes the integuments of the thigh are in a morbid state on one side of the limb, while they are sound on the other. In this case, a longer portion of integuments and muscular flesh must be left on the sound side; which will not prevent the formation of a good stump. The morbid state of the anterior or posterior side of the thigh sometimes extends so far above the knee, that it is advisable to amputate with a flap.§

Were the thigh-bone injured high up, and had gangrene extended about the trochanter major and posterior upper part of the thigh, if the

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* Consult C. C. Siebold, Diss. de Amputatione femoris cum relictis duobus carnis segmentis, Wirceb. 1782; Gräfe, Normen für die Ablösung grösserer Gliedmassen. Berlin, 1812; Richter, Anfangsgr. der Wundarzneykunst, b. vii.; Kap. 7. 8vo. Göttingen, 1804; Klein, Practische Ansichten der bedeutendsten Chirurgischen Operationen, 1tes Heft. 4to. Stuttgart, 1816; H. J. Brunninghausen, Erfahrungen und Bemerkungen über die Amputation, 12mo. Bamberg, 1818.

† Œuvres Chir. de Desault, t. ii. p. 547.

‡ See Edinb. Med. and Surg. Journ. 1823.

§ Hey's Practical Obs. in Surgery, p. 531. ed. 2.

head of the femur were sound, and the patient able to bear the operation, I would make a flap at the inner and upper part of the member.* Indeed, a flap-amputation of the thigh must always be attended with some difference, according as the soft parts on all sides of the limb happen to be sound, or not. When, in consequence of the flesh being severely injured, or diseased on one side, the flap must be entirely formed on the other, it will be necessary to save more skin and muscle in the latter situation, than if the surgeon had it in his power to form two flaps for covering the end of the bone. If possible, however, there should be two flaps, and placed laterally, or anteriorly and posteriorly, according to circumstances. In an operation high up the limb, if the flaps be lateral, Mr. Liston finds that there will be risk of a protrusion of the bone, because no muscles are left to oppose the muscles inserted into the trochanter minor, which will then raise the bone involuntarily towards the abdomen. Hence, in this part of the thigh, he prefers anterior and posterior flaps; for, "then the more the stump is raised, the better is the end of the bone covered; the anterior flap folds over it." He recommends the posterior flap to be made rather longer than the anterior. In the lower part of the thigh, lateral flaps are the best.† If the limb is to be taken off at, or below its middle, the pad of the tourniquet, if this be used at all, should be applied to the femoral artery, where it lies between the sartorius and adductor longus; but, if the operation is to be performed higher than this, the tourniquet would interfere with the knife, and prevent the due retraction of the muscles, and, consequently, it is better to compress the femoral artery as it is passing over the os pubis. In making the first flap, which I think should be an external one, in order not to cut the femoral artery in the commencement of the operation, the point of the knife, the edge of which is directed down towards the knee, should pass perpendicularly till it touches the bone, round the outer side of which it is to be closely guided, and then pushed through the integuments in the central line of the posterior part of the limb. With a gentle sawing motion, the external flap is then to be formed, consisting of the integuments, fascia, and part of the cruralis, and rectus, and of the vastus externus and biceps muscles. The length of the flap must depend on the diameter of the thigh; but, in general, from three to four inches will be sufficient; for, if the flap be too long, it rarely unites favourably. The point of the knife is then to be introduced perpendicularly again at the anterior and superior angle of the external flap, till it touches the bone, closely round which it is to be conveyed, till it is in a position to pass through the limb precisely at the upper and posterior angle of the external flap. The transfixion having been made, the internal flap is then formed by cutting downwards and inwards to the point chosen as the limit of its length. The bone having been sawn through, and the arteries secured, the flaps are brought together with two or three sutures, so as to meet in a perpendicular line, and lint dipped in cold water laid over the stump, until all oozing of blood has ceased, when common adhesive, or isinglass plaster, may be applied, and the sutures removed. The inner flap will comprehend the integuments, the fascia, part of the cruralis, adductor, sartorius, gracilis, semimembranosus, and semitendinosus, with the femoral artery, vein, &c.

* See Klein's Ansichten bedeutendsten Operationen, pp. 39—42, &c. 1tes Heft.
† See Liston's Elements, Part iii. p. 394.

### AMPUTATION AT THE HIP-JOINT.

In this operation, the following circumstances merit recollection : —

1. The acetabulum not being deep enough to contain the whole of the head of the femur, and the latter being partly embraced by the orbicular ligament, this ligament, if not divided close to the brim of the acetabulum, will form some impediment to the disarticulation. 2. When the thigh is in the position of abduction, the ligamentum teres is rendered tense by the head of the femur, and readily presents itself to the edge of the knife. 3. If it be intended to form two flaps of equal size, they should be separated by a line extending from the great trochanter to the opposite point of the diameter of the limb. 4. As the femoral artery corresponds above to the junction of the middle third of the head of the femur with its internal third, and only gets parallel to the bone three or four inches lower down, there must necessarily be between the artery and the neck of the femur, for a considerable part of this extent, a distance of fifteen lines, which, in several modes of operating, would permit the knife to pass over the neck of the bone without wounding the artery, and afford an opportunity for the vessel to be compressed before the anterior flap is completed. As the arteria profunda also takes the same direction as the femoral till it is at least an inch and a half below the trochanter minor, the knife need not interfere with it.*

Lisfranc adverts to four methods of finding the hip-joint with precision in the living body.

1st. From the anterior superior spine of the ilium make a perpendicular mark, fifteen lines long, and the external and front part of the joint will lie exactly six lines to the inner side of the lower termination of such mark.

2d. From the anterior inferior spine of the ilium, draw a perpendicular line, about six lines in length, and its termination will correspond to the upper part of the joint.

3d. If from the end of a transverse line, drawn from the spine of the os pubis outwards, rather more than two inches and a quarter long, another line, a quarter of an inch in length, descend at a right angle, it will also pass over the joint.

4th. If, from the outer, front, and upper part of the trochanter, a line half an inch long, be drawn perpendicularly upwards, and then another line be drawn from the end of the first at a right angle inwards, to the extent of an inch, the second one will extend to the head of the femur some little allowance being made for the difference in the length and direction of the neck of the femur in different subjects.

When the patient is in the recumbent posture, the tuberosity of the ischium projects about fifteen lines in front of the acetabulum.

### METHOD OF LISFRANC WITH TWO LATERAL FLAPS.

*First Stage.*—The femoral artery is to be compressed as it passes over the os pubis. When the left limb is to be removed, the surgeon is to stand on the outer side of it, while the patient is in the recumbent posture, with the tuberosities of the ischium projecting a little way beyond the end of the operating table. If possible, the limb itself is to be in the middle position between adduction and abduction ; and the anatomical points, above specified, in relation to the joint, are to be well recollected,

* Malgaigne, Manuel de Méd. Opératoire, p. 356.

and especially the directions for ascertaining the precise situation of its anterior and external part. At this place a long, narrow, but strong, sharp-pointed knife is introduced, with its edge directed towards the apex of the great trochanter. The point having passed down close to the head of the femur, is to be carried round its outer side; but, in proportion as the point enters further, the handle must be inclined outwards and upwards, so that the point may pass out a few lines below the tuberosity of the ischium. In order to fulfil this object, an assistant, or the surgeon himself, should grasp and draw outwards the integuments and muscles at the back of the limb. The transfixion having been completed, the knife, with the edge still turned towards the apex of the great trochanter, is to be carried downwards along the bone, with a sawing motion, rather than by pressing much upon it, and thus the external flap is formed. This is to be immediately raised, and such arteries as pour out much blood compressed with the fingers of the assistants, and tied before the rest of the operation is proceeded with.

*Second Stage.* — The surgeon, with his left hand, then pushes the soft parts inwards, and introduces the point of the knife below the head of the femur, on the inner side of the neck, with the edge turned directly downwards. Then the knife is to be carried under the neck of the femur, and pushed through the limb, without touching the bones of the pelvis, at the posterior and superior angle of the wound. Being now held perpendicularly, it is conveyed two inches downwards close to the femur, avoiding, however, the trochanter minor; and, as soon as the incision affords room enough, an assistant compresses the femoral artery contained in the flap, and the second stage of the operation is concluded by giving to this internal flap a length corresponding to the external.

*Third Stage.* — The surgeon now takes hold of the femur with his left hand, and with a scalpel freely divides the orbicular ligament at the inner side of the joint, which being done, the ligamentum teres can easily be reached with the end of the knife, and cut through. Lastly, the knife, held perpendicularly, is to be applied to the inner side of the joint, and carried from within outwards, so as to cut through the rest of the orbicular ligament, and any fasciculi of muscular fibres not previously divided.

When the right limb is to be removed, the surgeon must stand by the side of the patient's trunk, in order to be able to operate with the right hand.

The advantages of Lisfranc's method are, the quickness with which it is executed, as I have often demonstrated at University College on the dead subject; and its occasioning as little loss of blood as possible, the arteries of the external flap being tied before the internal one is formed, and the femoral artery taken hold of by an assistant before the latter flap is completed. The flaps meet well, and the extensive wound admits of being completely closed, which may be accomplished with straps of adhesive plaster, aided, if necessary, with three or four sutures.

When, owing to the state of the injury, or disease, a sufficient flap cannot be saved on one side of the limb, the flap on the other side is to be made proportionably longer.

### BÉCLARD'S METHOD.

The thigh being held in the state of half abduction, the scrotum carefully raised, and the artery compressed, as it passes over the os pubis, the surgeon, standing on the outside of the limb, feels for the great trochanter, and introduces the point of the knife one inch above it. The edge is to pass as close as possible to the bone, at the inner side of the limb, its

point being pushed out in a situation precisely opposite the place of its entrance. The knife is next carried down, close to the anterior surface of the bone, to rather more than three inches below the joint where the anterior flap is to end. Then the capsule, and any soft parts covering it, are to be divided transversely, and the ligamentum teres cut through. The knife is next to pass, from before backward round the head of the femur to the back of this bone, down which it is to be carried to the extent of about three inches below the joint. Thus the posterior flap is completed.* According to Velpeau, Béclard made the anterior flap, after the completion of the posterior one.

Mr. Liston also prefers anterior and posterior flaps. "Transfixion, with a knife proportioned in size to the dimensions of the limb, is made horizontally, the instrument being passed in a somewhat semicircular direction, so as to include as much of the soft parts as possible; and an anterior flap is made by cutting downwards. During the passage of the knife across the joint, the assistant rotates the limb a little, so as to facilitate the bringing of the instrument out, with its point well inwards. In the left limb, the rotation will be inwards; in the right, outwards. After the formation of the flap, the assistant abducts forcibly, and presses downwards; the joint is opened, the round ligament cut, the capsule divided, and the blade of the knife placed behind the head of the bone and the large trochanter; and the posterior flap is then made rapidly. After transfixion for the superior flap, and when the sawing motion has advanced but a little way, the compressing assistant shifts his hands into the incision, immediately behind the back of the knife, and so obtains a firm grasp of the femoral artery previously to its division." † As this cannot now bleed, Mr. Liston secures the other arteries first.

### AMPUTATION OF THE LEG.

In the thigh, amputation is performed as low as the case will allow. In the leg, the common practice is to make the incision through the integuments sufficiently low to enable the operator to saw the bones, about four inches below the lower part of the patella. This is necessary in order to have a sufficient surface in front of the limb for the application of a wooden leg, and not to deprive the stump of that power of motion, which arises from the flexor tendons of the leg continuing undivided.

The tourniquet, or pressure with the thumb, should be applied to the femoral artery, two thirds of the way down the thigh, just before the vessel perforates the tendon of the adductor muscle. The operator is to stand on the inside of the leg, in order to be able to saw both bones at once. The leg being properly held, the integuments should next be drawn upward by an assistant, while the surgeon, with one quick stroke of the knife, divides the skin completely round the limb.

Having made a circular division of the integuments, the next object is to preserve skin enough to cover the front of the tibia and the part of the stump corresponding to the situation of the tibialis anticus, extensor longus pollicis, and other muscles between the tibia and fibula, including those covering the latter bone; for, throughout this extent, there are no bulky muscles which can be made very serviceable in covering the end

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* J. F. Malgaigne, Manuel de Méd. Opératoire, p. 358.

† See Liston's Elements, Part iii. p. 396. For a description of other methods, I refer to my Dictionary.

of the stump. But, on the posterior part of the leg, the skin should never be detached from the gastrocnemius muscle, which, when obliquely divided, will, with the soleus, here form a sufficient mass for covering the stump. Hence, as soon as the skin has been separated on the anterior and external side of the leg, the surgeon is to place the edge of the knife in the incision of the integuments, and cut in the Alansonian way through the muscles of the calf, from the inside of the tibia, quite to the fibula. Then the flap, formed by the calf of the leg, is to be held back by the assistant, while the surgeon completes the division of the rest of the muscles, together with the interosseous ligament, by means of the catling, or any narrow double-edged knife.

In amputating below the knee, particular care must be taken to cut every fasciculus of muscular fibres, before the saw is used. Every part being divided, except the bones, the soft parts are to be protected from the saw by a linen retractor, made with three tails, one of which is to be drawn through the interosseous space.

The principal arteries, requiring ligatures, will be the anterior and posterior tibial, and the peroneal. The sharp anterior edge of the tibia, if likely to injure the integuments, may be removed by means of pliers, or a fine sharp saw.

In dressing the wound, the soft parts preserved for covering the bones should be brought together, so as to make the line of their union not transverse, but obliquely perpendicular, the lower end of it being more external than the upper. Thus the tibia and fibula may be effectually covered, without the strips of adhesive plaster forcibly pressing the skin against the sharp edge of the tibia. The strap of plaster, on which most dependence is placed, should go over the centre of the stump, at the point corresponding to the interosseous space.

### FLAP-AMPUTATION OF THE LEG BELOW THE TUBEROSITY OF THE TIBIA.

If the right leg is to be removed, the operator places himself on its inner side, and grasps the lower part of the limb with his left hand, while an assistant supports the foot. The knife enters over the outer side of the fibula, and is carried upwards along that bone for an inch and a half, or two inches. The incision is then extended across the front of the leg in a semicircular direction; and as soon as the knife reaches the inner part of the tibia, transfixion is performed, the point being pushed along the posterior surface of the two bones, and out at the upper angle of the incision over the fibula. The knife is then carried downwards, and a posterior flap formed of sufficient size to cover the stump.

All this is effected by uninterrupted sweeps of the knife, that is, without ever removing its point from the track of the incision. With the same knife, the integuments on the forepart of the leg are then dissected up a little way, so as to form a small semilunar flap. The muscles in the interosseous space are next divided, and the knife is carried round the bones for the division of any of the soft parts yet uncut. Mr. Liston prefers sawing the bone in the perpendicular direction. Before laying down the flap, he removes the sharp anterior ridge of the tibia with the cutting pliers. In operating on the left leg, transfixion is commenced by passing the knife close behind the tibia, and its point is afterwards pushed through the preliminary fibular incision.* The most simple plan is first

* See Liston's Elements of Surgery, Part iii. p. 391.

to form the posterior flap by transfixion, and then to make the anterior flap, and divide the muscles in the interosseous space. The anterior flap should be somewhat longer than usually made, so as to cover the tibia better, and render it unnecessary to have a posterior flap of great length, which always proves a source of profuse suppuration.

### AMPUTATION OF THE ARM.

The structure of the arm bears a great analogy to that of the thigh. There is only one bone round which the muscles are arranged, the deep ones being adherent to it, while the outer ones extend from their origins to their insertions, without being attached to it. The first are the brachialis internus, and the two short heads of the triceps; the others are, the long portion of the latter muscle, and the biceps. Hence amputation of the arm may be performed in a very similar manner to the same operation on the thigh, unless it be necessary to remove the limb above the insertion of the deltoid muscle.

The patient may either sit on a chair, or lie near the edge of a bed, and an assistant is to hold the arm in a horizontal position, if the state of the limb will allow it. The pad of the tourniquet is to be applied to the brachial artery, as high as convenient. The assistant is then to draw up the integuments, while the surgeon makes the first circular incision. In this operation, the skin need only be detached from the muscles to a very moderate extent, for there is no risk of not having sufficient flesh and integuments to cover the bone. Here, indeed, some surgeons imitate Dupuytren, and cut at once through the skin and loose portions of muscle. If the ordinary method be followed, the biceps may be divided first, and, after the retraction of this loose muscle, the brachialis internus, which is fixed to the bone, may be cut through and separated a little upwards from the bone.

The triceps may next be cut through at once, by one sweep of the knife, with its edge turned obliquely upward. The other proceedings do not require description, after the account already given of what is necessary in amputating the thigh.

When it becomes indispensable to amputate the arm high up, the subclavian artery is to be firmly compressed, as it passes over the first rib, by an assistant, who can effectually accomplish this important object with his thumb, or by pressing the vessel from above the clavicle with the handle of a key, covered with soft materials. When the bone can be sawn through below the insertion of the pectoralis major, there is no peculiarity in the method of operating. But, if it be necessary to take off the limb still higher up, the circular incision is not advisable. Here some surgeons make a flap of the deltoid muscle, and commence with making an incision corresponding to its margin in shape and situation. Then the muscle is to be detached from the bone beneath, so as to form the flap, which is to be turned up. The operation is now finished by cutting through the other soft parts, from one side of the base of the flap to the other.

Instead of making a short stump, when the arm must be taken off high up, Larrey prefers amputating at the shoulder-joint. He says, that, if the humerus is sawn through higher than the insertion of the deltoid muscle, the stump becomes retracted towards the arm-pit by the pectoralis major and latissimus dorsi; the ligatures on the vessels irritate the axillary plexus of nerves; great pain and nervous twitches are excited;

tetanus is frequently brought on; the stump is affected with considerable swelling; and at length, anchylosis of the shoulder follows.*

According to Mr. Guthrie, when amputation is attempted at the insertion of the pectoralis major, the bone will mostly protrude after a few dressings; and a disagreeable painful stump be the consequence. The artery is also liable to retract into the axilla, where it cannot readily be taken up. Here, instead of amputation at the shoulder-joint, he recommends the following operation: — "Two incisions of a similar shape are to be commenced, one or two fingers' breadth below the acromion, as the case may require; the point of the inner one, instead of ceasing, as in the operation of the shoulder, a little below the pectoral muscle, is to be carried directly across the under part, to meet the point of the outer incision; so that the under part of the arm is cut by a circular incision; the upper, in the same manner as in the operation at the shoulder. These incisions are only through the skin and cellular membrane, which have liberty to retract, but are not to be turned up. The deltoid and pectoralis major are then divided close to the inner incision, and the opposite portion of the deltoid, with the long head of the biceps on the outside, to the extent of the outer incision. A half-circular cut on the under part, in the line of the skin down to the bone, clears it underneath, and shows the artery retracting with its open mouth, which is at this moment advantageously pulled out by a tenaculum, and secured." The flaps are then held asunder, and the bones sawn, &c.†

### AMPUTATION OF THE ARM WITH LATERAL FLAPS.

One of the quickest methods of removing the arm is Dupuytren's operation, in which he cut the integuments and muscles together, separated the muscular fibres upwards from the bone, and then applied the saw. Another expeditious method, and one which also forms an excellent stump, is amputation with lateral flaps, which may be adopted at any point below the insertion of the deltoid muscle. The limb is held up from the side at a convenient height, and the point of the knife, with the edge directed towards the elbow, is introduced directly down to the bone, either at the front or posterior part of the limb, and, as nearly as possible in the middle of it. As soon as the point of the knife touches the bone, it is to be conveyed very closely round it, till the position of the blade is such, that the point can be pushed through some part of the central line of the limb, directly opposite to the place where the knife first entered. The transfixion having been completed, a flap is formed by cutting rapidly downwards, with a sawing motion of the knife, inclining its edge downwards or upwards, according as it may be the internal or external flap which is being formed. As soon as one flap has been made, an assistant is to hold it out of the way while the surgeon makes the other. "The knife is again entered, about half an inch below the commencement of the first incision, and by inclining the handle, the point is brought round the bone, and made to appear on the opposite side also of the first incision." ‡ When it is the external flap which is being formed, this part of the operation is facilitated by pulling the soft parts outwards with the left hand. Lastly, the knife is carried rapidly round the bone,

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* Mémoires de Chirurgie Militaire, t. iii. p. 53., &c.
† Guthrie on Gunshot Wounds, p. 340.
‡ See Liston's Elements, Part iii. p. 383.

so as to divide any of the adherent muscular fibres yet uncut, and then the saw is to be used.

I have sometimes tried this method in University College Hospital, and find it has the advantages of expedition and of making a good stump. The hemorrhage was effectually commanded by the pressure of the fingers on the brachial artery just below the axilla. The projection of nerves is most likely to be avoided by giving the edge of the knife rather a sudden turn outwards, after the proper length of flap has been secured.

### AMPUTATION OF THE FOREARM

Should be performed as low as the case will allow. The tourniquet is to be applied with its pad on the brachial artery, at the inner edge of the biceps muscle, or the flow of blood through that vessel may be commanded by an assistant making pressure on it. While one assistant holds the hand, another grasps the forearm, above the place where the first circular wound is to be made, and draws up the integuments. After the amputating knife has been carried round the limb, the skin is to be detached from the fascia, a little way upward. The muscles are then to be divided obliquely upwards with the same knife, which, if not too broad, is also to be employed for completing the division of the parts, between the radius and ulna. If the blade be wider than is convenient for this purpose, the catling, or any narrow double-edged knife, must be used. The retractor is to be applied, and the bones sawn, with the hand in a state of pronation.

In general, only four vessels require ligatures, viz. the radial, ulnar, and two interosseous arteries.

Larrey deems it advantageous to take off the forearm in its fleshy part, notwithstanding the nature of the disease, or injury would admit of the operation being done towards the wrist. However, as I have amputated several forearms near the wrist, and the stumps healed in the best way, I see every reason for still adhering to the old good maxim of saving as much of the limb as possible. The cause of the bad success, which many of the French surgeons have had after amputating in the tendinous part of the forearm, has been correctly referred by Mr. Guthrie to their prejudices against the attempt to heal the stump by the first intention.*

### FLAP-AMPUTATION OF THE FOREARM, AS PRACTISED BY KLEIN †, LISTON, &c.

The surgeon, with his left hand, grasps the wrist, and places the forearm in the middle state between pronation and supination. Supposing the right forearm is to be removed, the knife, held perpendicularly, enters over the centre of the radius, and its point, after reaching the bone, is inclined inwards, and, being conveyed across close to the palmar surface of it and the ulna, completes the transfixion at a point opposite that of its entrance. By cutting rapidly downwards and inwards, the first flap is then formed. The knife is again introduced over the radius, just below the upper part of the first wound, and conveyed across the opposite side of the bones until its point emerges at the other extremity

* On Gunshot Wounds of the Extremities, p. 370.

† Practische Ansichten der bedeutendsten Chir. Operationen, p. 45. 1tes Heft. 4to. Stuttgart, 1816.

of the first incision. The second flap is then made. The two flaps being retracted, the knife is carried round the bones, and passed freely between them, after which they are to be sawn perpendicularly with the forearm in the same position. Amputation of the forearm, by means of the circular incision, may be performed with tolerable expedition, and, in my own practice, the stump has usually healed up with facility, so that I am rather in favour of it; though which operation is here preferred, may be a point of no very great importance.

### FLAP-AMPUTATION AT THE WRIST.

If the hand be extended back, the angle which it forms with the forearm will denote the radio-carpal articulation, which is one line below the transverse projection of the radius, and about five above the cutaneous fold between the hand and forearm. The middle of the joint may also be found two lines and a half above a line, drawn across from the point of the styloid process of the radius to that of the ulna. The knife is to pass across from one styloid process to the other, and the anterior flap be formed. The hand being then put into the prone position, the knife is introduced at one of the upper angles of the first incision, transfixion performed, and a posterior semilunar flap made. The operator is then to make an incision below the styloid process of the radius, and with a semicircular sweep of the knife corresponding to the direction of the articulation, all the ligaments are to be cut, and the operation finished. According to Malgaigne, this method, which is followed by Lisfranc, is a quick and showy one, but less advantageous in its results, than amputating at the wrist with a circular incision.

### AMPUTATION AT THE SHOULDER-JOINT.

The loss of blood is to be prevented, by compressing the subclavian artery from above the clavicle. The choice of the method of operating must be determined by the state of the soft parts covering the joint.

### LA FAYE'S METHOD WITH ONE FLAP.

With a large common bistoury, a semicircular incision is to be made, with its convexity downward, across the integuments covering the deltoid muscle, about four inches below the acromion.* The skin is not to be detached; but the surgeon is to proceed immediately to raise the muscle from the bone, quite up to the joint. If the circumflex arteries bleed considerably, they are now to be tied, before the operator proceeds further. Then the surgeon should cut the tendons passing over the joint, and also the capsular ligament, so as to be enabled to dislocate the head of the bone. With one stroke of the amputating knife, he is then to divide the skin, muscles, and other parts underneath the joint, and thus complete the separation of the limb. Then the axillary artery is to be instantly taken hold of with the forceps or double tenaculum, and tied. The flap of the deltoid muscle is next to be laid down, and its edge will then meet the lower margin of the wound.

The preceding method is one of remarkable simplicity, as I can truly affirm, not only because I have tried it myself, in three instances, but seen it performed on several occasions by other surgeons. The last case, in which I was requested to give my assistance, was a patient of Dr.

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* The horns of the semicircle, if I may use the expression, are to extend upward along the anterior and posterior margin of the deltoid muscle.

Blickes', of Walthamstowe: the operation was practised as a last resource for a spreading mortification of the arm from external violence; and, though the man survived only about a fortnight, nothing could be more easy than the operation itself, and it was impossible to have had a better stump.

In order to make a flap of the deltoid muscle, some operators prefer first pushing a catling, or long, straight, double-edged knife, through this muscle near the joint, and next cutting downwards, they detach as much of the flesh from the bone as they consider necessary; the flap is then turned up; the tendon of the long head of the biceps and other muscles passing over the joint are divided; the capsular ligament is cut; the head of the bone disarticulated; and the operation finished, by passing the knife downwards between the glenoid cavity of the scapula and the head of the humerus, and, with one stroke, dividing all the parts towards the axilla.

### DUPUYTREN'S METHOD WITH ONE FLAP.

The arm being raised from the side, the deltoid muscle is grasped with the left hand, and a double-edged knife passed through its base, directly below the acromion, and carried down close to the outer side of the humerus, so as to form an external flap of suitable extent. This is to be held up by an assistant, while the humerus is moved near to the side, in order to incline those tendons outwards, which are inserted near the head of the bone, and which are now to be divided, beginning with the posterior ones, which are more easily got at, on account of the greater space between the acromion and the head of the humerus, than between the latter part and the coracoid process. The fibrous tissues, connecting the head of the bone to the acromion, must likewise be divided, after which the operator takes hold of the arm with his left hand, dislocates the head of the bone outwards, and passes the knife inwards for the purpose of dividing the soft parts in that direction, where the principal nerves and bloodvessels are situated. At this moment the assistant, who holds up the external flap, pinches up the soft parts, by placing the thumb of his right hand on their bleeding surface, and the four fingers under the axilla, and thus compresses the artery. The operator, now having no fear of hemorrhage, completes the division of the parts on a level with the attachments of the pectoralis major and latissimus dorsi to the humerus. The flap is then brought down and united by the first intention. This is the operation of La Faye and Ravaton simplified, and perfected. As M. Malgaigne observes, by directing the edge of the knife inwards, the capsule of the joint might be laid open by the first stroke.

### LISFRANC'S METHOD WITH TWO FLAPS.

In this operation, the surgeon is particularly to remember that, between the acromion and the coracoid process, there is a triangular space, bounded behind by the clavicle, and where the arch over the joint is simply fibrous.

1st. Supposing the left arm is about to be removed, it is to be raised outwards nearly to a right angle. The surgeon stands behind the patient, and grasps the cushion of the shoulder with his left hand, putting his thumb on the humerus, and the index and middle fingers on the above-mentioned triangular space. Then taking a double-edged knife, eight inches long, he introduces it parallel to the humerus, at the outer side of

the posterior margin of the axilla, in front of the tendons of the latissimus dorsi and teres major, with the blade in such a position that its flat part forms with the axis of the shoulder an angle of 35°, while its upper edge is turned a little forwards. The knife is carried up along the posterior and external side of the humerus, till it arrives under the acromion: now its point is to be depressed, and its handle raised, to the distance of two or three inches from the arm, till it forms with the axis of the joint an angle of 30° or 35°. Then the surgeon is to press directly on its point, which will pass through the joint, and come out in front of the clavicle at the inner side of the acromion, at the triangular space above described. Next, while the handle is kept nearly motionless, the end of the blade is carried round the head of the humerus from within outwards, and from below rather upwards; and directly the knife is clear of the acromion and head of the bone, it is carried boldly downwards along the external side of the arm, and the posterior flap is formed, about three inches in length.

2d. The operator, keeping his hand depressed, and cutting from the heel to the point, slides the knife from behind forward at the inner side of the head of the humerus, depresses the handle till it is perpendicular to the horizon, directs an assistant to compress the artery, and thus completes the anterior flap.

When the right arm is to be amputated, the surgeon may either plunge the knife into the triangular space, above indicated, and bring its point out in front of the posterior margin of the axilla; or else he may stand at first behind the patient to make the posterior flap, and then move to the patient's side to finish the anterior one.

No method is more expeditious than the foregoing. In the first stage, the surgeon cuts at once the tendons of the latissimus dorsi, teres major and minor, supra and infra spinatus, a portion of the deltoid, one half of the capsular ligament, the subacromial fibrous tissue; — in a word, almost all the parts attached to the humerus, the head of which can be immediately afterwards disarticulated.

When the patient is under the age of fifteen, M. Lisfranc, recollecting the cartilaginous state of the acromion, recommends another method with two flaps, the peculiarity of which consists in directing the knife, so as to remove the cartilaginous extremity of that part of the scapula. But, as M. Malgaigne justly remarks, the latter expedient, by lessening the prominence of the shoulder, would be likely to increase the deformity resulting from the operation.

### LARREY'S OVAL METHOD.

An incision is begun at the acromion, and carried down to an inch below the level of the neck of the humerus, dividing the integuments and the deltoid, down to the bone, into two equal portions. An assistant then draws up the skin of the arm towards the shoulder, and the operator makes two oblique incisions, which commence from the termination of the first, an inch below the acromion; one extending to the anterior border of the axilla; the other to its posterior border; and both prolonged so as to divide the pectoralis major and latissimus dorsi very close to their insertions.

The cellular connections of the two flaps to the bone are next divided, and the flaps themselves held up by an assistant, who, at the same time, stops the bleeding from the circumflex arteries by the pressure of his fingers. The joint is now exposed, and, with one stroke of the knife,

over the upper semicircle of the head of the humerus, the capsule and tendons are cut through. The head of the humerus is then dislocated; and the knife being conveyed to the inner side of the bone, the flesh is detached from the latter. Finally, while an assistant compresses the axillary artery, the surgeon completes the operation by cutting transversely through the remainder of the skin and muscles, on a level with the lower ends of the two oblique incisions.

The arteries having been secured, there are, strictly speaking, no flaps; the wound, on being closed, presenting, as after all oval amputations, merely the appearance of a straight line.

### CIRCULAR AMPUTATION AT THE SHOULDER.

Garengeot, Alanson, Graefe, Sanson, and Cornuau, are recorded amongst its patrons. A circular incision is made through the integuments, three inches and a half, or four inches below the acromion. The skin is retracted, and the deltoid cut obliquely from below upwards, so as to expose the joint. With another stroke of the knife, the tendon of the biceps and the upper part of the capsule are divided. The head of the humerus is then dislocated; the knife carried to the inner side of the bone; the muscles separated from it in that direction; and, while an assistant compresses the artery, the soft parts towards the axilla are cut on a level with those on the outer side of the shoulder.

M. Sanson makes his first incision one finger-breadth from the acromion, and unites the anterior with the posterior wound: in fact, as M. Malgaigne remarks, the result is the same as that of Larrey's mode, divested of the upper incision, but more difficult of execution.*

Excellent as some of the preceding operations are, the exclusive preference to any one of them, as declared by some writers, has been made without reflecting, that, in many of the examples in which amputation at the shoulder is indicated, the deltoid muscle is much lacerated, or more or less of it actually torn away. Under such circumstances, a sufficiency of soft parts for making the flaps must be saved, from whatever quarter they can be obtained, whether the external, or the anterior, or the posterior side of the shoulder. Sometimes a flap can be obtained, indeed, only at the posterior, or the anterior side, as every experienced military surgeon is well aware of.

### AMPUTATION OF PARTS OF THE HAND.

As Dr. Macfarlane correctly observes, the propriety of sometimes attempting to save a portion of the foot, or hand, in cases of injury, or disease, by having recourse to partial amputation, has been long known, and acted upon both in this country and on the Continent. If the thumb and little finger can be preserved, or a portion of either of them, the advantage to the patient will be considerable. In University College Hospital, we have had many patients, whose hands were so badly shattered and crushed by machinery, that, at first, it seemed as if it would have been impossible to save any part of them. Yet the experiment of partial amputation having been made, very useful portions of the hand were saved. Thus, the thumb, and one or two fingers have sometimes been sacrificed and the rest of the hand saved; or, what has been still better, the thumb and one or two fingers have been saved, though the other fin-

* See J. F. Malgaigne, Manuel de Médecine Opératoire, pp. 329—334.

gers, and even some of the metacarpal bones have been unavoidably removed. With such facts before him, let every surgical practitioner pause a little, before he sanctions so great a mutilation as that of removing the whole hand.

### AMPUTATION OF THE TWO LAST PHALANGES OF THE FINGERS.

These phalanges, though but loosely confined in their respective places by the anterior ligament, and behind by the extensor tendon, are closely retained in it by the lateral ligaments. Hence, in order to open the joint freely, it is the latter, which require division. The line of the articular interspace, as M. Malgaigne remarks, has nearly a transverse direction, and in the articulation, of the first with the second phalanx, is situated on a level with the cutaneous fold on the palmar side of the finger; while, over the articulation of the second phalanx with the third, the articular interspace is half a line below the cutaneous fold.

*Lisfranc's first Plan.* — In removing the last phalanx, the operator takes hold of it with his thumb and forefinger, and bends it to an angle of 45°. There are then three guides to the articular interspace. 1. At the back of the joint a conspicuous wrinkle of the skin: the line of the articular interspace is half a line below it. 2. If this wrinkle be wanting, the dorsal prominence caused by the flexion is to be noticed, and the incision made half a line below it. 3. The termination of the furrow of the palmar surface is seen on each side of the joint: half a line below this, the articulation will be found. The heel of a straight bistoury is to be placed perpendicularly on the skin over the left extremity of the articular interspace, and a small semicircular flap is formed by cutting towards the right side of the finger. This first stroke will frequently lay open the ligament at the back of the joint. The next thing is to divide the lateral ligaments. In cutting through the left one, the knife is to be held perpendicularly to the axis of the last phalanx, with the handle nearer than the blade to the operator, and the edge also slightly inclined towards him. In this way, the incision is accommodated to the disposition of the articular surfaces, and the ligament is cut through at the first stroke. The knife is then applied to the other side, and the second lateral ligament divided in the same direction, but with the handle of the knife directed downwards, and kept further from the operator than the blade. The joint having now been largely opened, the phalanx is to be placed in the extended position, and the knife, having been carried through the joint and capsular ligament towards the palm, is there brought out, a semicircular flap being formed of sufficient size to cover the end of the bone.

Amputation between the first and second phalanges is performed in a similar way, except that the dorsal incision should terminate on each side precisely at the extremity of the palmar fold of the skin. The surgeon, as he is dividing the lateral ligaments, is to avoid cutting the base of the palmar flap.

*Lisfranc's second Method.* — All the fingers are to be bent, except that which is about to be removed; and the hand is to be placed in the supine position. The surgeon takes hold of the phalanx with the forefinger and thumb of his left hand. A straight, very sharp-pointed knife, with the edge directed towards the extremity of the finger, is introduced half a line below the palmar cutaneous fold, if it is the third phalanx which is to be removed; but exactly at the base of this fold, if it is the second phalanx. The knife is to pass closely across the palmar and lateral sur-

faces of the bone, nearly to the heel of the blade, and then the edge is to be inclined upwards, and a semilunar flap made. The knife is next applied perpendicularly at the base of the flap for the purpose of cutting the palmar portion of the capsule. But, in this method, it is scarcely necessary to divide the lateral ligaments separately, as with a single stroke, the knife may now be carried completely through the articulation, and the integuments divided, without making any dorsal flap. If the extensor tendon should project too much, a piece of it should be cut off with scissors.

In general, no ligature is necessary, and the flap is to be retained in its place with adhesive plaster.

### AMPUTATION OF A FINGER AT THE METACARPAL EXTREMITY.

The articulation is an enarthrosis with loose ligaments; and the articular prominence, or knuckle, presenting itself when the finger is bent, is formed entirely by the metacarpal bone, the phalanx playing on its inferior surface. In the healthy state, the joint is usually situated ten or twelve lines above the commissure of the fingers.

Here amputation may be performed with two flaps; or the oval, or the circular method may be adopted. The oval method seems to me the best.

1. The precise situation of the joint having been ascertained, and the phalanx bent, an oblique incision is to commence three lines beyond the articulation, and terminate at the digital commissure. The finger is then to be extended, and the incision continued across the palmar side of it, precisely in the direction of the cutaneous furrow between the finger and the hand. The knife having reached the opposite digital commissure, the finger is to be bent again, and the incision extended so as to rejoin its other extremity two lines below the point where it was begun.

2. The fingers are then to be strongly separated, the edges of the wound dissected up, the back of the capsule opened, the lateral ligaments cut, and the operation concluded by detaching the finger on its palmar side. The result is a linear cicatrix not at all encroaching on the palm.

### AMPUTATION OF ALL THE FINGERS TOGETHER FROM THE METACARPUS.

In this operation, it is useful to remember, that the heads of the second and fourth metacarpal bones are really on the same level; but that the third, which supports the middle finger, projects beyond them about one third of a line; while, on the contrary, the fifth, on which the little finger rests, is half a line shorter.*

### LISFRANC'S METHOD.

1. In the right hand, the operator begins with making a semicircular incision, with its convexity downwards, extending from the inner side of the head of the fifth metacarpal bone, over the points where the fingers separate from the hand, and terminating on the external side of the head of the second metacarpal bone. The integuments are retracted by an assistant, and, if necessary, the surgeon dissects them a little way upwards.

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* See J. F. Malgaigne, Op. cit. p. 313.

2. The point of the knife is carried across the four joints, so as to divide the dorsal ligaments; then the lateral ligaments of each articulation are cut in succession; and afterwards the palmar ones.

3. Lastly, the knife is conveyed under the inferior surface of the phalanges, and the palmar flap formed, at first towards the little finger, the incision following the direction of the cutaneous furrow of the palm, and each finger being lifted up successively, as the knife traverses the parts.

The mode of proceeding is the same for the left hand, except that the first incision is carried from the forefinger to the little finger.

The same method will also answer for the amputation of two or three fingers; an assistant holding the others out of the way, while the surgeon makes the dorsal flap principally with the point of the knife, and begins and finishes the incisions on a level with the articulations, which are to be opened.

*Circular Method, as practised by M. Cornuau.* — 1. The hand being placed in the supine position, the operator grasps the four fingers with his left hand, and makes in the digito-palmar furrow a semilunar incision, successively through the skin, vessels, nerves, and flexor tendons, down to the joint. 2. The hand is then turned prone, and the circular incision completed on the back of the hand, on a level with the commissure of the fingers, dividing all the soft parts there, and penetrating into the articulation. 3. The heads of the phalanges are now to be dislocated, and the operation finished by cutting through the lateral and anterior ligaments.

## AMPUTATION OF THE THUMB.

While the palmar aspect of the metacarpal bone of the thumb is thickly covered, the dorsal surface is almost subcutaneous. This bone is connected by means of loosish ligaments to the os trapezium, the articular surface of which is slightly concave from within outwards. By inclining it towards the metacarpal bone of the forefinger, its head may be made to project externally. On the inner side, the articulation is separated from that of the adjoining metacarpal bone by an osseous ridge, one line in breadth, appertaining to the os trapezium. Lastly, the direction of the joint is oblique, or corresponding to a line, which, when drawn from its outer side, would extend to the root of the little finger.

In the ordinary mode of amputating the thumb and its metacarpal bone from the trapezium, the thumb is placed in the position of abduction. 1. The heel of a bistoury, held perpendicularly, with the point upwards, is then applied to the middle of the commissure, and an incision boldly made downwards, but gradually inclining towards the metacarpal bone of the thumb, until the knife is stopped by the trapezium. 2. Then the edge of the knife is to be conveyed into the articulation in the direction above specified, and the head of the metacarpal bone luxated towards the palm. 3. The joint having been thus cut through, the edge of the knife is reversed, and carried along the radial edge of the metacarpal bone, so as to form the external flap, which should be as fleshy as possible, and end a few lines beyond the articulation of the metarcarpal bone with the first phalanx.

Some operators commence with forming the external flap, after transfixion of the soft parts at its base; and they then open the joint from without inwards.

### AMPUTATION OF THE THUMB BY AN OVAL INCISION. — SCOUTETTEN'S METHOD.

If the left thumb is to be removed, the hand is placed supine, and a longitudinal incision made through all the soft parts down to the bone, beginning one line above the articulation of the trapezium, and ending at the commissure on the inner side of the first phalanx of the thumb. The hand is now to be put into the prone position, and the incision prolonged from the first over the dorsal surface, precisely in the direction of the upper cutaneous furrow, and to the point where the first incision began. The muscles adherent to the whole extent of the external side of the bone are then to be divided; but, on the palmar side, only at the upper half of the bone. The joint is then laid open at its posterior side, the metacarpal bone dislocated outwards, and the detachment of the thumb completed by carrying the knife close to the inner surface of the metacarpal bone.

In amputating the right thumb, the first incision is made on its radial side.

### AMPUTATION OF THE LITTLE FINGER AND THE METACARPAL BONE.

The surface of the unciform bone, which receives the fifth metacarp bone, is concave from behind forwards, and slightly from within outwards, so that a knife cannot be pushed at once completely across the joint; but it will pass very well half way through it from within outwards, in the direction of a line, which would terminate at the middle of the second metacarpal bone.

1. In order to determine the place of the joint, the inner edge of the metacarpal bone is to be traced with the forefinger, till a prominence is felt extending towards the palm. This is the unciform process, and directly in front of it lies the articulation. The articular interspace may also be felt on the back of the hand, especially when the bone is moved.

2. The soft parts being grasped and drawn away from the bone, a sharp knife is introduced perpendicularly through the skin and muscles opposite the ulnar side of the articulation, and the edge carried close to the bone from behind forwards. Thus a flap is made, which ends a little beyond the head of the phalanx. 3. While an assistant holds the flap out of the way, the surgeon dissects the integuments from the back of the bone, leaving untouched, however, the extensor tendon. The soft parts being drawn outwards, the knife is carried along the other side of the bone, without injuring the integuments on either side; and passing from behind forwards, it divides every thing as far as the digital commissure. 4. Its edge is then applied to the inner side of the articulation, and enters half way into it in the direction above specified, and in being withdrawn again cuts through the dorsal ligament. Then, for the division of the ligament of the two metacarpal bones, the point is passed obliquely between the two bones, with the edge turned towards the wrist. All that now remains to be done, is to cut through the muscles and ligaments on the palmar side.*

In this country, the operation is frequently executed by cutting through

* See Observations on Amputations of the Foot and Hand. Med. Gaz. 1836. For many of the foregoing directions, I am indebted to M. Malgaigne, whose little treatise on the Operations is one of considerable merit.

the interosseous space down to the os unciforme; forming the flap; and then cutting through the joint.

### AMPUTATION OF METACARPAL BONES ALONE.

The removal of injured, or diseased metacarpal bones, without their corresponding fingers, is sometimes practised. In compound fractures or dislocations, when the injury is confined to one or two of these bones, they may be excised, and a useful hand preserved; but, when the injury is more extensive, primary or secondary amputation will generally be required. In one instance of disease of the metacarpal bone of the ring finger, Dr. Macfarlane, of Glasgow, removed the bone by transfixing the metacarpal space on each side with a French bistoury, and cutting down from the carpal articulation to the first phalanx. A useful hand was the result. In another instance, he removed the metacarpal bones of the middle and ring fingers: he aimed at preserving no flap, and divided the metacarpal spaces by cutting upwards from the division of the fingers, taking care to avoid the extensor tendons of the fore and little fingers, which are apt to be divided on approaching the carpus. The metacarpal bones were readily dislocated from the os magnum and os unciforme, and with a little force the parts were put in contact. After several months, a serviceable hand, with free motion of the fingers, was obtained. Portions of these bones may be easily cut out with the aid of the cutting pliers.

### AMPUTATION OF PARTS OF THE FOOT.

I. *Amputation of a single Toe.*—The joints of the toes resemble those of the fingers; but the great toe has usually three sesamoid bones, two situated inferiorly, and one internally; while the second toe sometimes has one, and the little toe another. The methods of operating are here the same as on the hand; but that practised with an oval incision is often preferred.* Whether in amputating the great toe, it is most advantageous to disarticulate its first phalanx from the metatarsal bone, or to amputate in the continuity of the latter, is a disputed point. The first method is objected to by some practitioners, because the head of the first metatarsal bone is left, forming too great a projection, difficult to cover properly, and not well calculated to bear pressure. On the other hand, it is argued, that the head of this bone constitutes one of the points of the tripod, on which the foot rests, and hinders the internal side of the foot from inclining too much downwards. Hence, it is contended, that, if possible, it ought to be preserved. If the plan of amputating through the metatarsal bone be preferred, it is to be divided either with a fine saw, or a strong pair of cutting pliers.

II. *Amputation of the five Toes, according to the Method of Lisfranc.*—Few accidents are likely to occur, involving all the toes so severely as to require their removal, without the metatarsal bones being likewise implicated. Yet such cases have been met with, and, perhaps, as Velpeau observes †, they are more likely to happen where the toes are frost-bitten and perish, than from any other cause. But, even in examples of this kind, the necessity for the operation may sometimes be superseded by allowing time for the dead parts to be detached, after which, the end of

* J. F. Malgaigne, Op. cit. p. 335.

† Nouveaux Elém. de Méd. Opératoire, t. ii. p. 449.

the foot will heal by the granulating process. In the operation, it is to be recollected, that the second metatarsal bone is one third of a line longer than the first, which lies nearly on the same plane as the third; the fourth is half a line behind the latter; and the fifth still more backward, so that, according to the calculation of M. Malgaigne, a transverse line, drawn from its articulation, would pass over the origin of the articular part of the first.

1. A semilunar incision is begun at the inner side of the head of the first metatarsal bone, and extended close to the line at which the toes leave the foot, to the external side of the fifth metatarsal bone. The flap is then dissected up.

2. The point of the knife is then passed from within outwards over the joints, so as partly to open them; after which, the lateral ligaments are to be cut.

3. The knife is next introduced under the phalanges of the great and little toes, and then under all the phalanges at once. The surgeon, with his left hand, now presses the toes upwards toward the instep, and carries the edge and point of the knife from within outwards, following the track of the furrow in the fore part of the sole. The arteries having been tied and the wound dressed, the foot is to be laid on its outer side, in order that the pus may more readily escape, in the event of suppuration.

III. *Amputation of the first Metatarsal Bone.* — The posterior end of this bone has an extensive articular surface, in the direction from above downwards, slightly concave, and articulated only with the great cuneiform bone. The articulation is strengthened by four ligaments, an internal, a dorsal, a plantar, and an interosseous ligament. The following method is adopted by M. Lisfranc: — The operator takes hold of the integuments and muscles at the inner side of the bone with the thumb and fingers of his left hand, and draws them inwards as far as he can, in order to have a flap of suitable thickness. The point of a narrow straight bistoury is then introduced perpendicularly between the inner side of the bone and the soft parts, two lines behind the articulation, and a flap formed along the bone, terminating a little beyond the joint between the metatarsal bone and the first phalanx. From the base of this flap, which is to be held back by an assistant, another incision is made, which crosses the upper surface of the bone rather obliquely, and terminates at the inner and upper part of the articulation with the first phalanx. The knife is then carried between the two metatarsal bones, as close as possible to their posterior ends, and brought out on the external and plantar side, without touching any point of the skin; and every thing in the way of the knife is now cut through as far as the commissure of the toes. The next step is the disarticulation, which is accomplished by dividing the internal ligament, with the point of the bistoury kept perpendicularly, and the edge directed rather obliquely from within outwards, and from behind forwards, so that it may follow the direction of articular interspace. The upper ligament having been next cut through, the edge of the knife is turned upwards, and the point plunged between the external side of the first cuneiform bone and the inner side of the extremity of the second metatarsal bone. The interosseous ligament is then divided by cutting upwards, after which the surgeon completes the disarticulation by cutting through the few remaining ligamentous and muscular fibres.

Instead of making a second incision, after the flap is formed, the skin may be dissected up, from the base of the flap as far as the joint between the metatarsal bone and first phalanx, and drawn outwards by an

assistant. Here, as M. Malgaigne observes, the essential thing is to be able to pass the knife between the two metatarsal bones, without wounding the integuments.

Instead of disarticulation, the first metatarsal bone is sometimes divided with a strong pair of cutting pliers, which plan, if the disease or accident will allow, has the advantage of being less likely to excite inflammation in the joints of the tarsus.*

IV. *Amputation of other Metatarsal Bones.*—The fifth may be amputated in a similar way. For the removal of the second, third, or fourth, the oval method is often preferred. Béclard used to amputate the two first metatarsal bones as follows: — An incision is begun at the first interosseous space, six lines in front of the articulation, and extending obliquely as far as the commissure between the second and third toes; it next descends along the furrow under the second and first, and then passes obliquely upward to the point where it commenced. It is a true oval incision. Then, from the upper angle of this incision, two others are made, twelve or fifteen lines in length; one passing inwards and backwards, and the other outwards and backwards. The integuments are then dissected up on each side, and the bone freed from the parts covering it. Next, in order to get at the articulation, the posterior flap, bounded by the two last incisions, is reflected.

The same mode of proceeding is applicable to the disarticulation of the fourth and fifth metatarsal bones.

V. *Amputation of the whole of the Metatarsus.*— Here the joint is formed on one hand by the three cuneiform bones and the cuboid bone, and on the other by the five metatarsal bones; and its direction is such, that its inner side is nine lines more forward than its outer. The tuberosity of the metatarsal bone of the little toe will denote the situation of the joint between that bone and the cuboid; for it is situated immediately in front of a depression, which corresponds to the articulation. When the foot is placed in the position of abduction, the tendon of the peronæus brevis, which is attached to the tuberosity, may also be seen, or felt. The inner side of the joint may be found by attending to the following guides. 1. If a transverse line be drawn from the tuberosity of the fifth metatarsal bone to the inner edge of the foot, the joint will be found three quarters of an inch in front of it. 2. If the forefinger be carried along the inner and interior side of the first metatarsal bone, from before backwards, a tuberosity is first felt, then a depression, and lastly, a second protuberance. The joint is between these two eminences. 3. If the finger be passed along the inner edge of the foot, from behind forwards, the prominence of the navicular bone is felt an inch in front of the malleolus internus. The joint lies about thirteen or fourteen lines still more forward. 4. If the foot be bent on the leg, the tendon of the tibialis anticus, which is attached both to the great cuneiform and the first metatarsal bone, may be felt. 5. Lastly, as Malgaigne observes, the most prominent point of the instep, in front of the navicular bone, being ascertained, the joint is three lines nearer the toes.

As for the direction of the articular surface, the outer part, between the fifth metatarsal bone and the cuboid bone, is doubly oblique; at first, in the direction of a line, drawn from this point to the first joint of the

* The disadvantage of removing the first metatarsal bone, without the great toe, has been ably explained by Mr. Rynd. See Dublin Journ. of Med. Science, vol. viii. p. 292.

great toe; and then in the direction of another line, drawn from the same point to the middle of the first metatarsal bone.

The direction of the articulation of the fourth metatarsal bone corresponds to a curved line, about an inch in length, begun externally, and terminating inwardly, four lines in front of the point of its commencement.

The articulation of the third metatarsal bone is nearly transverse, and usually half a line more forward than the last.

The second metatarsal bone extends backward, being lodged in a kind of mortise, formed by the three cuneiform bones, the internal side of which is four lines deep, and oblique from behind outwards; while the external side is two lines deep, and oblique from behind inwards. The posterior side is six or seven lines in breadth, and flat, and nearly transverse.

The articulation of the first metatarsal bone is three lines in advance of that of the third, and its direction corresponds to a line drawn from its inner part to the middle of the fifth metatarsal bone.

In respect to the ligaments, if the second metatarsal bone be excepted, which is fixed in the mortise by three ligaments, each metatarsal bone has on its dorsal side but one ligament. The plantar ligaments are not of less importance than the three interosseous. The first internal one, which is the strongest, goes from the outer side of the first cuneiform bone, and the inner side of the second, to be inserted into the corresponding surfaces of the first and second metatarsal bones. The second, or middle ligament, proceeds from the external side of the second cuneiform bone and the inner side of the third, to the outer side of the second metatarsal bone, and the inner side of the third. The third is fixed, on one hand, into the outer side of the third cuneiform bone, and the inner surface of the cuboid; and, on the other hand, into the external side of the third, and the inner side of the fourth, metatarsal bone.

In consequence of the foregoing arrangement, the lateral parts of the mortise are only in immediate contact with the second metatarsal bone towards the dorsum of the foot, and the interspaces, left on the plantar side for the lodgment of the interosseous ligament, will permit the point of the knife to enter.*

*Lisfranc's Method.* — On the right foot, a semilunar incision is made across the instep, half an inch in front of the joint, through the whole thickness of the soft parts. The skin is drawn back, and the point of the knife placed on the outer side of the joint. The edge, being carried in the directions above specified, now enters the joint, and passes as far as the third metatarsal bone. There the knife is to be inclined half a line more forward, and the incision extended almost transversely to the second metatarsal bone. In this part of the operation, the general maxim is to be followed of not letting the blade become locked in the joint, but merely to aim at dividing the ligaments with its point. As soon as the knife has reached the second metatarsal bone, it is to quit this side of the joint, in order to attack it at the internal side. Here it is to be held perpendicularly, and introduced with the edge towards the tarsus, so as to pass close along the inner surface of the first metatarsal bone; and directly it is stopped by the head of the bone backwards, its position is to be made perpendicular to the axis of the foot, and the joint is to be penetrated by a sawing motion, in the direction of a line extending to the middle of the fifth metatarsal bone. In detaching the mortise connection,

* See J. F. Malgaigne, Manuel de Méd. Opératoire, pp. 342—344.

the operator passes the point of the knife between the first cuneiform and the second metatarsal bone, with the edge turned towards the leg, and cuts along the whole of the inner side of the mortise, not forgetting its slight obliquity inwards. In this manner, the penetration of the joint between the first and second cuneiform bone will be avoided, and the internal interosseous ligament be completely divided. The knife is then withdrawn, and its point carried transversely over the dorsal ligament at the posterior part of the mortise, and then from behind forward over the dorsal ligament at its external side. Gentle pressure is now to be made on the end of the foot to separate the articular surfaces; while the external and middle interosseous ligaments are divided from above downwards, with the point of the knife.

In finishing the operation, the surgeon places the foot in a perfectly horizontal position, and carries the point of the knife freely over the plantar ligaments; detaches the textures which are adherent to the posterior end of the metatarsus, avoiding the tuberosities of the first and fifth metatarsal bones; and then pushing the knife under the whole row of them, he carries it forward along their inferior surface, and thus forms a semilunar flap, the inner part of which should be two inches long, and the outer one inch. The aim should be to save more skin than muscle. If any large tendons should be left denuded in the flap, they are to be cut away with scissors. It is the plantar flap which is designed to cover the whole of the wound; the small upper flap being only intended to prevent any exposure of the upper surface of the tarsal bones. The upper flap should only be employed as a cover for the end of the foot, when there is not enough skin afforded by the state of the limb for the perfect formation of the plantar flap; because the cicatrix will be situated too much forward, and ill calculated to bear pressure.

VI. *Amputation at the Middle of the Tarsus, or the Articulation between the Astragalus and Os calcis behind, and the navicular and cuboid Bones in front.* — If the foot is extended, the outer side of this joint will be found twelve or fifteen lines in front of the extremity of the fibula; its inner side, ten or eleven lines in front of the malleolus internus; and its middle part, about an inch in front of the ankle joint. When the foot is flat on the ground, the articulation is about three quarters of an inch in front of the tibia; but, when extended, the interspace may be nearly thrice this measurement. Another guide is the mid-point between the malleolus externus and the tuberosity of the fifth metatarsal bone; here is the articulation between the os calcis and the os cuboides, situated, according to Lisfranc, six lines behind that tuberosity. In passing the finger along the outer side of the foot from the malleolus externus, the first tuberosity met with is formed by the os calcis, and the joint is in front of it. To find the inner end of the joint, the finger may be passed forward along the internal side of the foot from the malleolus internus; and the first protuberance met with, will be that of the navicular bone: the articulation is directly behind it. (Richerand.) The precise situation of the upper and middle part of the joint may be ascertained by extending the foot, and placing it in the position of adduction; if the finger is now put on the junction of the external with the middle third of the intermalleolar space, and the instep traced with it, the first eminence met with, will be the head of the astragalus, constituting part of the joint itself. (Dupuytren.)

As for the direction of the articular surfaces, when the foot is bent, the astragalus and os calcis are nearly in the same line; when it is extended, the os calcis advances at least three lines more forward than the astragalus.

The navicular bone extends a good way towards the malleolus internus, and here the direction of the articulation is that of a line, drawn from the back and inner part of that bone, to the place of junction of the posterior with the middle third of the fifth metatarsal bone. In its middle third, the articulation inclines slightly backwards towards the malleolus externus; then it turns a little forwards, and lastly rather backwards again. Therefore, in cutting into the joint at its external side, the knife should be inclined a little forwards.

The most important ligament, the true key to the joint, as M. Malgaigne expresses himself, is the interosseous, attached on one side to the os calcis and the astragalus; and, on the other, to the navicular and cuboid bones. Its situation corresponds to the depression of the external and inferior side of the head of the astragalus: and here it must be attacked.

The *operation* is performed on the left foot as follows: — The surgeon places his left thumb on the external side of the joint, and his fore-finger on the tuberosity of the navicular bone. Between these two points a semilunar incision is made, the middle part of which should be half an inch in front of the joint. The inner part of the joint is then opened in the direction above particularised, and the knife then carried to the front of the head of the astragalus. The dorsal ligaments are then cut with the part of the edge of the knife near its point; and next the outer side of the joint is opened with the edge inclined a little forwards. The point is now introduced under the external and anterior side of the head of the astragalus, and, with the edge turned forwards, the interosseous ligament is cut in the direction of the articular surface of the os calcis.

The joint being thus freely laid open, the plantar ligaments are to be divided, and the knife conveyed close under the bones, to form a suitable flap. This is most expeditiously done, I think, by transfixion. In this part of the operation, care should be taken to avoid the protuberances of the navicular and cuboid bones, and beyond them, those of the first and fifth metatarsal bones.*

The plantar and dorsal arteries of the foot having been secured, the flap is to be brought over the astragalus and os calcis, and fixed by means of adhesive plaster, with or without the aid of a couple of sutures.

I have seen cases, in which the remainder of the foot after this operation was so serviceable, that the patients walked with but a very trivial degree of lameness. Mr. Copland Hutchison sent one of his patients to my house, on whom the operation had proved thus successful. However, Dupuytren, Lisfranc, and some other eminent surgeons, prefer amputating at the junction of the metatarsal bones with the first phalanges of the toes, whenever the state of the limb will allow it, because, the whole of the tarsus being preserved, the anterior lever of the foot continues greater than the posterior; and the extensor tendons of the toes adhering to the cicatrix, aided by that of the tibialis anticus, inserted into the inner cuneiform and first metatarsal bones, prevent the foot from being displaced backward; a serious grievance, which, though not constant, is alleged to have sometimes followed Chopart's operation, and required a division of the tendo Achillis. This operation is not well suited for scrofulous disease of the foot; nor for mortification, which is either spreading, or has already reached on any side above the place of the incisions.

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* See J. F. Malgaigne, Man. de Méd. Opératoire, p. 347.

## OPERATIONS ON ARTERIES.

### LIGATURE OF THE COMMON CAROTID ARTERY.

This operation is occasionally necessary for the cure of aneurism; the stoppage of hemorrhage; and the cure of certain tumours, composed of vascular erectile tissue, growing within the orbit. It has also been undertaken in cases, where extensive tumours of this character were situated on other parts of the face and head, but, as I believe, without any decided success.* The operation has been sometimes resorted to for the prevention of hemorrhage in the removal of the lower jaw, and large swellings of the neck. This practice is not, however, usually adopted by the most judicious surgeons, who know, that a double operation is generally avoidable, either by pressing the common carotid artery against the transverse processes of the cervical vertebræ, if necessary, or by tying, or pressing on the mouth of, every large artery, as soon as such vessel is divided.

The right common carotid, which arises from the innominata opposite the sterno-clavicular articulation, is shorter, and, at its commencement, more superficial, than the left, which originates further back from the arch of the aorta. After emerging from the chest, each of them has at its inner side the trachea, and higher up the thyroid gland (which sometimes overlaps it), the pharynx, and the larynx, near which it continues up to its usual place of bifurcation, the upper edge of the thyroid cartilage. At its external side is the internal jugular vein, which partly overlaps it; while between the two vessels, and rather behind them, the pneumogastric nerve descends enclosed with them in the same sheath of condensed cellular tissue. Behind the sheath is situated the great sympathetic nerve, resting on the rectus anticus muscle; while the inferior thyroid artery also crosses from behind the lower portion of the same sheath in its course inwards and upwards towards the thyroid gland. The nervus descendens noni usually lies on the forepart of the sheath; though occasionally some of the twigs, derived from the arch formed by its junction with two filaments of the cervical plexus, are found within the sheath lower down the neck. The common carotid artery may be regarded as resting on the transverse processes of the cervical vertebræ, with the interposition of the longus colli and rectus capitis anticus muscles. On its outer side, and near its root, it is covered by the sterno-mastoid muscle, which gradually passes backward, so as no longer to conceal it. On its inner side, it is covered, first by the outer border of the sterno-hyoid and sterno-thyroid muscles, and then by the corresponding lobe of the thyroid gland, and several considerable veins of the face and neck, as they are proceeding towards the internal jugular vein. It is divided into two portions by the omohyoideus muscle which crosses over the anterior surface of the sheath, about the middle of the neck, or opposite the upper rings of the trachea. In fact, as Velpeau observes, this little muscle, as it ascends from behind the sterno-mastoideus to the os hyoides, divides the side of the neck into two very regular triangular spaces. In the lower one, the sides of which are formed by the trachea, the clavicle, and the omohyoideus, the artery is concealed by the inner border of the sterno-mastoid muscle, and is deeply situated; while in the

* See Velpeau, Nouveaux Elém. de Méd. Opér. t. i. p. 239., where many trials of this practice are referred to. The result is very discouraging.

upper triangular space, bounded externally by the margin of the sterno-mastoid muscle, above by a transverse line drawn across from the os hyoides, and below by the omohyoideus, the situation of the artery is more superficial.

1. *Operation below the Omohyoideus.* — The patient should lie on his back, with the neck extended, and the head turned towards the opposite side. The anterior edge of the sterno-mastoid muscle is the guide for the external incision, which should be about three inches in length, terminating a little way above the sternum. The first stroke of the knife divides the skin, superficial fascia, and platysma myoides. Thus the edge of the sterno-mastoid muscle is exposed. This is to be drawn to the outer side of the wound, and the sterno-thyroid and sterno-hyoid muscles towards the trachea, when the deep cervical fascia will be brought into view, and require to be carefully divided: for this purpose, a portion of it may be pinched up with the forceps, and cut with the edge of the knife kept horizontally, and close to the end of the forceps. Into the opening thus made, a director is to be introduced, along which the further division of the fascia may be safely made. The sheath is to be carefully opened in the same manner, and so as to avoid the internal jugular vein and nervus descendens noni, but only to the extent of half an inch, in order not to disturb the connections of the artery more than absolutely requisite for the passage of the aneurism needle and ligature under it, according to the principles advocated in the consideration of the subject of hemorrhage.

Were it necessary to tie the common carotid very low down, an incision might be made three inches in length, beginning at the sternal end of the clavicle, and carried obliquely upwards and outwards, over the interspace between the sternal and clavicular portions of the sterno-mastoid muscle. The skin, platysma myoides, cellular tissue, and fascia are then to be cautiously divided in succession, while the two portions of the muscle are held apart. The jugular vein will now present itself, at the inner side of which will be found the artery, in front of the longus colli, the vertebral artery and vein, and the great sympathetic nerve, which last is in close relation to the posterior part of the sheath. After the sheath has been opened, the surgeon should separate the artery, from the vein and nervus vagus, and apply the ligature according to the following rule, which is applicable to the ligature of great arteries in general: — The aneurism needle, eye probe, or whatever other instrument is employed for the conveyance of the ligature under the artery, is to be passed between the artery and vein, with the point turned away from the latter vessel, and guided closely round the artery, by which means the vein, together with the nervus vagus, in this instance, will not be endangered by the needle, and, at the same time, will be safely excluded from the ligature. The point of an aneurism needle, however, should never be so sharp as to be likely to wound either the artery or vein, yet fine enough to pierce with facility the delicate cellular tissue, connecting the interior of the sheath to the artery.

2. *Operation above the Omohyoideus.* — From the point where the common carotid is crossed by the omohyoideus, opposite the upper rings of the trachea, up to its bifurcation, the artery is covered only by the integuments, platysma myoides, and fascia, for the sterno-mastoid muscle has now diverged from it backwards in its course towards the mastoid process. However, though this part of the carotid artery is thus superficial, it is frequently covered by a plexus of veins.

The chin being turned towards the opposite side, the first incision is to commence on a level with the os hyoides, and to extend downwards, about two inches and a half, near the inner border of the sterno-mastoid muscle. The skin, platysma hyoides, and fascia having been divided, and the sterno-mastoid muscle drawn a little towards the outer side of the neck, the sheath of the great vessels, with the nervus descendens noni in front of, or to the outer side of it, is seen immediately above the omohyoideus muscle. The surgeon, avoiding the nerve, now opens the sheath, and passes the aneurism needle with the ligature between the internal jugular vein and the carotid artery, from without inwards, and closely under the latter vessel, for reasons already explained.

By extending the incision upwards towards the mastoid process, the external carotid might be exposed as high up as the point where it reaches the tendon of the digastricus muscle, and a ligature applied half an inch above the bifurcation; but for various considerations, one of which is the nearness of the ligature to a collateral branch, and the danger of this interfering with the closure of the vessel, it is generally deemed more advantageous to take up the common carotid. Even in a wound, it might sometimes be difficult to ascertain positively, whether the bleeding proceeded from the latter vessel, or the external or internal carotid.*

### LIGATURE OF THE ARTERIA INNOMINATA, OR BRACHIO-CEPHALIC TRUNK.

This, which is the first branch given off by the arch of the aorta, arises at the junction of the ascending with the transverse part of that arch; and is situated behind the first bone of the sternum; passing obliquely upwards to behind the right sterno-clavicular articulation, where it divides into the right subclavian and right carotid arteries. Above, it is separated from the first bone of the sternum by the sterno-hyoid and sterno-thyroid muscles; and below, by the left subclavian vein, which crosses it.† Its external side is in contact with the pleura, while its inner rests upon the trachea. It varies in length from one to two inches, and is sometimes wanting; in which case, the right carotid and subclavian arteries arise from the arch of the aorta separately. The pneumo-gastric nerve and internal jugular vein lie a good way external to it. Between the sterno-thyroid and sterno-hyoid muscles and the arteria innominata, a very loose cellular tissue intervenes, in which lie several veins descending from the thyroid gland to the left subclavian vein.

In the method of operating commonly advised, the skin, the superficial fascia, the platysma myoides, the sterno-mastoid, sterno-hyoid, and sterno-thyroid muscles, are the principal parts cut; but no vessel, nor nerve of importance, is injured. Yet if, instead of searching for the innominata from before backwards, and rather from above downwards, calculating from the sterno-clavicular articulation, the surgeon were to cut too far outwards, the pneumo-gastric and recurrent nerves, and the internal jugular vein, and principal branches of the subclavian artery, would be endangered.

*First Method.* — The patient is to be placed on his back, with his head considerably extended backward, so as to bring the innominata as high

* See P. J. Manec, Traité Théorique et Pratique de la Ligature des Artères, fol. Paris, 1832. Also Alf. Velpeau, Nouveaux Elém. de Méd. Opératoire, t. i. p. 244.

† See Dr. Quain's Elements of Anatomy, p. 432. ed. 2d.

up as possible. The first incision is to begin immediately above the sternum, at the mid-point between the two sterno-mastoid muscles, and extend over the origins of the right sterno-mastoid muscle, three inches towards the right shoulder, at the distance of about half an inch above the clavicle. By this the skin, superficial fascia, and platysma myoides, are divided. Another incision, about two inches in length, is then made at the inner border of the right sterno-mastoid muscle, so as to join the inner end of the first. The next thing is to cut through the sternal origin and part of the clavicular attachment of the sterno-mastoid muscle, which may be safely done with the aid of a director. The flap is then reflected outwards. The operator has now brought into view the deep cervical fascia, and the outer portions of the sterno-hyoid and sterno-thyroid muscles, under which a director is to be passed, when they may be cut through with a probe-pointed bistoury. After this, a cutting instrument is not to be employed, but the artery separated from its connections with the aid of a director, or other blunt instrument; and, in detaching the vessel at its outer and posterior part, great care must be taken not to lacerate the pleura. The aneurism needle is then to be conveyed between the artery, the pneumogastric nerve, and the pleura on one side, and its point brought out between the artery and the trachea on the other. Manec considers the perpendicular incision superfluous, but Dr. Mott and Professor Graefe, who have had occasion to tie the innominata in the living subject, both made the incision at the inner side of the sterno-mastoid muscle. With regard to the fate of the patients, one died on the 26th day after the operation; the other on the 56th. A case under Mr. Lizars had a similar end.

*Second Method.*—An incision, between two and three inches in length, is first made near the lower part of the internal margin of the sterno-mastoid muscle, and parallel to it. With the fingers, or a director, the operator then separates the cellular tissue interposed between the sterno-mastoid and the sterno-hyoid and sterno-thyroid muscles, and then also separates that which intervenes between these two muscles and the trachea. On reaching the cellular tissue, in which the veins from the thyroid gland ramify, they are pushed aside, or cut through, after having been tied. The patient's head being now bent forward, the surgeon passes his forefinger between the trachea and the sterno-hyoid muscle, and feels the artery: with a blunt curved probe, it is separated from its connection, first on the right side, then on the left, and lastly below. The ligature is then applied, as already explained. This plan, which was suggested by the late Mr. King, has never been tried on the living subject.

### LIGATURE OF THE SUBCLAVIAN ARTERY, WHERE IT PASSES OVER THE FIRST RIB.

The subclavian artery ought to be studied, first, in the part of its course before it reaches the scalenus*; secondly, where it is passing behind that muscle; and thirdly, from the outer border of the same muscle to the outer edge of the first rib.† In the first division of their course, the right and left subclavian arteries differ considerably. The right is larger

* The right subclavian artery has been taken up in this place by Mr. Liston in two instances of subclavian aneurism, in University College Hospital. In one of the cases, the right carotid artery was also tied at its origin. In both examples, fatal hemorrhage ensued from the artery on the distal side of the ligature.

† See Dupuytren, Leçons Orales de Clinique Chir. t. iv. p. 528.

and shorter than the left, which, as coming from the arch of the aorta, is more deeply placed. But, after reaching the internal edge of the scalenus anticus muscle, both arteries have nearly the same relations to other organs. In the latter, or third, division of its course, the artery lies deeply within a triangular space, bounded upwards and outwards by the omo-hyoideus; inwards by the scalenus anticus; and below by the clavicle. After passing from behind the scalenus, its direction is outwards and downwards over the pleura and a groove in the first rib. The left, however, lies more closely to the rib; the right being only in contact with its outer edge.* The artery is necessarily beneath the clavicle and behind the subclavius muscle. Above, it is in contact with the dorsal nerve of the brachial plexus; while, in the direction forwards, and a little below the artery, is placed the subclavian vein, which reaches this situation by passing in front of the scalenus anticus, while the artery passes behind it. At this point, then, the scalenus anticus is interposed between the artery and the vein, with the phrenic nerve descending near the inner border of it. The cervical nerves, converging to form the brachial plexus, pass above and more backward than the subclavian artery, in front of the scalenus posticus, and consequently they and the artery must lie in the space between this muscle and the scalenus anticus. In the triangular space, already described, the artery may be got at by dividing the following parts: — 1st, the skin; 2d, the superficial fascia; 3d, the platysma myoides; 4th, the deep cervical fascia; 5th, a quantity of cellular tissue, which is interspersed not only with veins, and lymphatic glands, but pervaded by two arteries of importance, namely, first, the supra-scapular, which runs under the back edge of the clavicle towards the root of the coracoid process, and, secondly, the posterior scapular artery, which, after having arrived at the posterior angle of the scapula, descends along its base to its inferior angle. It is between these two arteries, then, that the surgeon has to make his way to the subclavian. When the attachment of the sterno-mastoid muscle to the clavicle is extensive, it is necessary to divide also a part of it. Within the above triangular space, the external jugular vein, as well as several of its branches, descends; and if it lie rather more towards the outer side of the neck than ordinary, and cannot be pushed sufficiently inwards, it may be indispensable to divide it after a double ligature has been introduced under it. In individuals whose necks are short, the first rib is situated very low, in relation to the clavicle, and consequently the depth of the subclavian artery is considerable. The same disadvantage may be produced by the aneurismal tumour pushing the clavicle upwards. In general, when the neck is long, the interspace between the clavicle and first rib is but moderate, and the subclavian artery is consequently less distant from the skin.† But one of the most essential points of surgical anatomy, with reference to the ligature of the third division of the subclavian artery, is the tubercle of the first rib, to which the scalenus anticus is attached, and close to the outer side of which the artery always passes.

*Operation.* — 1. If the state of the disease will allow, the shoulder is to be depressed and pushed forwards. The situation of the external jugular vein having been ascertained in order that it may not be cut, if possible, an incision is made directly above the clavicle, and parallel to its

* See P. J. Manec, De la Ligature des Artères.

† See Dupuytren, Leçons Orales de Clinique Chir. t. iv. p. 578.

posterior border, beginning one inch from the sternal end of that bone, and terminating at the insertion of the trapezius; or, I may say, that it should extend nearly to the anterior margin of the trapezius, about two thirds of the way along the posterior border of the clavicle. If the operator conceives that a freer division of the integuments will facilitate the operation, he may make a perpendicular cut an inch and a half long, which is to descend along the outer margin of the clavicular portion of the sterno-mastoid, and join the horizontal incision. 2. The skin, superficial fascia, and platysma myoides, having been divided, and the external jugular vein held to one side with a blunt hook, the surgeon may next divide a part of the sterno-mastoid muscle, if its extension outwards should render this proceeding advisable. 3. The omohyoideus, situated between the two layers of the cervical fascia, may now be seen crossing the outer extremity of the wound, and the deep cervical fascia is found to stop the surgeon's advance more deeply towards the artery; consequently, it is to be cautiously divided with the aid of a director, after which no further use of a cutting instrument should be made. 4. With a probe, or director, the surgeon now separates the cellular tissue, and searches for the external border of the scalenus anticus at the anterior and inner part of the wound,—a sure guide to the artery; for, by tracing it downwards with the left forefinger, he is conducted to the tubercle of the first rib, immediately external to which, the artery will be felt pulsating. 5. Under the guidance of the same finger, the ligature is then cautiously introduced under the artery, by means of a common aneurism needle; or, if necessary, that invented by Weiss, or others expressly made to convey ligatures under arteries inconveniently placed for the use of common means. The point of the needle, which should never be too sharp, is to be passed under the artery, directed from before backwards, in order not to endanger the subclavian vein; and, just at the moment when the needle is passing, the operator is to keep the artery down with his left fore-finger, so that the point of the needle may have room to be brought up, without getting hold of the lowermost nerve of the brachial plexus.

M. Blandin refers to an instance, in which the subclavian vein passed behind the scalenus anticus, between this muscle and the artery (Anatomie Topographique); and M. Manec saw an example, in which the subclavian artery was in front of the scalenus anticus, between that muscle and the vein. The possibility of such anomalies should be remembered.

### LIGATURE OF THE SUBCLAVIAN ARTERY IN THE SECOND DIVISION OF ITS COURSE, OR BETWEEN THE SCALENI.

The operation is begun in the manner of the preceding one; and the tubercle of the first rib having been felt, a director, somewhat bent, is introduced behind the anterior scalenus, and the lower attachment of this muscle divided with a probe-pointed bistoury. In this part of the operation, care must be taken not to injure the phrenic nerve, which descends along the inner margin of the scalenus anticus, and a little in front of it; nor the subclavian vein. The muscle, directly it is cut, is retracted, leaving the artery exposed, under which the director may then be passed in Dupuytren's way from without inwards, along the groove of which an eye-probe with the ligature is to follow. Thus, he avoided including the nearest nerve of the brachial plexus, and though the director and eye-

probe were passed from without inwards, the subclavian vein was perfectly safe, because no instrument capable of puncturing it was employed.

### LIGATURE OF THE BRACHIAL ARTERY IN THE MIDDLE AND UPPER PARTS OF THE ARM.

The brachial artery commences at the lower margin of the axilla, and terminates about three quarters of an inch below the bend of the elbow, its course corresponding to a line drawn from the centre of the armpit to the middle point between the condyles of the humerus. In the upper half of the arm, it lies near the inner margin of the coraco-brachialis, and then crossing over the insertion of this muscle, it becomes situated at the inner side of the biceps, which partly overlaps it, especially when the fore-arm is in the prone position. At first, the artery lies in front of the triceps muscle, but below the insertion of the coraco-brachialis: the muscle, on which it rests during the rest of its course, is the brachialis anticus. The median nerve, which, above, runs along its acromial margin, soon gets in front of it, and, crossing it about the middle of the arm, lies completely upon its inner side below. Two satellite veins accompany the artery, and sometimes even cover it, or separate it from the median nerve. The ulnar and internal cutaneous nerves, which run near the artery above, separate further and further from it, as they descend. In thin subjects, the artery is but a very little way under the fascia, which sends off a duplicature, for the investment of the artery, the accompanying veins, and the median nerve. In the lower third of the arm, the trunk of the basilic vein lies over the track of the artery. Amongst the anomalies deserving notice, is the high bifurcation of the artery, a frequent occurrence*; and the occasional passage of the median nerve under the artery †, a rarer circumstance. In all ordinary cases, this nerve is the first cord met with behind the inner edge of the biceps, below the insertion of the coraco-brachialis.

In selecting the place for the external incision, four circumstances serve as our guide. 1. In the upper part of the arm, the inner border of the coraco-brachialis, which, in a muscular person, rather overlaps the vessel, but below the insertion of this muscle, namely, all along the lower half of the arm, the inner edge of the biceps denotes the best place for the external incision. 2. The oblique line, drawn from the middle of the armpit to the middle of the space between the condyles of the humerus. 3. Placing the fingers of the left hand on the track of the median nerve, and making the incision just at its inner side, as directed by Lisfranc with reference to the lower half of the arm. 4. The pulsation of the artery.

An incision, three inches in length, having been made through the integuments, the surgeon passes his left forefinger into the wound, and ascertains again the precise situation of the artery and median nerve. With the aid of a director, the fascia is next divided to the extent of the external incision. The median nerve is the first cord now met with at the inner margin of the biceps, and is easily known by its firm round feel and white colour: it is to be separated with a probe or director from the

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* In a case of circumscribed false aneurism, Dr. Browne, of St. Mark's Hospital, tied both branches with success, the omission of which practice has in some other instances been followed by the death of the patients from hemorrhage. See Dublin Journ. of Med. Science, vol. viii. p. 253.

† See Velpeau, Nouveaux Elém. de Méd. Op. t. i. p. 212.

sheath, and the artery will be found either directly under it, or, if the operation be done low down the limb, at its external side. Further inwards, lies the internal cutaneous nerve; and five or six lines backward, is the ulnar. The sheath having been opened, the ligature is to be passed under the artery, with the precaution of not including the veins.

In order not to mistake the ulnar for the median nerve, which would cause much confusion, it is advantageous to direct the incisions from the front towards the back of the limb.

In the upper part of the arm, the external incision is to correspond to the inner margin of the coraco-brachialis; and, very high up, the median nerve will present itself on the acromial side of the artery.

### LIGATURE OF THE BRACHIAL ARTERY AT THE BEND OF THE ELBOW.

An incision is to be made, two inches and a half or three inches long, parallel to the radial edge of the pronator radii teres, beginning nearly an inch above the trochlea, and ending at the central point between the condyles of the humerus. Under the skin are situated the median and basilic veins, with the accompanying branches of the internal cutaneous nerve. An assistant holds these vessels aside with a blunt hook, or the end of a bent probe. The fascia is now arrived at, which should be divided on a director, as well as the aponeurosis coming off from the biceps. Then, having detached the artery from the adjacent cellular tissue and fat, and from the deep veins, as well as the median nerve, the surgeon should pass an eye-probe between the artery and the latter nerve. The artery will be found resting upon the inner portion of the brachialis anticus, between the biceps and the pronator radii teres. Pursuing its course downwards and forwards, and from within outwards, it crosses completely over the tendon of the biceps low down. A deep-seated vein runs near its radial margin; and the median nerve, which sometimes touches its ulnar edge, is often separated from it by a few fibres of the brachialis.*

### LIGATURE OF THE EXTERNAL ILIAC ARTERY.

The aorta, having reached the body of the fourth lumbar vertebra, bifurcates into the two common iliac arteries, which diverge from one another as they pass to the sacro-iliac symphysis. Here each of these trunks subdivides into the internal and external iliac arteries. From the sacro-iliac symphysis, where the external iliac artery begins, down to Poupart's ligament, where it terminates, it describes a gentle curve with the convexity outwards, which curve is greater in women than men, and always more marked the broader the pelvis is. The course of the artery is obliquely downwards and outwards, to the middle point between the anterior superior spinous process of the ilium, and the symphysis pubis. In its descent, it lies upon the inner border of the psoas muscle, with the external iliac vein at first behind it, and afterwards on its inner side, connected to it by a loose cellular tissue, that is readily torn. The anterior crural nerve is separated from the external iliac artery by the psoas muscle. The artery is connected behind to the iliac fascia by a cellular tissue, which adheres firmly to each side of the vessel. In front of this fascia is the peritoneum, loosely connected to it. The internal branch of the genito-crural nerve, in its descent from the lumbar plexus to the

* See Velpeau, Nouveaux Elém. de Méd. Opératoire, t. i.

upper and internal part of the thigh, runs along the inner and front surface of the artery. Several lymphatic glands are contiguous to the artery, as it passes down to Poupart's ligament. The ureter crosses over the lower part of the common iliac artery, and the spermatic vessels cross in front of the external iliac artery. No branches are given off from the latter artery until it has nearly reached Poupart's ligament, where the circumflexa ilii arises from its outer, and the epigastric from its inner side. The intestines, lying between the artery and the parietes of the abdomen, may readily be lifted up from that vessel, together with the peritoneum. For the purpose of applying a ligature to the external iliac artery, the following parts must be divided: — 1. The integuments. 2. The superficial fascia. 3. The aponeurosis of the external oblique muscle. 4. The internal oblique muscle. 5. The transverse muscle. 6. The fascia transversalis. But the peritoneum, which can be raised from the iliac fossa, should not be wounded. Care must also be taken not to injure the external iliac vein, and the epigastric artery, which ascends obliquely upwards and inwards, between the fascia transversalis and the peritoneum, at the inner side of the internal abdominal ring. In consequence of the situation of the origin of the internal iliac artery, a ligature cannot be applied more than three inches above Poupart's ligament, without great risk of failure.

*Operation. — Abernethy's Method.* — The incision is made through the integuments, beginning above Poupart's ligament, half an inch on the outside of the abdominal ring, and extending obliquely upwards about three inches in the course of the artery. The skin, superficial fascia, and aponeurosis of the external oblique muscle having been divided, the left forefinger is introduced, at the lower angle of the incision, under the lower border of the internal oblique and transverse muscles, which are also to be divided with a probe-pointed bistoury to the extent of an inch and a half. The fascia transversalis having been cautiously opened with the aid of a director, the peritoneum and bowels are to be pushed upwards and inwards over the psoas muscle, so as to expose the external iliac artery, an inch and a half, or two inches, above Poupart's ligament. With a common aneurism needle, or that of Weiss, a ligature is then passed under the artery from within outwards, by which means the vein will not be endangered.

*Sir Astley Cooper's Method.* — A semilunar incision, three inches long, is made through the integuments, in the direction of the fibres of the aponeurosis of the external oblique muscle, with its convexity downwards and outwards. It commences a little way in front of the anterior superior spinous process of the ilium, and terminates near the abdominal ring. The aponeurosis of the external oblique muscle is next divided in the same direction. On raising the semilunar flap, the spermatic vessels are seen, and these serve as a guide to the opening in the fascia transversalis, named the internal abdominal ring, a little to the inner side of which the epigastric artery runs. The finger being now passed below the cord, the external iliac artery will be felt pulsating directly behind the internal ring, where it may be easily taken up. The latter opening is placed nearly at the mid point of the crural arch. It is to be divided in the direction outwards with a probe-pointed bistoury, guided along a director.

Mr. Norman cuts in the direction of Poupart's ligament; but, in other respects, follows Sir Astley Cooper's plan. M. Roux begins the incision

a little above, and half an inch from the spine of the ilium, and lets it terminate at the centre of the crural arch.

*Velpeau's Method.* — A slightly curved incision, three inches long, is made parallel to Poupart's ligament, but a little above it, the centre of which is to correspond to the place of the artery. By the first stroke of the knife, the skin and superficial fascia are divided. Then the aponeurosis of the external oblique, which is cut on a director. Next the fibres of the internal oblique present themselves, the lower portion of which are detached with the end of a probe, or director, and pushed with it upwards and backwards, while the lower margin of the wound is pressed downwards with the forefinger of the left hand. The fascia transversalis is torn in the same way as far as the spermatic cord, which is to be pushed in the same direction as the fibres of the internal oblique.

The cellular tissue, connecting the artery to the iliac fascia, is now ruptured with a probe or director, which instrument is then to be conveyed to the inner side of the artery, and moved gently backwards and forwards, in order to separate the artery from the vein. The ligature is next conveyed under the artery with an eye-probe, or an aneurism needle. Care is taken to tie the artery sufficiently above the epigastric. Béclard lost his patient by placing the ligature below it; and hence, Bogros always looks for the epigastric, before he searches for the external iliac.

During the other steps of the operation, the abdominal muscles should be relaxed, and the patient make no efforts, for otherwise the bowels will force themselves against the wound, and the peritoneum be exposed to injury. Whatever method be preferred, the course of the epigastric artery at the inner side of the internal ring, between the peritoneum and the fascia transversalis, must be remembered. In one instance, it was wounded by Dupuytren.

### LIGATURE OF THE COMMON ILIAC ARTERY.

The bifurcation of the aorta generally takes place on the fifth lumbar vertebra, but sometimes on the fourth, which circumstance must make a difference in the length of that artery, in different subjects. The right common iliac artery is longer than the left, because the bifurcation of the aorta is situated rather to the left of the median line. The right common iliac artery descends obliquely over the last lumbar vertebra, from which it is separated by the common iliac veins in their passage to the vena cava. Its own corresponding vein is first behind it, and then internal to it; while, on the left side, the common iliac vein runs along the inner side of the artery, having first passed under the right common iliac artery. The common iliac artery lies behind the peritoneum, and is crossed by the ureter just before it reaches the sacro-iliac symphysis, where it divides. The left has the sigmoid flexure of the colon in front of it; and the right, a portion of the ilium.

In Dr. Mott's plan, an incision is begun on the outside of the abdominal ring, half an inch above Poupart's ligament, and extended, about eight inches, to a point above the anterior superior spinous process of the ilium, in a semicircular form.

Mr. Crampton's incision, the concavity of which was towards the navel, was seven inches long, and reached from the last rib to the anterior superior spinous process of the ilium. The layers of the abdominal muscles, and the fascia transversalis, having been divided, the peri-

toneum and the bowels are then pushed forwards, and inwards which will also lift the ureter off the lower portion of the artery. While an assistant holds the peritoneum and the bowels out of the way, the surgeon passes the ligature under the artery, with due regard to the situation of the vein.

### LIGATURE OF THE INTERNAL ILIAC ARTERY.—MR. STEVENS'S METHOD.

An incision, five inches in length, is made six lines from the outer side of the epigastric artery, and parallel to the course of this vessel. The skin, muscles, and fascia transversalis, having been successively divided, the peritoneum is separated with the fingers from the psoas and iliac muscles, and pushed inwards as far as the bifurcation of the common iliac artery. The pulsations of the internal iliac may then be felt in the deep part of the wound.

### LIGATURE OF THE FEMORAL ARTERY.

The femoral artery extends downwards along the anterior and inner part of the thigh, from the lower termination of the external iliac artery and the body of the os pubis, down to the upper part of the popliteal space; or we may say, that it begins at the crural arch, and terminates at the junction of the middle with the lower third of the thigh, where it passes through an opening in the adductor magnus, and then becomes the popliteal artery. The direction of its course corresponds to that of a line, drawn from the middle of Poupart's ligament, obliquely inwards round the thigh, to the popliteal space. But, as Dr. Quain has remarked, if the knee be semiflexed, and the limb rotated outwards, the course of the vessel may be marked out by a line, drawn from midway between the anterior superior spine of the ilium, and the symphysis pubis, to the lower border of the patella. The femoral vein accompanies the artery through its whole course, being placed at first on its inner side, and on the same level with it, but getting behind, or under it, yet still a little inwards, about two inches below the os pubis, and maintaining this position to the end. The artery, as it descends, becomes gradually deeper. At first, it lies on the inner border of the psoas muscle, by which it is separated from the os pubis, the brim of the acetabulum, and the hip-joint. Lower down, it gets on the pectineus and adductor brevis; next on the adductor longus; and lastly on the united tendons of the latter and the adductor magnus. Externally, the psoas muscle is interposed between its upper portion and the anterior crural nerve, which, in the groin, is situated about three quarters of an inch to the outside of the artery. The sartorius crosses the artery very obliquely, being, above, completely to the outside of it; in the middle part of the thigh, covering the artery; and below, lying on its inner side. Two or three branches of the anterior crural nerve run for some way along the sheath of the artery; and the largest of them, the nervus saphænus, having entered the sheath, descends along the upper and outer side of the artery in the middle part of its course. In the upper third of the thigh, the femoral artery is covered only by the integuments, the superficial fascia, the inguinal glands, and the fascia lata. In the middle third, it is additionally covered by the sartorius, directly under which is a fascia extended from the adductor muscles to the vastus internus, thin above, but dense lower down, and constituting another texture lying over the artery. In the Museum of University College is a fine specimen of

a double femoral artery, the two divisions afterwards conjoining again into one trunk. Examples of a double femoral vein are also on record.*

### OPERATION IN THE UPPER THIRD OF THE THIGH.

This part of the limb is preferred by Scarpa and many other excellent surgeons, on account of the artery being more superficial than in the middle third of the thigh. An incision, three inches in length, is made through the integuments and superficial fascia, in the track of the artery, as above specified, and the determination of which in the living body is rendered easy by the pulsations of the vessel, except in fat subjects. The centre of this cut should be nearly four inches below Poupart's ligament, unless circumstances were to compel the surgeon to take up the artery immediately below the crural arch — between the profunda and the epigastric arteries. The knife is to be carried down in the track of the vessel, but rather to the outer than the inner side of it, in order to avoid the vena saphæna major, which enters the femoral vein in this part of the thigh. The fascia lata having been exposed, the surgeon, previously to dividing it, is to remember, that, in the direction downwards, the inner edge of the sartorius separates it from the artery, which is not the case in the upper part of the inguinal triangle. The fascia having been opened nearly to the same extent as the integuments, a portion of the femoral sheath is to be lifted up with a pair of forceps, and divided, but only so far as to make room for the ready passage of an eye-probe, or aneurism needle, round the artery, in which step of the operation the instrument should be introduced on the pubic side of the artery, between this vessel and the vein, and with the point turned away from the latter, and brought up again at the external side of the artery. The branches of the anterior crural nerve should not be included in the ligature, one half of which, after a knot has been made, is to be cut off, so as to lessen the quantity of extraneous matter in the wound. The edges of the incision are then to be brought together.

### OPERATION IN THE MIDDLE OF THE THIGH.

The limb is to be slightly bent, rotated outwards, and placed on its outside. An incision, three inches in length, is made through the integuments and superficial fascia, in the track of the artery, or rather in a line corresponding to the inner edge of the sartorius. The fascia lata having been next divided to nearly the same extent, the sartorius presents itself, and may be recognised by the direction of its fibres downwards and inwards. As soon as this muscle is raised, the fascia extending from the adductor muscles to the vastus internus is seen, and will require to be carefully divided, for the purpose of exposing the sheath of the femoral vessels.

For the purpose of more certainly avoiding the vena saphæna major, Mr. Copland Hutchison, and M. Roux, are advocates for making the incision on the outer side of the sartorius, which is to be pushed inwards. This is not, however, the common practice. The arterial sheath is opened, and the ligature applied, according to rules already given.

### LIGATURE OF THE POPLITEAL ARTERY.

The patient is to lie upon his face with the leg moderately extended When the *lower portion of the vessel* is to be secured, an incision, three

* See Dublin Journ. of Med. Science, No. xxvii.

inches long, is made in the median line of the limb, through the skin and subcutaneous fat and cellular tissue, care being taken to push the external saphænal vein outwards, if it should present itself. After the fascia has been divided, some surgeons lay down the knife, and, having separated the cellular tissue and fat with a director, and likewise the head of the gastrocnemius, take up the artery with the precaution of detaching it from the nerve and the vein with the director.

### ABOVE THE CONDYLES.

Here the external saphænal vein may be more easily avoided. The incision should be longer, and rather nearer the inner, than the external margin of the ham, at least above; and it should descend in a slightly oblique direction to the point over the space between the condyles. Under the fascia is the nerve; more deeply and inwardly lies the popliteal vein; and quite towards the bone, and on the inner side of the vein, rather under it, the artery; which is generally separated with difficulty from the latter. In the instance of a sloughing ill-conditioned wound, attended with hemorrhage from the posterior tibial artery, however, where I had occasion to tie the popliteal artery in University College Hospital, the vein, which was soon recognised by its dark blue colour, did not occasion any difficulty in getting the ligature round the artery, and the operation, which was completed with the utmost facility, did not occupy more than three or four minutes. As Dr. Duncan of Edinburgh, Mr. Chandler of Rotherhithe, the two house-surgeons, Mr. Wallace, and others, well know, there was none of the trouble experienced which has, somewhere or another, been very erroneously described. What is of more importance, the operation put a permanent stop to the hemorrhage. In this case, the fact of an artery not conveying the slightest sensation of throbbing, when exposed, and touched, was most unequivocally exemplified.

## DIVISION OF TENDONS FOR THE CURE OF CLUB-FOOT, AND OTHER DEFORMITIES.

Synonymously with the term "club-foot," Dr. Little employs the word *talipes*, as a generic term to embrace all those deformities of the feet, which arise from the contracted state of certain muscles; and he uses the terms *varus*, *valgus*, and *equinus*, to designate the specific forms of such deformities.

The least complex is the *talipes equinus*, which consists in a simple extension of the foot, by which the heel is elevated, and the patient rests upon the toes and metatarsal bones, no part of the sole behind the latter touching the ground. By the habitual disuse of the limb, the full developement of its bones is impeded, and its muscles are small and flaccid.

The most frequent of these deformities is the *talipes varus*, combining extension with adduction of the foot; and, to these characteristics, a third may be added, viz. a rotation of the foot, somewhat analogous to supination of the hand, in a greater or lesser degree, according to the severity of the disease. The inner edge of the foot is thus raised from the ground, forcing the sufferer to walk entirely on the outer margin.

In the *talipes valgus*, which is comparatively rare, there is a partial bending of the ankle, with abduction and a rotation of the foot, by which the outer edge of the sole is raised from the ground. In a complete case,

the patient treads entirely upon the inside of the instep, and upon the malleolus internus.*

Passing over the palliative treatment by means of friction, shampooing, electricity, the moxa, &c. applicable to some cases, it is certain that all these varieties of deformity may, and frequently do, require the knife. In most cases of talipes equinus, the section of the tendon of Achilles will restore the foot to its proper position. For this purpose Dr. Little prefers a small, curved, sharp-pointed bistoury, with a concave edge, the cutting part of the blade being seven tenths of an inch in length, and the greatest width one tenth, in order that the external puncture may be small. The patient being seated, an assistant supports the knee, whilst another, drawing down the patient's heel with his left hand, and pressing upwards the toes and front of the foot with his right, produces the necessary degree of tension in the tendon about to be divided. The bistoury is passed through the skin, one or two fingers' breadth above the malleolus internus, with one of its sides turned towards the tendon, and the other forwards. As soon as the point has passed beyond the external edge of the tendon, and nearly reached the skin of the opposite side, the knife is turned, so as to bring its edge against the anterior surface of the tendon, which is then divided by withdrawing the knife, and usually at one stroke.†

It is a matter of importance to let the external wound be small; and hence some operators use a sharp-edged needle. If a tendon be cut, and an extensive division of the skin over it be made, suppuration is likely to ensue; and, if this be protracted, a portion of the tendon may either slough, or become adherent to the integuments, so as to render the operation more or less a failure. The healing process should not be disturbed by premature attempts to extend the limb. The wound should be closed before extension is commenced; and, for this purpose, two or three days are generally sufficient. During this period, the limb may be laid on its outside on a pasteboard splint. The flexion of the foot is to be maintained with mechanical means. One of the most simple contrivances is a band, or strap, extending from the point of the shoe to the fore part of another band, or strap, placed round the limb above the knee. But various means are preferred by different operators. In some obstinate cases of talipes equinus, Dr. Little has found it necessary to divide the tendons of the tibialis posticus and flexor longus pollicis.

The treatment of talipes varus consists in dividing the tendon of the gastrocnemius; and, if the case be of long standing, it may also be requisite to cut the tendons of the tibialis anticus, and tibialus posticus, with the extensor and flexor proprius pollicis, as exemplified in cases recorded by Dr. Little.

In the talipes valgus, Dr. Little refers the deformity chiefly to the peronei muscles; though it is usually necessary to divide also the tendo Achillis, and even the tendon of the tibialis anticus, before the foot can be restored to its natural position.

Stromeyer, by means of a small boot, with a long spring, operating in a direction opposed to the abnormal eversion, succeeded in a few months in curing a talipes valgus in a very young infant.

Theyoungest patient, in whom Dr. Stromeyer divided the tendo Achillis

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* See a Treatise on the Nature of Club-foot, and Analogous Distortions, by W. J. Little, M. D. 8vo. Lond. 1839.

† Little, Op. cit. p. 30.

for talipes varus, was eight months old. Dr. Little operated on one child of twenty months; and Mr. Whipple on another aged fourteen months. With regard to the other extreme, Dr. Little narrates a case (No. xxxiv. p. 258.) of non-congenital distortion from contraction of the gastrocnemii and other muscles, converted by exercise into a deformity, resembling talipes varus: the cure was accomplished by dividing the tendo Achillis, though the disease had existed forty-eight years.

Just as I was closing this volume, I had a consultation with Dr. Little on a gentleman, who, in consequence of an extensive necrosis of the tibia, now cured, for which I formerly attended him, with Mr. Earle, is unable to bring his heel to the ground. The patient, who was referred to us for an opinion by Mr. Wood, of Rochdale, Lancashire, after having long had recourse to mechanical contrivances in vain, has been recommended to try what benefit will result from the division of the tendo Achillis. As the case, on account of its origin from the effects of necrosis, is very interesting, I trust that Mr. Wood will take an opportunity of letting the profession hear the result of the proposed treatment.*

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* The reader should consult, in addition to Dr. Little's valuable work, Beiträge zur Operativen Orthopädik. 8vo. Hanover, 1838. Whipple, Lond. Med. Gazette, vol. xx. p. 826, who differs from Stromeyer and Dr. Little in having recourse to flexion of the foot, directly after the tendon has been cut. M. Bouvier, Mém. sur la Section du Tendon d'Achille, &c. 4to. Paris. 1838. Also a judicious account of the subject in British and Foreign Med. Review, No. 16. art. 5.

THE END.

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