

SURGICAL DISEASES

AND

SURGERY OF THE DOG

CECIL FRENCH

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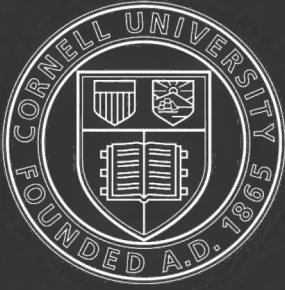
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SURGICAL DISEASES
AND
SURGERY OF THE DOG

WITH NINETY-ONE ILLUSTRATIONS

BY

CECIL FRENCH

Doctor of Veterinary Science (McGill University)

WASHINGTON, D. C., U. S. A.

WASHINGTON, D. C. U. S. A.
PUBLISHED BY CECIL FRENCH

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CHAPTER I

General Surgery

ANTISEPSIS. ASEPSIS. ANTISEPTICS.

Since Lister first advocated the employment of chemical agents to prevent bacterial development in wounds, the principle has been generally adopted, though it has received modification in recent years. The original plan of *antisepsis* comprehended the disinfection of instruments, suturing material, operator's hands, area of operation, and everything coming in contact with the wound, by means of chemical germicides supplemented by post-operative treatment of the wound with antiseptic agents to inhibit the growth of bacteria. Antisepsis is still practised, but on this continent has given place largely to the *aseptic* method in which the use of chemical agents is limited solely to the disinfection of the operator's hands and the cutis of the area of operation, sterility of instruments and suturing material being obtained by means of heat; no antiseptics are permitted to come in contact with the wound, chemical agents being regarded as irritants to the tissues. Whatever advantages either method may have over the other in its application to human surgery it is not within our province to consider and we need only concern ourselves with the one best adapted to canine surgery. There can be no question whatever that the necessity for the application of the principle in the latter instance has been greatly over-rated and that, with a few exceptions, equally as good results are obtainable when nothing more than the ordinary rules of cleanliness are observed. The danger of starting up pyogenic processes consists not so much in introducing bacteria from without as it does in creating conditions within under which such bacteria can thrive to the point of producing a toxic effect. It is when putrescible matter exists in spaces removed from direct contact with the phagocytic action of the living tissues that the conditions are ripe for bacterial multiplication. Putrescible matter is easily creatable by the ligating of portions of tissue, such as the omentum and large vessels, so as to form stumps;

it is also ready existent in the form of certain natural secretions, especially those of serous cavities, such as joints and the pleural sacs, where septic surgical interference is commonly followed by pyogenic processes, particularly when abnormal accumulations of fluid are present. The normal peritoneum must be excepted on account of the well-known comparative immunity it enjoys, probably by reason of the numerous recesses existing between the coils of the viscera where there is a chance for microbic activity to become localized, the pleura and joints on the other hand offering an unbroken extent of space for the accumulation of fluids. Hence, the object should always be to avoid the creation of putrescible matter, but inasmuch as this is a matter of impossibility in some parts of the body, it is necessary to take precautions to prevent infection by the practice of aseptic methods, or resort to the alternative of drainage. Aseptic methods are indispensable in operations involving interference with the thorax, the cerebro-spinal canal, joints, and deeply situated organs such as the thyroid gland; they are not so necessary when the peritoneum is concerned, excepting when ascites is present, but are advisable as a precautionary measure; they are also expedient in operations on the surface of the body but can be dispensed with where local infection has already occurred, as in wounds and abscesses.

The preliminary steps in an operation on the lines indicated above consist of sterilization of instruments and material and disinfection of the hands of the operator and the cutis in the area of operation.

Sterilization of Instruments. Instruments are best sterilized by boiling for at least ten minutes, and if some powdered carbonate of soda is added to the water to the amount of one drachm to the pint, so much the better. Sodium carbonate dissolves the capsules of the germs and the latter are destroyed in much shorter time, and moreover, it inhibits rusting. Chemical disinfectants are unreliable but should be used to receive the instruments during the course of the operation to prevent fresh contamination. For the latter purpose a solution of carbolic acid (5:100) is suitable.

Sterilization of Hands. The hands of the operator always require thorough cleansing. They should first be scrubbed in hot water and soap, particular attention being bestowed on the nails. They should then be immersed for a few minutes in a strong solu-

tion of permanganate of potash until stained dark brown. Decolorization can be effected by soaking them in a warm saturated solution of oxalic acid, and the effect of the latter can be neutralized with lime water. If it is desired to conduct an operation under undoubted absolute asepsis the only alternative is to wear thin rubber gloves.

Sterilization of Region of Operation. It is practically impossible to completely disinfect the skin. Only the microorganisms in the superficial layers can be destroyed by chemical agents. Those existing in the deeper layers can not be reached by any agent short of a gas, but it is known that they possess but feeble pyogenic capacity which the living, healthy tissues have the power to overcome. Welch proved that the white staphylococcus occurs in wounds where every possible antiseptic precaution has been taken, but it seldom exerts interference with the process of healing. Of course, what has been written concerning the hands of the operator applies equally as well to the cutis of the area of operation, but in addition the hair should always be removed by means of clippers or razor.

Antiseptics. There being such a variety of antiseptic agents, I shall only briefly refer to a few which are specially adapted to the particular purpose in view. *Permanganate of potash* is most valuable possessing as it does both microbicidal and deodorant properties and being at the same time free from toxicity. It owes its power to its capacity to rapidly give up oxygen in the presence of moisture. It is effectual for both dermal and mucosal surfaces. It is used in the strength of 1:100 to 10:100. *Corrosive sublimate* is very useful as an inhibitory agent, particularly in exposed joints, but it is poisonous and corrodes metal. It is prepared by manufacturing pharmacists in tablets of definite strength and is used in solutions of 1:2000, 1:1000, and 1:500. *Carbolic acid* is effective in the strength of 2:100 to 5:100, but must be used with great caution as dogs are peculiarly susceptible to its toxic effect. *Creolin* is an effective agent widely used. It is only slightly toxic and does not corrode instruments. It is used in strength of 1:100 to 5:100. *Boric acid* is a mild antiseptic particularly useful for eye work in saturated solution of 4:100. *Peroxide of hydrogen* is an unstable oxidizing agent usually of uncertain strength, capable of setting free ten or twenty times its volume of nascent hydrogen. Its sole use is

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for evacuation of pus cavities. Being without irritant effect, it may be poured in full strength into a septic wound. It immediately liberates its oxygen, effervesces and forms a frothy foam which brings dead and moribund matter to the surface. *Boiled salt water* in the strength of 5:1000 to 1:100 is used for flushing the abdominal cavity and the bladder.

Of the dry antiseptics the synthetic powder *Tri-brom-phenol-bismuth*, commercially known as *Xeroform*, is without a peer. It not only promotes active healing but exerts a pronounced anodyne effect as well. Whether used on ulcers or freshly infected wounds the beneficial results are quickly apparent. Other excellent preparations are *Aristol*, *Iodol*, and *Bismuth Formic-Iodide*.

SUTURING AND LIGATING MATERIAL.

The materials commonly used for suturing and ligating are silk, silver wire, silkworm gut, catgut, linen thread and rubber bands. Pure Chinese twisted *silk* forms an excellent suturing material for general purposes. Either white or black is used, the latter being more easily seen, which is a matter of some advantage in suturing hollow viscera. When used in the skin, the texture should be moderately stout (Nos. 6-12), but for hollow visceral organs it should be as fine as is consistent with strength (No. 2). As a buried suture or ligature it is also very desirable as it readily becomes encapsulated in the tissues and remains inert. It is best rendered sterile by boiling just before using. *Silver wire* is indispensable in bone suturing. If rendered perfectly sterile when inserted and the wound remains free of infection, it may generally be allowed to remain permanently in place without fear of its giving rise to irritation, though the latter sometimes happens, which necessitates its removal after it has served its purpose. *Silkworm gut* being non-absorbable and at the same time having a perfectly smooth surface, is preferred by some to silk. It is rendered sterile by boiling and the knots possess little tendency to become undone or loosened. *Catgut* is theoretically a very valuable suturing material on account of its being absorbed and not requiring removal. But it is sterilized with difficulty (it can not be boiled), it is apt to be absorbed too rapidly, and it becomes untied too easily through swelling and softening by absorption of moisture. Chromicized catgut is said to be capable of resisting absorption from three to four weeks. Any one of the other

materials, if properly sterilized, is used to better advantage, because, though they do not become absorbed in buried positions, they are safely encapsulated by natural processes and rendered perfectly harmless. It is only rarely that a buried non-absorbable suture needs to be removed. *Linen thread*, as supplied for sewing machines (it is specially spun so as to travel evenly through the eye of the sewing machine needle) is strong, ties a good knot, is sterilized by boiling, is not irritative, and can be obtained anywhere where sewing machines are sold, and is therefore a desirable material for fine sutures or ligatures. *Rubber bands* form an excellent material for use as ligatures where portions of vascular internal organs are extirpated. They never slip from position, do not cut through delicate tissues and offer no impediment to the healing process. Glusk advocates their use in operations where portions of the liver, lungs, or spleen are removed, and Senn has used them to advantage in surgery of the pancreas.

ABSORBENTS.

The best sort of absorbent to swab up blood and other fluids during an operation is a pledget of sterilized gauze.

SUTURES.

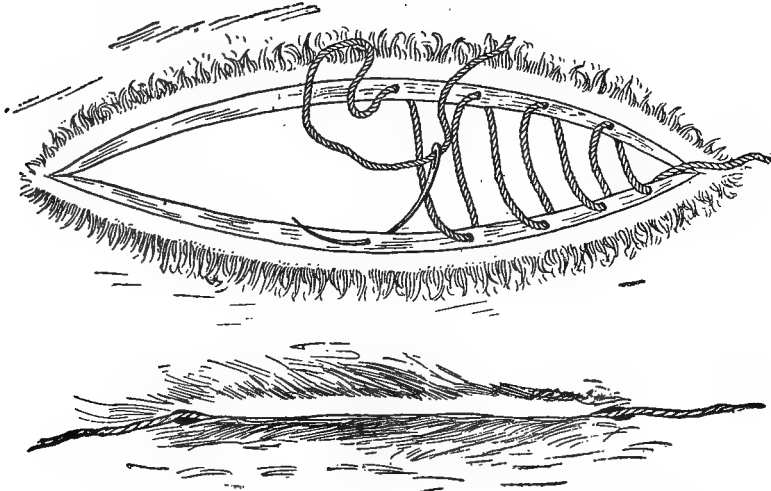
Of the various sutures used in general veterinary practice, I can commend but two for application to cuticular wounds. These are the "simple interrupted" and Halsted's "buried" or "subcuticular" suture.

The *Subcuticular Suture* is undoubtedly superior to any yet devised for canine work. Halsted contrived it whilst making a series of experimental extirpations of the thyroid gland owing to the difficulty which he experienced in maintaining aseptic wounds with the ordinary suturing which penetrates superficially. It is well-known that the skin, particularly in its upper layers and in the hair follicles, swarms with microbes, and while these in large proportion are non-pathogenic and do not inhibit the healing process, any suture which passes from without to the subcutaneous tissue of necessity creates a highway for microbic migration. The result is subcutaneous infection and a wound which, perforce, must heal by secondary intention with suppuration, which is always a slow process

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and one subject to more or less cicatrisation. In non-infected surgical wounds this suture, applied under aseptic conditions, will secure healing by first intention. In traumatic wounds, which are invariably more or less infected, such desirable result is not always obtainable, though, at times, the two cut cuticular edges will speedily unite whilst the subcuticular wound heals by the slower process of suppurative granulation. This suture is particularly adapted to linear wounds.

The subcuticular suture is applied in the following manner: The needle is introduced on the under surface of the skin, as near to the upper commissure of the wound as possible, and including only the deeper layers of the skin, is made to emerge at the cut edge. Cross-



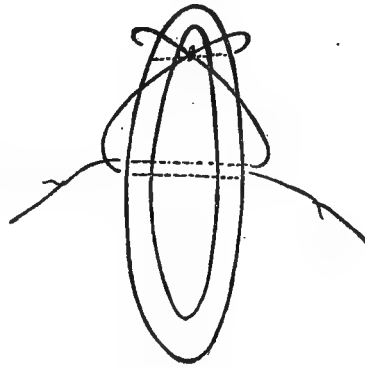
No. 1. The Subcuticular suture (a) in course of application (b) completed.

ing over, the same process is repeated on the opposite side, and so on alternately. Sebacious follicles and hair follicles should not be perforated by the stitches. If the wound is believed to be aseptic and free of spaces the suturing is extended as far as the inferior commissure, but if it is known to be infected, the suturing should be carried only to a point which will allow a proper orifice for drainage. When the entire row is completed both free ends are pulled on in opposite directions which brings the edges of the wound into close ap-

position. Knots are unnecessary because the tissues hug the uninterrupted suture so closely that slipping does not occur. The ends should be cut off quite close or the animal may seize them and drag the suture out. When reunion of the parts is established, which is usually the case at the end of ten or fourteen days, provided the healing process has proceeded without check, the suture may be easily withdrawn by seizing one end and applying traction on the same.

The *Simple Interrupted Suture* needs but a passing reference. In ragged, angular and uneven wounds, where the subcuticular suture can not be employed, and in those cases where the latter does not succeed, recourse must be had to it. This suture should be tied in a reef knot, and the latter should be made to one side of the wound. Each suture should be placed from one-third to one-half inch from its neighbor.

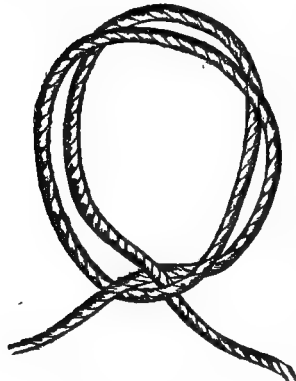
For severed mucous membrane the best suture is that figured in the accompanying illustration. It was devised by Thomas. It is superior to the simple continuous suture because it brings the cut edges of the mucosa tightly together and divides the wound into independent segments. Each end of the suture is threaded on a cambric needle. Commencing at the top end of the wound, one needle is passed through, and the silk or catgut follows until there is half the length of the suture on each side with its needle attached. A reef knot is tied and the needle which is on the right side is brought over the left and passed through lower down and back again to the right, while the needle which is on the left is taken over to the right and passed through back to the left immediately adjoining the previous one. A reef knot is again made and so on throughout the extent of the wound. The various sutures employed in surgery of hollow viscera are fully described under ENTERORRHAPHY.



No. 2. Thomas suture.

APPARATUS AND METHODS OF RESTRAINT.

Muzzles. Mouth Speculums. The simplest method to prevent the dog from biting is to select a piece of tape or soft rope, make an overhand knot or a half hitch in the same, slip the loop



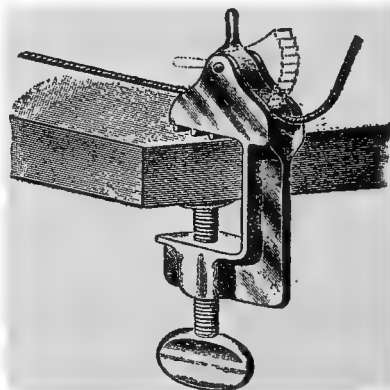
No. 3. Simple muzzle of tape or rope.

over the closed jaws with the knot or hitch undermost, tighten the latter, carry the free ends under the ears to the back of the head and tie there in a bow-knot. Fractious animals should be held by their owners and prevented from backing away or turning the head while this is being done. All short-faced animals (Bulldogs, Boston Terriers, Pugs, Toy Spaniels), in which the capacity of the nasal passages is small must be secured in this manner with extreme caution. Under even a moderate degree of excitement their nasal passages are insufficient to accommodate

the increased respiration, and these animals are forced to breathe by the mouth. If this avenue is closed suffocation results, and the heart may be overstrained or rupture of the pulmonary vessels take place, to be followed by death within a few hours. The jaws may also be secured with the ordinary muzzles sold in the stores, but very few of the latter are really effective for this purpose.

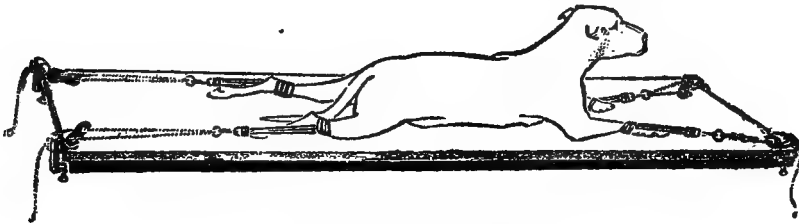
In some cases, particularly of fractious animals, morphine is very useful as a means of control, injected hypodermically. It renders an animal contented, more or less oblivious to its surroundings and unmindful of slightly painful manipulations.

Hopples. There are several patterns sold by the instrument makers, but of these I can confidently recommend as the best the portable Daw-



No. 4. Dawson-French Portable Hopples.

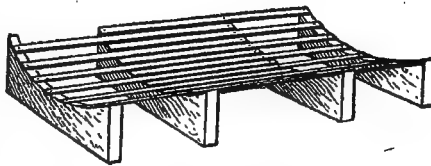
son-French model. Its main feature is its self-locking action. A swinging cam is suspended in a frame through which the control rope passes. The frame is supplied with a screw-clamp by means of which it is attachable to and detachable from any part of any table at will. One set of four large and one set of four small noose leg-bands are provided. These will fit an animal of any size, and are connected to the control ropes by steel snaps. Should the operator wish to tighten the control rope he does so by merely pulling on it, and the moment he lets it go it is firmly clinched by the cam. The animal can be quickly released from the control position at any moment by simply holding back the handle bars, by which the cam is prevented from clinching and allows free passage of the rope. A simpler but less effectual instrument was invented by Hobday, in



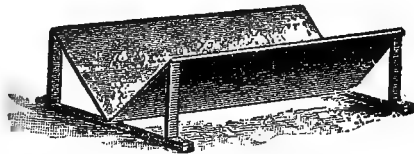
No. 5. Hobday's Hopples.

England. Lacking any of these devices a very simple method of hopping is to take four pieces of soft rope of good length and convert one extremity of each into a noose. This is slipped over the foot and tightened while the other end is fastened to the leg of the table.

Operating Table. An ordinary kitchen table answers all purposes. Where may be covered with zinc practice warrants it, this which should drain to the center. Here a small pipe should carry off fluids to a bucket suspended beneath. To prevent the coat of the animal from becoming saturated with blood or other



No. 6. Extension Grate.



No. 7. Young's Operating Trough.

fluids the extension grate made of enameled iron or improvised out of wood will be found very useful. Another simple device is known as Young's operating trough.

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ANESTHETICS.

General anesthetics should be administered prior to the commencement of all operations involving severe or protracted pain. Not only is their employment prompted by humane consideration but without it the accurate conduct of delicate operations is rendered a matter of great difficulty and often an impossibility, owing to struggling on the part of the animal. Their employment is contraindicated when cardiac or pulmonary diseases exist.

Local anesthetics, hypnotics, or narcotics are employed to dull the peripheral or central sensibilities in operations of a minor nature. Narcotics are also useful for the control of refractory or vicious animals when under examination. Both hypnotics and narcotics are also used for the production of complete general anesthesia, but in this case very large doses are necessary, from which the animal is slow to recover and which are not free from danger. It will be found convenient to resort to them when the services of an assistant are unobtainable.

GENERAL ANESTHETICS.

Chloroform and **Ether**, either alone or combined and diluted with ethyl alcohol are the drugs most extensively used for the production of general anesthesia.

The vapor of chloroform, if administered under proper conditions allows of no comparison with other anesthetic agents. There can be no doubt that any danger attending its use has been much overrated, owing to neglect of the observance of fundamental rules governing its successful administration. Nevertheless, I would warn those unaccustomed to giving it, not to employ it for valuable animals.

The principal advantage derived from chloroform administra-

tion is: Production of profound narcosis unaccompanied by reflex movements which is preceded by a mild preliminary period of excitement and succeeded by a rapid recovery from its effects. It is dangerous only when administered in concentrated form. It is then liable to produce rapid fall of blood-pressure through paralysis of the vaso-motor center, which is quickly followed by paralysis of the respiratory center. At the same time the heart's action grows weak under the combined influence of vagus inhibition, vaso-motor paralysis and dilation of its cavities from the direct action of the drug, though it may continue to beat two to five minutes after respiration has ceased. In a small percentage of cases the heart's action may be the first to fail.

Ether is safer than Chloroform on account of its stimulating properties. But there are well-deserved objections to its use, the stage of excitement being very great and prolonged, even if the administration be pushed without admixture of air; it is usually productive of reflex movements and tetanic contractions of the extremities; and complete narcosis is only possible under continuous administration. These objectionable features can, however, be overcome in large measure by previous administration of narcotics. Only the best quality of ether fortior should be used.

But ether is liable to produce undesirable after-effects in the form of affections of the respiratory tract, whereas the danger from chloroform ceases with its withdrawal. Under ether-anesthesia there is always great secretion of saliva and mucus, while under chloroform the amount is infinitesimal. This matter was carefully studied by Hoelscher in a series of experiments on dogs. The animals were subjected to anesthesia lasting one hour. They were laid in various positions—in the horizontal, with head elevated, and with the head depressed. The buccal secretions were also stained by injections of gentian violet. In all the animals that lay in the horizontal position, the colored secretions were found to have penetrated to the smallest bronchii, showing that the force of the inspired air current was sufficient to drive back the buccal contents into the bronchii. Moreover, the secretion acted as an obstruction to the passage of the air and the animal was forced to breathe harder. When the animal lay on the left side it tended to reach the left lung more, and only slightly the right. In animals whose heads were greatly elevated, this was sufficient to cause death by oc-

clusion of the respiratory tract. When the head was depressed slightly there was rattling in the throat, but the secretions did not penetrate any further. When the head was allowed to hang free, the secretions escaped from the mouth and none were inspired, but when with the head thus held the fluids were prevented from escaping they were inspired. Hence, in the administration of ether the position of the head is a matter of great importance and must be such as to permit of drainage of the buccal secretions. Rattling in the throat is significant of their inspiration, and is to be avoided. Vomiting is also more apt to occur with ether, and this with labored breathing is productive of inspiration-pneumonia.

For the safe administration of either of these drugs a certain proportion of air is necessary. This is particularly true of chloroform to which a large admixture is essential for safety. The proportions have been worked out by Bert. He found that when the anesthetic vapors and air were mixed in certain definite proportions, and continuously inspired, safe anesthesia was established. If the proportion of the medicamentary substance was increased, death resulted. The interval between the anesthetic and lethal dose he designated the "maniable zone." In carefully determining the limits of this zone with various agents, he arrived at the singular conclusion that in every instance the lethal dose is precisely double the anesthetic.

To illustrate, the following table is useful:

| | ANESTHETIC DOSE | | LETHAL DOSE |
|---------------|-----------------|-----------------|-------------|
| Chloroform | 9 | | 19 |
| Ether | 37 | "maniable zone" | 74 |
| Ethyl Bromide | 22 | | 45 |

The figures indicate the number of grams of the anesthetic liquid mixed with 100 liters of air, and then reduced to vapor.

If an animal is made to inspire a mixture corresponding to about the middle of the maniable zone, it is rapidly anesthetized and will remain so as long as the administration is continued. But the maniable zone is singularly limited, a few extra drops converting the active dose into a lethal one. This is particularly true of chloroform. Eight grams volatilized in one hundred grams of air did not

narcotize a dog, but twenty grams killed it. The range is twelve grams.

Ether has the same power in proportion, but is infinitely less dangerous, since between active and lethal dose there is a range of nearly forty grams. According to Embley, the chief factor in the causation of sudden death under chloroform is vagus inhibition. Chloroform vapor not stronger than one and one-half per cent in air after a period of mild excitation, slowly depresses vagus excitability, and if administered in strength of over two per cent may cause dangerous or persistent inhibition. This action is all the more intense and fatal from being exercised upon an organ whose spontaneous excitability is diminished by the paralytic effect of the drug upon the heart muscle itself. The failure of respiration is due to fall of blood-pressure, and takes place invariably long before the heart stops. Hence respiration should be watched as an index to the circulatory condition.

If atropine is administered prior to the chloroform the vagus is never inhibited and cardiac arrest does not follow. Rudolf and others have made similar observations. Hence, we have in atropine, administered hypodermically previous to chloroformization a very convenient antidote, one which reduces all risk of vagus inhibition to a minimum. If a little morphine is combined with the atropine the primary excitant period attending the chloroform administration is suppressed, but the atropine should be in amount somewhat in excess of what would be given alone, to provide for the mutual neutralization of the two alkaloids. A suitable mixture for this purpose is made in the following proportions: Morphine sulphate three-quarters of a grain, atropine sulphate one-twentieth of a grain, distilled water one drachm. Of this, small dogs take five to ten minims, medium sized dogs ten to twenty minims, and large dogs twenty to thirty minims, hypodermically. Some twenty minutes later the chloroform should be administered. In this manner very little of the latter drug suffices to induce a profound and safe narcosis of considerable duration.

During administration the action of the iris should be closely observed. It is an almost infallible guide in the estimation of the blood-pressure. Insensibility of the conjunctiva is often regarded as an indication of insensibility of the higher centers; but as a matter of fact, the former is established before the latter, conse-

quently it can not be regarded as a satisfactory test. The first effect of chloroform on the pupil is dilation from excitement, varying in degree and duration in different individuals. Coincident with the approach of the stage of narcosis and fall of blood-pressure, the pupil commences to contract and continues to do so slowly until either the return of sensibility or the stage of asphyxia. The stage of complete or operative narcosis is reached when the pupil no longer dilates in response to otherwise painful stimuli. It is the degree of contraction which must govern the administrator in the exercise of his judgment as to the quantity of vapor permissible. Should the pupil become strongly contracted and immobile the danger point is reached and the vapor must be immediately withdrawn and fresh air supplied. Otherwise, the pupil will be seen to dilate suddenly and completely and almost at the same time the breathing will cease, an indication of vaso-motor paralysis and asphyxia, a state from which it is difficult or impossible to resuscitate the animal. There is, therefore, no pronounced change to give warning of impending danger, and as soon as the pupil is strongly contracted the supply of vapor must be cut off and air supplied until dilation again commences, when, if necessary, more vapor may be supplied and withdrawn as before, and this procedure kept up until the completion of the operation.

To resuscitate from the asphyxial condition free access of air to the lungs must be secured. The inhaling mask is cast aside and the tongue grasped and drawn forward. Artificial respiration is then resorted to. The effect is twofold. It not only brings fresh air to the alveoli, but acts as a mechanical heart-stimulant and restorer of blood pressure. Hence to be effectual it should be moderately vigorous to the point of compressing the chest. A good plan is to suspend the animal with the head downward. It is believed that this causes a determination of blood to the brain to stimulate the flagging centers, and the vapor of the drugs being heavier than air tends to gravitate.

Some practitioners place much confidence in medicinal antidotes, such as the vapor of ammonia, medicinal doses of official dilute hydrocyanic acid, hypodermic injections of ether and strychnine, but it should be remembered that if the respiration and circulation are nearly at a standstill, drugs have little chance of being carried to the vital centers, and moreover, many valuable seconds may

be lost in administering them. Prudence suggests that the best course to pursue is to quickly supply as much as possible of Nature's stimulant—pure air, by promptly resorting to artificial respiration in the open air, and to place little if any dependence on medicinal antidotes. Wood reported before the Berlin Congress in 1890 that he had repeatedly taken dogs in which both respiratory and cardiac movements had been absolutely arrested by chloroform or ether and had restored them to life by pumping air in and out of the lungs. Artificial respiration should be persisted in for some minutes after all signs of vitality have disappeared. When recovery follows the animal needs to be closely watched until the practitioner is thoroughly satisfied that danger no longer threatens. If strychnine is used it should be injected hypodermically in minute doses. Hobday recommends placing hydrocyanic acid on the back of the tongue. He uses one-eighth of a minim of the four per cent strength to each pound body-weight of the animal.

For the proper dilution of chloroform with air the employment of some special apparatus is desirable, and it is also advantageous in economizing the drug. In Britain two or three patterns are in use, devised respectively by Hoare, Junker and Hobday, all being worked by manual or pedal compression. But when an animal is previously atropinized a simple inhalation mask suffices. No such care is necessary with ether and the mixtures, which are preferably administered by the simple inhalation mask. When the latter is not available a tumbler or flower-pot may be substituted.

Chloroform should not be administered in the presence of gas or candle flame, as it is decomposed thereby and sometimes causes a persistent and harassing cough in the operator.

On account of the depressant action of chloroform and the excitant action of ether, it was believed that the narcosis could be increased and the effect on the circulation better controlled if the two drugs were mixed. The first mixture was tried by Weiger, a Viennese dentist, in the year 1850. It was composed of nine parts of ether to one of chloroform, and received the name of the Vienna Mixture.

In Germany the Billroth Mixture, consisting of ten parts of chloroform, three of ether and three of alcohol, has found much favor. It is undoubtedly the best of the mixtures. It produces profound insensibility after a very short period of excitement (one to

three minutes) and one-half to one ounce suffices to maintain complete anesthesia for thirty to sixty minutes. The English or A. C. E. Mixture, consisting of ethyl alcohol one part, chloroform two parts and ether three parts, is an excellent one, producing a narcosis equally as deep as the Billroth but induces greater preliminary excitement and salivation. One ounce is sufficient to produce a sleep lasting twenty to thirty minutes. The Hyderabad Chloroform Commission found that only by respiration of the concentrated vapor of this mixture could death result with difficulty, and respiratory failure always appeared first.

The comparative rate of evaporation of the drugs composing the mixtures was studied by Ellis. A definite quantity of ether evaporates in ninety seconds in the usual room temperature of 65° F. The same quantity of chloroform takes five minutes to evaporate under the same conditions, and the same quantity of alcohol takes twelve minutes. If equal parts of alcohol and ether are mixed evaporation of the ether is retarded—instead of seventy-five seconds it takes two minutes, and the remaining alcohol takes another nine minutes. The A. C. E. Mixture evaporates as follows: In the first sixty to seventy-five seconds all the ether with some chloroform is evaporated, in the next three to four minutes chloroform and alcohol, the first preponderating, and in the following two minutes the rest of the alcohol.

LOCAL ANESTHETICS.

Cocaine is the principal local anesthetic. Caution should be exercised in the selection of the drug, as it often contains impurities when it is necessarily disappointing in its action. The crystals should be rather large, colorless and nearly odorless. Great caution must also be observed in its employment, since in overdose it is rapidly toxic. Lethal effect is manifested by mental distress and violent muscular spasm.

In text-books it is the custom to direct the employment of solutions of varying degrees of strength rather than mention the maximum dose which can be safely borne by the dog, a system which is vague and confusing and opens the door to disastrous consequences. Accordingly, no mention is herein made of solutions, that being a matter which must be left to the judgment of the operator, bearing

in mind that the greater the concentration the quicker to develop and the more widespread the anesthesia. The maximum dose which can be employed hypodermically without causing any constitutional disturbance must not exceed one-sixteenth of a grain per pound bodyweight. On mucous surfaces this amount may be slightly exceeded, particularly in parts possessing much density of mucosa, such as the vagina where absorption does not readily occur.

The anesthetic effect develops in from two to eight minutes and lasts from fifteen to sixty minutes and covers an area about an inch in diameter. It may be intensified by dissolving the cocaine in a quarter per cent c. p. sodium chloride or a five per cent phenol solution. It may also be considerably prolonged by the addition of one-fifth the amount of morphine. There is an additional advantage in combining the last named drug in that it possesses antidotal power over cocaine. Cocaine is most conveniently carried in the form of tablets of definite strength as prepared by the manufacturing pharmacists.

Solutions are applied to the conjunctiva and other mucous surfaces by means of the camel's hair brush or medicine dropper. In this manner some slight anesthetic effect may be obtained on the skin itself in parts where the latter is thinnest.

To properly anesthetize the skin in the area of operation, the point of the needle should not be immediately thrust through the skin as in administering an ordinary hypodermic injection but must first stop within the skin which should receive a few drops of the fluid. When an extended area is to be operated on, a series of injections should be made, the point of the needle being reinserted within and near the periphery of the wheal produced by the previous injection. In the case of a tumor, a circle of injections can be made to surround the area.

Eucaine is preferred to cocaine by some practitioners. Its anesthetic effect is somewhat slower to develop but it lasts longer and is just as complete and is also less toxic and may be safely administered in doses of one-half grain per pound bodyweight.

Eudrenine is a combination of cocaine and adrenalin. It possesses an advantage over cocaine alone in that the adrenalin diminishes vascularity of the part and thereby hinders absorption of the cocaine, besides tending to render minor operations bloodless.

NARCOTICS. HYPNOTICS.

Morphine and **Chloretone** are very useful narcotic and hypnotic agents in canine practice. With full somnific doses of the former, hypodermically injected, most dogs can be rendered indifferent to minor operations, but with few exceptions it is rarely possible to obtain complete anesthesia with loss of reflexes. It is a very valuable agent in controlling fractious animals either for examination or operation. It speedily produces a contented frame of mind which enables a complete stranger to safely proceed with examination. Subcutaneous injection of somnific doses causes a slight and sometimes irritant swelling at the point of injection which, however, quickly subsides. In from three to ten minutes weakness of the hind quarters, restlessness and salivation develop. Nausea and vomiting frequently occur and less often evacuation of the bowels. On this account the practitioner should never administer the drug in rooms where carpets or rugs might be damaged. In some thirty minutes a light slumber is induced from which the animal can be awakened without much difficulty. The somnolence lasts five or six hours and the after-effects persist ten to twenty-four hours. According to Guinard, who studied the action of this drug experimentally, a safe hypodermic somnific dose for mature animals is one-twelfth of a grain per pound bodyweight, while half a grain per pound bodyweight is lethal. In other hands one-seventh of a grain per pound bodyweight has proven lethal. Guinard found puppies much more susceptible and that their death might be produced by one-seventy-fifth to one-twentieth grain per pound bodyweight.

Chloretone may be given in dose sufficient to entirely abolish nervous reflexes. For this the dose must be one and one-half grains per pound bodyweight. Less than that amount will produce but partial anesthesia, and is not sufficient to prevent the dog from howling. Two grains per pound bodyweight is dangerous and two and one-quarter grains is generally fatal. The drug should be given in large capsules, or better still, in konseals as the latter dissolve quicker, or it may be dissolved in whiskey or sherry wine. It is only sparingly soluble in water. An animal that has received a full dose of this drug is slow to recover its senses and equilibrium.

Given as a general anesthetic, chloretone acts on the central nervous system, but unless given in poisonous dose does not depress the circulatory system. Besides its central action, it possesses local

anesthetic properties. It may be substituted for cocaine, but should not be injected hypodermically other than in warm aqueous solution.

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INFLAMMATION.

Inflammation is the reaction to injury. It is tersely defined by Professor Adami as "an attempt of the organism to repair injury to a part." It is to be regarded as a physiologic process following a pathologic action, its one aim being to remove foreign matter from the part and bring about normal restitution. The phenomena of inflammation are essentially the same in whatever part of the body they occur, the characteristic gross changes being heat, redness, pain and swelling, of various degrees; the minute consecutive changes being temporary contraction of the capillaries followed by their dilation, effusion of serum, thickening and slowing of the blood stream, peripheral migration and diapedesis of leucocytes, and in advanced stages extravasation of the red cells. The causes are either mechanical injury (friction, heat or cold, acids or alkalies) or pathogenic microorganisms. Most surgical inflammations are of a septic nature. The inflammatory process may have one of the following several terminations: Resolution with preservation of the integrity of the part, fibroid induration replacing the injured tissue, abscess formation or ulceration with formation of cicatricial tissue, gangrene with formation of cicatricial tissue, and in the extreme degree generalized infection and intoxication and death of the organism.

Treatment. It must be remembered that a normal grade of inflammation is healthy and physiologic, and that treatment is only required to assist the organism when either (1) it is too weak to resist adequately, or (2) where the infective agent is too strong, or (3) when the reaction on the part of the tissues is excessive (exu-

berant granulations, etc.) We treat, in short, in order to aid the organism to an orderly reaction and, inasmuch as, in the vast number of cases, the inflammation is of microbic origin, most often our endeavor is to assist by removing the cause of irritation.

The treatment of inflammation comprises both local and constitutional measures. The cause must first be sought and displaced or rendered inert. Irritants must be removed and microbic activity reduced. The agents employed locally are cold, heat and moisture, astringents, irritants and counter-irritants, and blood-letting.

Cold in the form of an ice-pack, a stream of water from a hose, or a refrigerant lotion (potassium nitrate 5 parts, ammonium chloride 5 parts, water 16 parts) is valuable in the early stages as a preventive, to contract the arterioles and diminish the local blood-supply, but its action must be maintained without intermission, otherwise it does more harm than good by inducing a reaction after each application. Heat and moisture, in the form of hot water applications with a sponge, or poultices, are indicated to relieve tension and cause dilation of the vessels with increased flow of blood, when the inflammatory process is fully established and suppuration imminent. Heat and moisture tend to confine the suppurative process and bring it to the surface. Astringents are of service to constrict blood-vessels and are employed more often to combat inflammations of mucous membranes as the mucosa of the mouth and penis and the conjunctiva. For this purpose one of the most useful preparations is the supra-renal liquid which exerts an almost immediate effect. Other remedies commonly employed are aqueous solutions of zinc sulphate (2:1000—6:1000), crystalized alum (1:100—1:400), tannic acid (1:100—1:200). Irritants and counter-irritants are useful in some of the chronic forms, but only the milder kinds should be used, such as tincture of iodine and non-blistering liniments. Blood-letting is seldom practiced, but light scarification is an effective means to relieve tension in conditions of extreme congestion.

Constitutional treatment is exceedingly helpful in many cases. It must always be instituted with regard to the physical condition of the animal. In the asthenic type of inflammation saline purgatives should be administered, and their action supplemented with diuretics. Both these remedies relieve distended vessels and determine a flow of blood to the excretory channels. The diet should also be restricted. In the asthenic type, tonics and stimulating diet are indicated.

CONTUSION. HEMATOMA.

A contusion is a traumatic lesion in which the subcutaneous tissue elements are lacerated, but in which there is no manifest external solution of continuity. The amount of damage may be of any grade from simple capillary extravasations of blood into the areolar tissue (ecchymosis) to rupture of large vessels with profuse hemorrhage producing a sac of blood (hematoma), to pulpification of a large mass of tissue with impairment or destruction of tissue vitality. In a hematoma the blood accumulates in a distinct cavity in the tissues. The blood soon coagulates excepting when it exists in serous sacs. Cell proliferation takes place at the border and the blood pigment is gradually absorbed until only a clear serum remains. Suppuration may also occur. Besides the local disturbances, it is a remarkable fact that deep-seated and grave lesions often occur at remote points following violent shocks, notably disturbances of the cerebro-spinal fluid and rupture of visceral organs. Cadéac has recorded instances of death from rupture of the portal vein, right auricle, anterior and posterior vena cavae, respectively, and Goubaux and myself cases from rupture of the liver.

Symptoms and Diagnosis. Contusions give rise to tenderness and swelling. There may or may not be discoloration of the skin. Recent hematomata fluctuate, but old-standing ones have a firm circumscribed border with a soft fluctuating center, owing to fibrous tissue formation. They are distinguished from abscess by a history of occurrence of the swelling immediately after the traumatism and by absence of inflammatory phenomena. In the region of the abdomen they must be carefully differentiated from hernia, for which they are liable to be mistaken.

Treatment. Simple contusions are best left to natural processes of repair. Recent accumulations of blood should not be incised, unless infection has taken place, but they should be aspirated. Exception to this rule must be noted in the case of hematoma of the ear-flap, where experience has shown that the shortest road to repair is by free incision, turning out of the fluid blood and clots, and bringing the separated tissue into apposition with sutures passed right through the thickness of the flap. Hematomata undergoing organization are best removed by enucleation after exposure of the sac by incision through the skin. In severe contusions hot antis-

aptic applications are indicated, and later inunctions, as the inflammation subsides.

WOUNDS.

A wound is a traumatic or surgical lesion involving a breach of surface continuity. A wound is said to be simple when it has a clean edge and contains no foreign body; it is said to be complicated when it gives lodgment to a foreign body or has been exposed to infection. The local phenomena of wounds are pain, hemorrhage and loss of function, of degree depending upon the extent of injury. Division of a large or important vessel may be followed quickly by death, and severe hemorrhage may terminate in death some hours later by inducing cerebral anemia and consequent depression of the vital nerve centers. Division of a motor nerve results in limited paralysis, while the severing of a tendon causes at least temporary functional impotency. An ever possible constitutional phenomenon is reflex shock, which, however, is rare. The result of infection may be abscess, erysipelas, septicemia, or pyemia, but wounds that have commenced to granulate are proof against infection, the granulating tissue forming a protective barrier. This has been demonstrated by Billroth's well-known experiment of binding up a wound in such condition with a fetid bandage without any reaction following. The occasional more remote effects are thrombosis and embolism, and entry of air into the veins. Amussat made experimental wounds in the veins of the breast in numerous dogs into which air entered spontaneously, the animals dying in from one to twenty-seven minutes thereafter, while Erichsen found that the entry of a cubic inch of air would not cause death.

Wounds are usually classified according to their character, viz, incised, punctured, contused, bite, gun-shot, and poisoned.

Incised wounds are produced by sharp instruments and are usually simple, free of complications, and heal kindly without leaving much scar, though they may give rise to considerable hemorrhage and complete temporary functional impotency of a part when tendons or nerves are severed. Punctured wounds are caused by penetrating sharp bodies, hooks, etc. Such bodies may break off, the extremity remaining within the wound. If aseptic, it becomes encapsulated, but if septic gives rise to purulent inflammation. As a

rule, there is little hemorrhage. In the absence of foreign bodies puncture wounds heal kindly.

Contused wounds are caused by blunt bodies and are characterized by more or less mangling of the subcutaneous tissues and irregular laceration of the skin. They are very liable to be infected.

Bite wounds are usually caused by animals of the same species, and constitute one of the commonest forms of injury the practitioner is called upon to treat. They are often multiple and usually the flesh is torn and lacerated. The bites of vicious dogs or wild animals are sometimes sufficient to produce eventration and dislocation of the eyeball. Bite wounds are commonly followed by suppurative processes, the pus burrowing beneath the skin and forming abscesses. The possibility of the virus of rabies having been introduced into the system must always be considered, and steps be taken accordingly.

Gun-shot wounds occur principally in hunting dogs. Ordinary shot, when not fired at long range, enters the tissues at isolated points. Should it lodge in the skin it invariably sets up suppurative foci, but when it passes through the dermis and lodges in the deeper tissues it may become encapsulated without causing any trouble. When discharged at close quarters it may cause mutilation of tissues. In the case of missiles of greater caliber the possibility of remote lesions must always be considered. Vessels and nerves may be severed, bones fractured, and viscera punctured. Bullet wounds of the abdominal organs are considered elsewhere.

Poisoned wounds comprise those in which vegetable alkaloids, minerals, ptomaines, snake poison, the sting of wasps and hornets are deposited. They vary in their effect upon the organism according to their toxicity, some producing violent local inflammatory phenomena, gangrene, etc., others systemic intoxication.

In general, it may be said that wounds in the dog heal well when the animal is healthy, but the presence of chronic and infectious diseases tends to hinder the process. That pyogenic bacteria may be derived from the circulation has been shown experimentally by Rinne, who injected sterilized putrid fluids, together with staphylococci, into the peritoneal cavity and found that suppuration of all open wounds followed, which otherwise healed kindly. Open serous sacs also retard healing.

The healing of wounds, whether surgical or adventitious, has

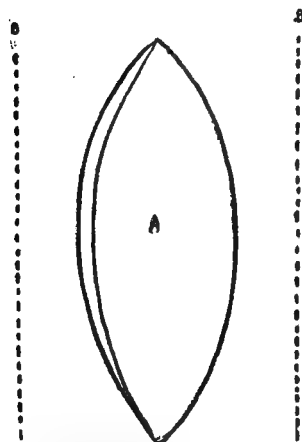
been variously classified, but for our purpose the following is the best and simplest division: (1) By first or primary intention, and (2) by secondary intention *i. e.*, through formation of granulating tissue either (a) without suppuration, or (b) with suppuration. What is termed healing by direct union, as may apparently take place between two wounded peritoneal surfaces during intra-abdominal operations, has no existence in fact, but is in reality healing by first intention, as a certain amount of serum is thrown out indistinguishable from the inflammatory condition, and it is the organization of this serum through fibrin which binds together. Healing by first intention is always aseptic, and theoretically, it should be the aim of the practitioner to ensure its sequence to surgical operations, but owing to the conditions under which our patients have their being, it is rarely possible to attain this desirable result. Hence, in the majority of cases, healing of surgical wounds in the dog takes place by secondary intention either without or with suppuration, but most often with suppuration. This, however, is a matter of little moment, provided adequate drainage is afforded. Adventitious wounds invariably heal with suppuration.

Treatment. The treatment of wounds comprises arrest of hemorrhage, removal of foreign bodies, drainage, and coaptation of edges. Hemorrhage from the larger vessels is controlled by ligation, preferably with silk, a tourniquet being employed in the meantime if deemed advisable; bleeding from capillaries is controlled by hot water or compression. To secure the best possible conditions for healing it is important that all oozing be completely checked. While experiment shows that blood-clot contains a large amount of bactericidal substance it is known that the pyococcus aureus is very resistant to the latter, and if present renders a clot putrescible and conducive to suppuration. In case of considerable hemorrhage large quantities of hot saline solution (5:1000—1:100) should be injected into the bowel or hypodermically. Foreign bodies must be extracted with forceps, and if necessary, their point of entrance enlarged. Usually, it is best to clip away the hair from the immediate vicinity of a wound. Antiseptic irrigation should be avoided, particularly in recent wounds, as all antiseptics tend to irritate the tissues more or less. A single exception is hydrogen dioxide, which may be used for the purpose of breaking up and removing septic material. It is better to cleanse with a stream of warm sterilized water directed

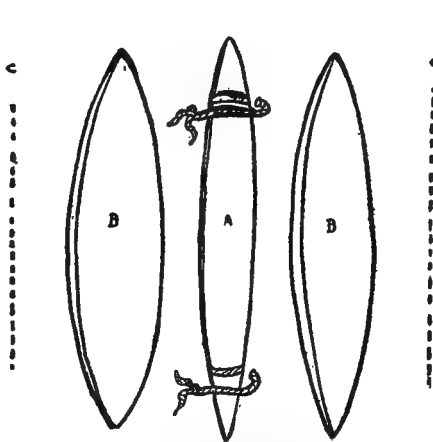
from a fountain syringe. Even in suppurating wounds antiseptics may be dispensed with where good drainage is provided. Abscesses must be opened and carefully inspected for presence of foreign bodies and dependent drainage openings established. The edges of fresh wounds should be adjusted with regard that no cavity be left in the deeper parts in which serum and blood may collect. Where this is not possible ample provision must be made for drainage, to prevent abscess formation. The part of a wound most difficult to treat is always the subcutis. Here the defensive power of the organism is poor, and should there occur any intervening spaces they form suitable pockets for the reception of blood and serum which, for the first few hours, exude in considerable quantity from the surrounding wounded capillaries and veinlets, and which, as already stated, form putrescible material. Should there be the slightest degree of infection present, the microorganisms, being removed from contact with living tissue, are free to multiply beyond the area of its phagocytic action, and thereby establish abundant suppuration. It is very difficult to prevent the formation of spaces in the subcutis, especially in fat animals. To ensure drainage the most dependent extremity may be left gaping, but in some cases it will be necessary to insert a strand of plain sterilized gauze, one end being allowed to protrude slightly, and leave it in place three or four days. This holds good, of course, where bandages can be applied or other means taken to prevent the animal from reaching the parts with its teeth or feet. Where the entire surface of the wound can be brought into apposition so that no cavity remains drainage can be dispensed with, but all doubtful cases should be drained. The edges of fresh wounds are best united with subcuticular sutures. But wounds the edges of which indicate the development of cicatrization, and from which an animal has once torn the sutures, are preferably to be permitted to fill up by granulation. It is remarkable what large-sized wounds will fill up completely by granulation and leave hardly a semblance of a scar particularly in animals with abundant hair.

Wide-open or gaping wounds very often do not permit of approximation or if they do the tension is so great as to preclude any possibility of sutures remaining in position. Such wounds are treated by the "Cherry" process. This consists of making a longitudinal incision on either side a short distance to the outside of and

parallel to the edges of the wound to relieve the tension, these incisions being allowed to fill in by granulation. But these supplementary

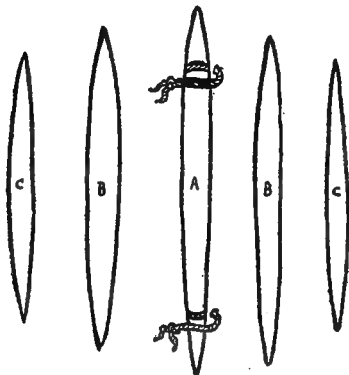


No. 8a. "Cherry" method of treating gaping wounds. (A) Original wound. (B) Site of relief-incisions.



No. 8b. "Cherry" method of treating gaping wounds. (A) Original wound reduced by (B) relief-incisions and (C) site of secondary relief-incisions.

incisions may in themselves present such gaping as to threaten a very long drawn-out filling in by granulation. That being the case secondary incisions are made to the outside of them.



No. 8c. "Cherry" method of treating gaping wounds, showing (A) much-reduced original wound and (B) (C) primary and secondary relief-incisions.

Where tendons are severed splints are often required to maintain the part in rest.

Shot, unless giving rise to irritation, should be left untouched.

The treatment of perforating thoracic and abdominal wounds is described elsewhere.

Poison wounds call for administration of stimulants, which in the case of snake-bite should be coupled with local cauterization.

SHOCK.

Shock is a profound reflex depression of the nerve centers resulting in vaso-motor paresis. The arteries losing their tone, the veins become distended, and less blood than normal reaching the brain, the vital centers are insufficiently nourished. It is due to afferent impulses set up by injury or operation. It may occur even under anesthesia, for though the afferent impulse constituting pain is abolished by general anesthesia, those affecting the vaso-motor, respiratory, and cardiac mechanisms are not controlled thereby. Happily, the condition is rare in the dog, but it sometimes occurs in animals of high nervous excitability, particularly where the injury concerns the genital apparatus. It has occurred during the removal of large tumors. I have experienced it following ablation of cancerous testicular tumor, and Goubaux and Cadiot and Almy have recorded instances following removal of mammary tumors. This form of shock is to be distinguished from that following profuse hemorrhage, or removal of a quantity of fluid from the abdomen, though in either instance, the effects are the same. Both the latter forms are of the nature of mechanical syncope, in the one case owing to cerebral anemia, in the other to sudden removal of pressure and consequent rapid distension of intraabdominal veins.

Symptoms and Diagnosis. The temperature is subnormal, the pulse is rapid, irregular, weak and compressible, the respiration shallow and irregular. The pupils are dilated and react but slowly to light. One peculiar symptom is a sort of stupid expressionless indifference to the surroundings.

Treatment. The indications are to raise the blood pressure as quickly as possible. This may be accomplished by injecting large quantities of hot saline solution (5:1000 to 1:100) both hypodermically and by the bowel. Eichel has shown that absorption of salt solution will compensate for considerable loss of blood in a short while, particularly when transfused intraperitoneally. Heat should be applied to the body, adrenalin chloride solution administered internally and hypodermics of trinitrin, digitalin, and minute doses of strychnine given. It may be necessary to practice artificial respiration.

ABSCESS.

An abscess is an accumulation of pus in any tissue of the body,

but usually in the connective tissue. It is the result of inflammation caused by pyogenic bacteria and the toxins which the latter elaborate. The bacteria generally find access to the tissues through a lesion of the cutis or a mucous membrane, but may be carried to their ultimate destination by way of the blood or lymph streams. The course of abscess formation is as follows: The provocative factor having gained access to a certain area of tissue, there is first multiplication of the same followed by concentration of leucocytes and other tissue cells. Many of these dying, liquefaction takes place in the center of the inflamed area, but at the outer zone of inflammation a sort of wall of granulation tissue forms, protecting the surrounding healthy tissues from the infected area. It is this wall which was formerly regarded as a secreting membrane of the pus and erroneously known as the "pyogenic membrane." When, however, the process is of an acute nature, the germs may multiply so rapidly that the walling in is incomplete, and, carried to surrounding tissues, more pus may form which must perforce burrow along a course of least resistance, principally through intermuscular spaces and along subcutaneous connective tissue, avoiding in its path joint capsules, bone and fasciae, until, upon reaching a dependent position, it begins to point and finally breaks through the skin or it may invade vital organs and produce grave results.

Two forms of abscess formation are recognized, viz, "acute" and "cold," according to the rapidity of their development. A cold abscess is ordinarily caused by tubercular infection, and it is generally well encapsulated owing to its chronicity.

The lesions leading to the production of acute abscesses are of diverse nature. Probably bites by other dogs figure in the majority of cases, while contusions and the lodgment in the tissues of infected foreign bodies either of external traumatic origin or by way of the alimentary tract are frequently responsible. Among some of the rarer forms may be mentioned: lympho-sarcomatous abscess occurring in the neck, abscess of the perineal region proceeding from suppurating prostate gland, abscess produced by passage of transitory strongyles as witnessed by Mégnin in the mammary region, and actinomycotic abscesses.

Symptoms and Diagnosis. The symptoms of abscess may be local or both local and general. Superficial abscesses are characterized by extensive local heat and swelling and but little constitutional

disturbance. They commence as a tumefaction with edematous periphery. Within some thirty-six hours the center of the swelling becomes soft and fluctuating and surrounded by a zone of indurated granulation tissue. With deep abscesses the initial symptoms are fever, refusal of food, pain upon motion of the affected part, and edema of more dependent parts.

Most abscesses cause more or less functional disturbance. Those of the legs interfere with locomotion and even support of the body, those about the throat inhibit deglutition and respiration, while pelvic abscesses lead to suppression of defecation.

The lesions with which abscesses are most liable to be confounded are cysts, soft tumors, and hernia (in abdominal and perineal regions.) For differential diagnosis, the aspirating syringe should be employed. When a cachectic, wasted condition of the system is evident, the tuberculin test is indicated.

Treatment. All acute abscesses in process of formation should be closely watched. Wherever feasible, their development should be assisted by hot fomentations. Immediately the presence of pus is detected, the latter must be promptly evacuated by an incision made with a sharp curved bistoury at the most dependent point. The opening should be free to permit of subsequent drainage. In those cases where the initial lesion is superficial and the fundus of the abscess so deeply situated that its actual location can not be determined, it is better to pass a probe or trocar through the initial lesion down to the depths of the sac and thence towards the skin. Where the point of the instrument is felt through the skin, the latter is snipped with scissors and the passage through the connective tissue enlarged. Some deep-seated abscesses, as in the parotid region, can only be safely reached with a trocar after a simple skin incision is made. The exit of the pus is to be favored by compression of the part and also by injection of peroxide of hydrogen. The next step is to remove any foreign body and then to irrigate the sac. Most authors recommend irrigation with antiseptic solutions, but this is really a matter of little moment, the object aimed at being to hasten repair by flushing the cavity and washing away all trace of dead and moribund tissue, and this can be accomplished equally as well with plain water as with antiseptic solutions. A fountain syringe is well adapted for this purpose. The drainage tract must be kept open for a few days. The treatment of cold abscesses requires more energetic measures.

They must be opened, irrigated, thoroughly curetted, irrigated again, and packed with antiseptic gauze.

ULCER.

An ulcer is an open sore of a superficial structure. It is brought about by ordinary pyogenic or specific bacteria acting the same as in abscess, an ulcer being a molecular death of a part of a free surface, an abscess the same thing within the tissues, pus being secreted in either case. But before such pyogenic bacteria can exert any ill-effect in a tissue, there must be some impairment of vitality of the latter either through destruction of its integrity by local irritation, mechanical violence, etc., or interference with its nutrition owing to disturbance of the local circulation or malnutrition of the body induced by disease. Ulceration may be regarded as an inflammatory disturbance which has continued past the point where healing takes place by granulation, or a sort of continued local dying of a part, though it is quite possible for an ulcer to heal spontaneously. A wound that does not heal by primary intention or scabbing becomes an ulcer. The process of ulceration consists of an infiltration of the inflamed area with leucocytes which destroy and replace the tissues. The leucocytes dying they are thrown off with the fluid elements derived from the blood as pus.

Common seats of simple ulceration are the edges of the ear-flaps, the external auditory canal, the tail, and the digits. Of specific origin are tubercular ulcers particularly of the neck and the ulcers of stomatitis.

Symptoms and Diagnosis. As already stated, any sore or wound which does not heal by granulation is to be regarded as an ulcer. But the process of ulceration may be healthy, or it may be indolent, or exuberant. In a healthy ulcer the edges are smooth, the base level and covered with healthy granulations, the surrounding parts normal, and an inodorous pus is discharged. An indolent ulcer is known by its sunken surface, its raised irregular edges. The discharge may be thin and watery. An exuberant ulcer is characterized by development of so-called "proud flesh," gelatinous granulations rising above the level of the surrounding parts. It is dark red and bleeds freely and discharges pus.

Treatment. In the treatment of ulcer it is important to protect

the sore from any kind of irritation, whether it be by the animal's own teeth, or from accumulated discharges. Healthy ulcers require soothing treatment by means of desiccant antiseptic powders. On external parts they should always be protected with gauze and bandages, though this is often a difficult matter to accomplish, owing to the persistence with which any kind of application and even muzzles are torn off. Indolent ulcers require gentle stimulation with weak distilled aqueous solutions of nitrate of silver (4:100) before the powder is used. Exuberant ulcers should be cauterized with the solid nitrate of silver stick or the actual cautery. Drainage must be provided for discharges where there is a tendency to accumulation. The general health should be attended to, laxatives and tonics being administered when the nutrition of the body is at fault. The ulceration of malignant tumors can only be treated by eradication of the growth.

FISTULA. SINUS.

A fistula or sinus is any abnormal tract in the tissues forming a communication between a septic focus or secreting gland and any other part of the body, either the surface or a natural cavity or canal. The term fistula is applied when the tract is open at both ends and the term sinus when it is open only at one end. The great majority of sinuses arise from abscesses which do not close up by granulation, and their failure to close is usually due to the presence of a foreign body or dead bone, but may also be due to protracted discharge bringing about induration of the tissues in the line of evacuation, and in rare cases to tubercular disease and actinomycosis. Occasionally fistulae originate as congenital defects. Where the tract communicates with a secreting gland, the secretion itself independent of any septic process may be sufficient to inhibit the healing process.

Treatment. The first step is to seek the cause. If a foreign body be present, steps must be taken to remove it. Dead bone must also be displaced. Next, the wall should be curetted or stimulated by injections of strong distilled aqueous solutions of nitrate of silver (5:100—10:100). Failing in this, the tract must be laid freely open, the lining membrane cut away, and the wound packed with antiseptic gauze so that healing may proceed from the bottom. Where it is considered inadvisable to open up the tract by reason of

the proximity of large vessels or other important structures, instead a counter opening may be made by inserting a director and cutting down on the same. It is hardly necessary to point out that provision must be made for drainage to guard against the reconversion of the sinus into an abscess. Special forms of fistula and their treatment will receive notice under their respective headings.

BURNS. SCALDS.

This form of injury varies in degree, from mere scorching to destruction of the cuticle and hair with production of blisters, to charring of the whole thickness of the skin, including often the deeper tissues, with consecutive gangrene. Deep and extensive burns are very apt to terminate fatally either through shock or absorption of toxic products produced by tissue destruction. Burns may be caused by superheated liquids or solids, or by caustic substances.

Treatment. In light burns very satisfactory results are obtained with applications of picric acid in solution (saturated while hot and decanted when cold). Soothing ointments are also efficacious. In severe burns treatment must be directed to prevention of sepsis, by dusting with analgesic antiseptic powders. Blisters should be opened by pricking with a needle. In gangrene, antiseptic irrigations and dressings are indicated. To quiet the nervous system and give relief from pain morphine and atropine should be administered hypodermically.

FROST-BITES.

The local effects of frost-bites resemble burns, and like the latter, may vary in degree from simple hyperemia and infiltration to separation of the epidermis by serous exudation, to mortification of the part. Frost-bites are usually confined to the extremities of the members, but it is very rare to observe extreme cases.

Treatment. The object to be aimed at is to restore the circulation as slowly as possible. For this purpose, the affected parts may be immersed in cold water, the temperature of which should be gradually raised, or they may be rubbed with snow. In severe cases leading to gangrene, the ordinary antiseptic treatment of wounds must be followed.

ERYSIPELAS.

This is an extremely rare disease, the dog being almost immune to the pathogenic action of the pyogenic streptococcus. Froehner has recorded witnessing only four cases in seventy thousand animals treated at Berlin. The infection, when it occurs, is apt to be metastatic and induce remote troubles, one of Froehner's cases having exhibited myocarditis, pericarditis, hepatitis and nephritis.

Symptoms and Diagnosis. The local symptoms are much less evident than in the human being, owing to the skin being hidden by the hair. The area of infection is swollen and intensely red or bluish red and sensitive. The usual constitutional symptoms of fever are also present.

Treatment. Locally, the inflamed area must receive a thorough cleansing with antiseptic solutions. The hair should also be removed with clippers. Following this, ichthyol or thiol should be applied in the form of ointment, the strength of the ointment being at least half and half. This dressing is to be freely and repeatedly applied. Internally, tincture of the chloride of iron should be administered in large doses, four or five times daily. Excessive febrile manifestations may be combatted with antipyretic drugs, or better still, by application of ice-packs to the body.

TOXEMIA. SEPTICEMIA. PYEMIA.

No sharp distinction can be drawn between these three forms of systemic poisoning, since, properly speaking, the difference is one of degree rather than of kind. By Toxemia is meant the absorption of and intoxication by the products of microbic activity (toxalbumins) having their origin in some local infective process. The term Septicemia is used when living pyogenic bacteria enter the circulation, while by Pyemia is meant the condition where these bacteria are deposited in distant tissues with resultant production of multiple abscesses. In the two latter conditions, therefore, the localization of the bacteria in vital organs is what is most to be feared. There may then result a train of disorders (cardiac, pulmonary, hepatic, renal, or cerebral), any one of which may be sufficient in itself to bring about a fatal termination. The microorganism most commonly concerned is the staphylococcus aureus, the streptococcus being but slightly virulent in the dog. Metastasis may be by the blood or lymph channels.

The commonest provocative factors are suppurative conditions following traumatic or unclean surgical wounds, retention of fetal tissues, intestinal lesions, and omphalo-phlebitis in young subjects. In some cases the origin is obscure.

Symptoms and Diagnosis. Differential diagnosis is difficult. The chief symptoms are high intermittent fever with rigor, complete anorexia, diarrhea, albuminuria, feeble cardiac action, vomiting, and great prostration. In pyemia, the secretion from the initial wound, is, as a rule, scanty but greyish or bloody. Symptoms of metastatic abscess formation are sometimes evident. Recovery from pyemia is rare. In young subjects, where the disease follows omphalo-phlebitis, it is common for suppurative foci to develop in superficial parts of the body, and these cases usually respond favorably to proper treatment.

Treatment. Treatment must be prophylactic rather than curative, *i. e.*, any possible further contamination of the blood stream must be prevented. Deep suppurative and gangrenous foci must be thoroughly drained and cleansed, and if necessary, amputation resorted to. Superficial metastatic abscesses must be freely opened. Constitutional treatment should be directed toward supporting the strength with stimulants, but drugs are of little avail. Antistreptococcic serum is worthy of a trial.

GANGRENE.

By gangrene is meant the mortification of tissue in bulk as distinguished from ulceration or molecular death of a part. Gangrene can occur with or without the presence of bacteria, the essential cause being the cutting off of the blood supply. Interference with local nutrition may result from crushing, the action of chemicals, burns, frost-bites, embolism, tight bandages, strangulated hernia, paraphimosis, and the products of specific microorganisms. A few instances are on record of infection by the bacillus of malignant edema which usually terminated fatally.

Symptoms and Diagnosis. Gangrenous tissue is recognized by its coldness, change of color, loss of sensation, and inability of the part to perform its function. Where the disease process has ceased to spread, there develops a so-called line of demarcation, which is a zone of inflammation and actively proliferating repair tissue.

Treatment. The cause must be removed, and spread of the condition prevented by separation of the dead from the living part. Where possible, return of the circulation may be encouraged by gentle friction, above the gangrenous area.

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CHAPTER II.

The Head and Neck.

CONGENITAL MALFORMATIONS.

Leaving out of account the malformations of the eye, ear, etc., which are treated of elsewhere, there is little of any surgical significance. Occasionally anencephalic monsters are born, and it is noteworthy that the shape of the head of the Bulldog and Pug is an inherited congenital malformation, brought to perfection, if I may use the term, by artificial selection.

What is known as Cervical Rib has been observed in the dog. Gruber recorded an instance in which the transverse process of the seventh cervical vertebra possessed a joint surface with which a supernumerary rib articulated and between which and the first sternal rib was a supernumerary muscle. On the opposite side the corresponding transverse process was somewhat lengthened. This condition is important only in that it may give rise to errors in diagnosis.

Bournay has described a congenital arterial-venous Aneurism in the neck resulting from abnormal termination of the two carotids and jugulars. It presented a subcutaneous pulsating tumor, which was augmented in volume when the head was lowered and diminished when the latter was raised.

TRAUMATIC LESIONS.

The commonest wounds about the head and neck are those resulting from bites by other dogs. When they suppurate they are very apt to terminate in abscess formation of considerable extent owing to the burrowing tendency of the pus. Spiked collars employed to restrain bulldogs are also a source of mischief, and one instance is recorded of an intractable sinus resulting from such a spike becoming detached and driven into the tissues. Puppies sometimes sustain parturition hematoma of the scalp during birth.

Treatment. All wounds about these parts should be closely watched for signs of subcuticular suppuration. Gaping wounds should be sutured with the buried suture with provision for drainage. Smaller wounds are best left to heal by granulation. If an abscess develops free exit must be given to the pus at its most dependent part. Fistulous tracts must be searched for foreign bodies.

ABSCESS OF THE SCALP.

This trouble is seen more particularly in young nursing puppies, but it also occurs in adult animals. In puppies it may be of pyemic nature following omphalo-phlebitis, but may also result from local traumatic influences as is the case in the adult.

Symptoms and Diagnosis. The condition is recognized as a large swelling on the top of the head, which very closely resembles that peculiar to hydrocephalus, in fact, the first sight of the trouble in the puppy may give the practitioner the impression that the animal is the subject of the latter condition. By palpation the subcutaneous situation of the fluid can easily be determined.

Treatment. The purulent matter must be evacuated by lancing at a dependent point, and reaccumulation prevented. Hydrogen peroxide may be injected to cleanse the cavity but if free drainage is provided, unassisted recovery is quick to follow.

FOREIGN BODIES.

Foreign bodies in the form of rubber bands are sometimes mischievously slipped over the head on to the neck or string may be tied tightly round the neck by children. Such bands by constant pressure soon cut through the skin and may dangerously constrict the trachea.

Symptoms and Diagnosis. If a linear wound is observed encircling the neck, such a foreign body may be suspected. At the outset, the animal makes repeated efforts to rid itself of the body. Later, as the constricting action encroaches on the trachea all the signs of dyspnea are exhibited.

Treatment. The indications are to remove the constricting agent by dividing it, and in order to do this it may be necessary to cut into the neck.

NEOPLASMS.

The growths affecting the eyes, ears, alimentary and respiratory tracts, thyroid and lymphatic glands, are treated of under their respective headings and only the more common ones which occur in the skin and subjacent tissues will be described here. These consist of papilloma, fibroma, hematoma, cutaneous horns, sarcoma, and carcinoma.

Papilloma. Warty growths occur about the head and neck, principally in old animals, but not so plentifully as on the extremities. Favorite seats are the vicinity of the eyelids and the nose.

Symptoms and Diagnosis. They are sharply defined and sometimes pedunculate. In consistence, they may be soft or hard with a smooth or slightly puckered surface. They are distinguishable from malignant growths by their limited dimensions and slow rate of growth.

Treatment. Simple excision with curved scissors is sufficient, but it is best always to cauterize the base with the actual cautery or lunar caustic.

Fibroma. These tumors are found about the ears and eyelids and the cheeks.

Symptoms and Diagnosis. Fibromata are always well demarcated and hard. They have their seat in the skin itself and with it are mobile from the subjacent tissues, or they are situated subcutaneously when of connective tissue origin. Occasionally they are pedunculate.

Treatment. The same as for Papilloma.

Hematoma. Contusion cysts occasionally occur as the result of traumatism, usually a blow from a club or stone. One case recorded by Siedamgrotzky resulted from a bite. Rupture of vessels taking place, there follows a condensation of connective tissue around the extravasation, and the blood is either quickly absorbed or undergoes organization and is more slowly absorbed, or it may suppurate. Some cases seem to arise spontaneously and to have communication with the veins, for if they are opened they continue to bleed persistently.

Symptoms and Diagnosis. Blood tumors are known by their subcutaneous position and their painless, tense, or fluctuating character. In the upper part of the neck they require careful differentiation from burrowing ranula and cystic goiter. Aspiration may be resorted to in doubtful cases.



No. 9. Carcinoma of the Neck.

Treatment. Hematomata should not be interfered with but allowed to undergo absorption.

Cutaneous Horns. There are a few cases of this peculiar form of growth on record. Favorite positions are the forehead and inner surface of the ear. The manner of their formation from sebaceous cysts and papillomata is described in the chapter on Neoplasms.

Symptoms and Diagnosis. As the name indicates, they are circumscribed outgrowths much resembling a horn.

Treatment. Extirpation should be practised, but the cyst at the base of the horn must be removed at the same time.

Sarcoma. Sarcoma of periosteal origin occasionally arises in the forehead. Being of highly malignant character with a great tendency to invasion of adjacent parts, the prognosis must always be grave. Sarcoma of cuticular or subcuticular origin is occasionally seen but it is not common. It has been observed to follow scratches or wounds.

Symptoms and Diagnosis. Periosteal sarcoma occurs as a subcutaneous enlargement or upheaval which exhibits a very rapid growth and soon attains an enormous size. The consistence of the growth is variable. Usually it is bone-hard at its base, but may fluctuate in the center of its surface. If adjacent bones are involved when the tumor has its seat in the forehead, there may be a hemorrhagic discharge from the nasal passages. Sarcoma of the skin appears as an irregular tuberculate growth and assumes a fungoid character when it breaks through the dermis.

Treatment. An operation in the early stages offers some chance of effecting complete eradication of the growth. Not only the actual tumor but the healthy tissues in the immediate neighborhood must be freely removed.

Epithelioma. Carcinoma. These tumors, formed of proliferating atypical epithelial or glandular (sebaceous or sudoriferous) cells show a predilection for the head, notably the forehead and vicinity of the ears, but occur also in other parts.

Symptoms and Diagnosis. Cancerous tumors vary in size from a pea to the infantile head. In consistence, they are moderately firm or hard, they are intimately united with the skin, and mobile from the underlying structures, have a rather circumscribed, irregular, puckered surface, and exhibit a tendency to ulcerate and become metastatic to the nearest lymphatic glands.

Treatment. Early and free removal is indicated, before the lymphatics become implicated.

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The Eyes

CONGENITAL MALFORMATIONS.

Sequestration Dermoid is a not infrequent form of growth of congenital origin consisting of a patch of skin usually bearing tufts of hair, situated on the mucosa lining the surface of the eyeball. The explanation of its occurrence will be found in the chapter on Neoplasms. It may be unilateral or bilateral and while it is usually confined to the conjunctiva covering the sclera at the outer canthus, it may also involve the corneal surface.

Treatment. The growth is operable, indeed, if not removed, it will sometimes slowly enlarge. The animal should be narcotized and the cornea anesthetized with cocaine. The growth is then seized with forceps and detached by cautious dissection. To prevent blood from beclouding the area a stream of warm sterilized water should be played over the eye during the operation. A white cicatrix usually develops which, however, is scarcely noticeable. Should the growth extend far over the cornea, it is best to leave that portion of it untouched.

Congenital Opacity of the Cornea. This is occasionally seen in the form of minute whitish spots which tend to clear up spontaneously.

Persistent Pupillary Membrane. As the term indicates, this is a condition in which the delicate membrane covering the anterior surface of the lens during the greater part of intrauterine life, fails to undergo complete resolution and persists as fibers, either singly or in strands, passing across the pupil, or as a vascular, slightly opaque membrane, floating or adherent to the capsule of the lens. The condition would seem to be hereditary in some cases, for Barrier recorded an instance in an animal whose dam had the same affection and had given birth to another blind litter, and whose sire had suffered from some visual defect the nature of which was not determined.

Symptoms and Diagnosis. Where but a few fibers persist, vision is not impaired and their presence is usually unnoticed until some disorder prompts a close inspection of the eye, but where the membrane persists as such the animal experiences difficulty in seeing, particularly in brilliant light, and walks with hesitancy.

Treatment. Strands and floating membrane are operable with technic similar to that observed in cataract or iridectomy.

Congenital Cataract. This is a rare affection appearing as a partial or complete opacity of the lens, which may be calcareous, and is in all probability due to hereditary influences. It tends to remain stationary.

Treatment. Treatment must be by discission or extraction of the lens.

Congenital Dislocation of the Lens. This condition has been recorded by Fromaget in bilateral form, the dislocated body being intimately adherent to the cornea. It is probably of hereditary nature, since in Fromaget's case another animal in the same litter was likewise affected and the sire was also blind.

Treatment. The indications are to extract the lens, exerting traction when it is adherent to any part of the chamber.

TRAUMATIC LESIONS.

The eye is liable to all forms and degrees of injury, chief among which are contusions and wounds either of which may be slight or severe. Contusions are usually produced by blows from blunt instruments and the resultant lesion may be anything from mere superficial loss of epithelium by the cornea to intraocular hemorrhage, luxation of the lens, or even disruption of the optic nerve. Slight injury to the cornea may, however, lead to severe ulceration by septic infection. On account of the incompleteness of the orbital arch a forcible contusion sustained immediately over the eye commonly results in luxation of the latter, particularly in breeds possessing prominent eyes, notably Pugs and Toy Spaniels, and this lesion may also occur when a body presses between the eye and the wall of the orbital cavity, as for instance, the tooth of another dog. In other words, one dog may actually bite out the eye of another. Wounds are mostly caused by sharp-pointed instruments, the tooth of another dog, the claw of the cat, or as is not uncommon, by minute

particles of sand or splinters of steel. The latter are apt to find lodgment in the substance of the cornea. Hunting dogs sometimes receive gun-shot wounds.

Wounds are non-penetrating or penetrating. Non-penetrating wounds are limited to the conjunctiva, the cornea, or sclerotic. When free from virulent infection they heal kindly, but microbic activity results in conjunctivitis or keratitis and its possible complications. Penetrating wounds are always serious when they pass the anterior chamber, owing to the liability to suppurative inflammation. Even when only the aqueous humor escapes the possibility of hernia of the iris is always imminent. Penetration of the lens by a foreign body may result in cataract.

Symptoms and Diagnosis. Contusions give rise to acute inflammation, lachrymation, pain, and photophobia, according to their severity, and edema of the lids. When intraocular hemorrhage occurs, the chambers become greatly distended and the eye acquires a volume two or three times the normal and bulges. The lids become everted and the humors assume a livid color, giving a hideous aspect to the animal. Relief is sought by rubbing the eye against hard surfaces. Wounds and foreign bodies are easily seen upon close examination, but the organ is sensitive to manipulation.

Treatment. In all contusions and wounds soothing antiseptic applications are indicated, as described under conjunctivitis and keratitis. Recent luxations are amenable to reposition, and if the optic nerve is not lacerated the sight may be preserved. To replace the globe, it is first cleansed and an assistant required to hold open the lids as wide as possible. Steady, firm pressure is then exerted over the globe outside the border of the cornea on both sides with the balls of the thumbs, until the organ slips back, which it generally does with a slight sound. It may be necessary to slit the external commissure before reduction can be effected and reunite it with a stitch later. Protective antiseptic bandages should be applied for a few succeeding days and the organ closely watched for signs of inflammation. Luxation of some hours' duration or accompanied with irremediable injury calls for enucleation of the globe. Foreign bodies must be promptly removed after five to ten minutes of local cocaine anesthesia (2:100). They are best lifted with a fine sterilized forceps or needle. When firmly embedded it may be necessary to pass a broad needle into and through the cornea and behind it to

form a surface against which to work so that the body be not pressed entirely into the anterior chamber. In human surgery the Haab magnet is employed to remove steel splinters. It compels the splinter to retrace the tract by which it entered, even from the lens. When a foreign body is within the anterior chamber it must be extracted by means of fine forceps or curette through an incision made at the inferior border, everything being done aseptically. In case of hernia of the iris the latter may be replaced with a sterilized sound or the protruding portion excised and the stump returned, instillations of eserine being used afterwards to cause its withdrawal from the wound. Intraocular hemorrhage is a serious condition, and it is seldom that any treatment short of enucleation is of use. Puncture is useless.

PARASITES.

Filaria may occur as evidenced by an observation made by Rossi. In this case there was kerato-conjunctivitis, which developed into ophthalmia. A fistula and staphyloma formed, and the eye was extirpated. The anterior chamber contained a purulent exudate in the center of which a female filaria was found.

At the Pisa College an instance of a tick attaching itself to the lower border of the cornea has been noted. In this case there were profuse secretion of tears and spasmodic closure of the lids.

Treatment. In the case of filaria, its exit must be prompted by puncturing under cocaine anesthesia the cornea at its superior border with a fine scalpel introduced flatwise and causing it to escape with the flow of aqueous humor. Ticks may be detached, under local cocaine anesthesia.

CONJUNCTIVITIS.

Inflammation of the conjunctiva is the commonest ocular trouble with which we have to deal. It is induced by ordinary pyogenic microorganisms or a mixed infection, and it is also probable that it is due in some instances to a specific infection. The provocative factors are traumatic lesions, foreign bodies, primary infectious diseases such as distemper and inflammations of the respiratory tract, and any condition tending to expose or irritate the conjunctiva, such as ectropion, entropion, sequestration dermoid, neo-

plasm of the membrana nictitans, and trichiasis. It may be brought about by dust in animals which habitually run under carriages.

Two principal forms are recognized—the catarrhal and the purulent—and either may run an acute or chronic course. The term “follicular conjunctivitis” is applied to a localization of the disease on the membrana nictitans, generally on its inner surface. Catarrhal conjunctivitis is a simple malady of mild type, usually of short duration, and characterized by vascularization and the secretion of a mucous or muco-purulent discharge. Purulent conjunctivitis is of a much more intense type, accompanied with considerable pain, a profuse distinctly purulent secretion, and commonly corneal lesions.

Symptoms and Diagnosis. In the catarrhal form the vessels become injected and a watery secretion at first forms and tends to run over the lids and excoriate the neighboring skin. The secretion soon changes to a greyish muco-pus and collects in the canthi and at night-time glues the lids together with a scab. The animal seeks to free itself of the matter by rubbing its eyes with its paws, but that there is little or no pain is evidenced by the lack of photophobia. In the purulent form the disease first appears mild, but in a few hours grows severe. The vessels become deeply injected, the lids swollen, there is great pain, photophobia, and sensitiveness to exploration, and tears are secreted profusely and run down the face. The inflammatory secretion at first is thick and ropery but later becomes distinctly purulent of a yellowish or greenish color. Keratitis frequently develops and quickly leads to corneal ulceration, and sometimes to panophthalmia. When the cornea becomes involved the disease runs a lengthened course and the acute symptoms pass to a more chronic state, in which the abnormal sensitiveness disappears. In follicular conjunctivitis the mucosa, principally of the inner surface of the third eye-lid, is studded with minute dark red round elevations which, when numerous, resemble granulation tissue. Under these conditions the membrana appears red and tumefied and projects more or less over the globe.

Treatment. The first step is to search for and remove any appreciable active irritant, such as a foreign body, entropion, or neoplasm of the third lid, and where there is any photophobia, confine the animal to a darkened room. In the catarrhal form any of the following lotions are useful: Boracic acid (1:100), permanganate of potash (1:2000), sulphate of zinc (1:250). In many cases, and

particularly where there is active congestion, it is possible to abort the trouble with instillations, repeated every two or three hours, of from one or two drops of adrenalin chloride solution (1:10,000—1:2,000), a remedy which is remarkably active in blanching congested membrane. It has a slight smarting effect to which some dogs strenuously object, but this can be averted by previous instillation of cocaine solution. Purulent secretions may be gently wiped away with a wad of absorbent cotton, and the conjunctival sac should then be copiously irrigated with any of the above-mentioned antiseptic solutions, and finally receive a few drops of nitrate of silver solution (1:200—2:100). When the condition assumes chronicity, the yellow oxide of mercury ointment (1:60) is indicated. The best way to treat the follicular form is to remove the membrana nictitans under cocaine anesthesia. It is seized with forceps, drawn forward, and quickly snipped off with fine curved scissors. The hemorrhage is insignificant.

SUPERFICIAL KERATITIS. ULCERATION OF THE CORNEA.

This is an inflammatory affection of the cornea which results from causes similar to those which are operative in producing conjunctivitis. But, it would seem that keratitis may also arise as an idiopathic manifestation to which the young of certain breeds, such as the Boston Terrier, show a marked predisposition. It is most often unilateral but is also frequently bilateral, and it is commonly associated with conjunctivitis. The inflammation may run one of several courses. Resolution by absorption may take place in the stage of infiltration. Should the process progress past this point to cell necrosis, it is most common for the superficial corneal layers to disintegrate and develop an open ulcer. In some cases the ulcer extends inwardly and destroys all the layers and perforation follows. When this happens, particularly at a lower peripheral situation, the iris is apt to fall forward and protrude through the opening and become united with the cornea by formation of repair tissue, when the condition is known as Anterior Synechia. Or, the ulcerative process may stop short at the superficial layers and the intraocular pressure cause the remaining layers to bulge forward (Kerectasia), or all the layers may be destroyed except the posterior one when the latter protrudes through

the opening in the form of a small pouch (Keratocele). Should the superficial layers remain intact, the pus infiltrates the deeper layers and an abscess results. Such an abscess may undergo resolution, but it tends to burst on the surface, or as sometimes happens, it discharges inwardly into the anterior chamber (Hypopyon) and there may inaugurate an acute ophthalmia. In rare instances, through failure of an ulcer to heal, a fistula develops. In some cases the ulcer becomes exuberant as in other parts of the body. As a result of corneal ulceration and the consequent formation of scar tissue an opacity remains which may vary in degree, receiving the name Nebula, Macula, or Leucoma according to its intensity. Sometimes the scar tissue formed after perforation fails to withstand the intraocular tension, and that portion of the cornea is forced forward to form a pouch-like protrusion. This is termed a Staphyloma. Ordinarily, a Nebula or Macula decreases little by little and finally disappears, but dense Leucomas are usually a permanency. Keratitis is generally accompanied with more or less pericorneal injection or conjunctivitis, but an asthenic type without manifest inflammatory reaction is sometimes seen during the course of exhaustive diseases.

Symptoms and Diagnosis. The earliest symptoms are photophobia, manifested by spasmodic closing of the lids, and increased sensitiveness and lachrymation. The cornea becomes infiltrated and opaque. This condition can last some weeks and be accompanied with suppuration and new vessel formation. The process continuing to the ulcerative stage, a grey or greyish white depressed or excavated area appears, of variable breadth and depth, surrounded by a zone of hazy cornea and sometimes vascularization. Threatened perforation is recognized by bulging of the floor of the ulcer, Kerectasia by a bulging opaque elevation, and Keratocele by a translucent, hernia-like pouch surrounded by a border of opaque cornea. Staphyloma is at first reddish, but later becomes densely opaque. Abscess formation, which may be of variable extent and occur at any portion of the cornea, is characterized by great photophobia, secretion of tears, and pericorneal injection, and by a spot which is at first grey but speedily grows yellow, and which may be sharply defined by normal cornea or surrounded by a zone of opacity. As already has been stated, an abscess, unless previously opened, discharges, as a rule, externally. When it empties into the anterior chamber, the pus appears as a yellow mass within.

Treatment. As in conjunctivitis, irritants must first be sought for and removed, and the animal should then be confined to a darkened room. During the stage of infiltration soothing applications are indicated and for this purpose a warm solution of boric acid (2:100) should be instilled by means of a medicine-dropper. If there is much congestion present atropine is to be added in the same proportion. In the stage of resolution yellow oxide of mercury ointment (1:60) may be smeared under the lids. Cocaine should not be employed as it hinders the healing of ulcers. The best treatment for ulceration is frequent instillations of distilled aqueous solution of nitrate of silver (1:100) or of permanganate of potash (1:2000); sublimate solution (1:5000), or formaldehyde (1:3000) are also excellent. In the torpid stage, after subsidence of the acute symptoms, gentle stimulation is needed, ointments of yellow oxide of mercury, iodol, or aristol, or insufflations of calomel, producing the best results. Indolent ulcers, keratocele, fistula, and kerectasia require touching with the solid nitrate of silver stick. In threatened perforation the intraocular tension should be diminished by aseptic paracentesis of the cornea. When perforation has taken place atropine (1:100) should be used to produce mydriasis or dilation of the pupil when the opening is in the center of the cornea, and eserine (1:1000) to produce myosis when it is at the periphery of the cornea, the object in both instances being to cause the iris to retire from the lesion and thereby lessen the liability to adhesion. Recent staphyloma is treated with instillations of eserine, or paracentesis to allow escape of the aqueous humor. Failing in this, the protruding portion should be ligated with fine silk under cocaine anesthesia, the ligature being allowed to remain in position for a day or two, when the occluded portion is excised, but in the interim the animal should be kept under morphine or it may otherwise damage the eye by scratching. Abscess should be opened, puncture with a needle sufficing. For nebula and leucoma yellow oxide of mercury ointment or insufflations of white sugar may be employed, together with internal tonic medication.

INTERSTITIAL KERATITIS.

This is a diffuse form of the disease in which the inflammation involves the several layers of the cornea. It is characterized by multiple opacities and profuse intracorneal vessel formation. Ulcera-

tion rarely takes place. It is seen in poorly nourished animals and also those with rheumatic tendencies.

Symptoms and Diagnosis. The disease commences as a haziness which is sometimes streaky, near the center of the cornea. This gradually spreads over the whole cornea, at the same time showing scattered spots of greater density. There is usually a slight flow of tears and some photophobia. Soon new blood vessels commence to grow out into the layers of the cornea from the ciliary vessels towards the center, producing a dull-red or salmon color. In the course of time, generally some months, the eye commences to clear from the periphery and the vessel formation subsides, although slight haziness and even minute vessels sometimes persist.

Treatment. The indications are to allay the inflammation and maintain mydriasis and for this purpose nothing is better than frequent instillations of atropine solution (1:100). Internally, the salicylates should be administered in rheumatic subjects and tonics in asthenic animals. In the clearing stage, after irritation has subsided, the yellow oxide of mercury ointment (1:60) may be applied with advantage.

OPHTHALMITIS.

This term is applied to acute inflammation of part or all of the eye. It is generally of a suppurative type. As a rule, it results from causes of external origin, such as traumatism, perforating ulcer of the cornea, infected operations, burns, etc. One case is on record as having followed washing of the animal with strong lye. According to some authorities, it may arise by endogenous infection. When limited to the anterior chamber the disease remains unilateral, but when the entire eye is affected, the fellow usually sooner or later becomes involved.

Symptoms and Diagnosis. The eye is tumefied and projecting, and very sensitive. The conjunctiva are red and swollen. The cornea loses its transparency, or if a perforation has occurred, a wound is seen with injected or granular edges through which issues a purulent matter. There is some fever present and the animal is depressed and refuses to eat. When there is absence of a wound, an ophthalmoscopic examination is necessary to detect the presence of inflammatory debris.

Treatment. When the disease is confined to the anterior chamber, antiseptic irrigation is indicated, and when the entire organ is implicated there is nothing to do but to practise early enucleation.

GLAUCOMA.

Glaucoma is a disease in which there is an augmentation of the intraocular fluids, and as a consequence, increased intraocular tension. It may arise as a primary affection or secondarily as a complication of some other pre-existing disease. Acute, subacute, and chronic types are recognized. The disease is most often seen in aged animals and is more common in females than in males.

Symptoms and Diagnosis. Attention is usually first drawn to the condition by a haziness or opacity of the cornea which is more pronounced in the center than at the periphery, and by injection of the conjunctival veins. On palpating the ball with the finger-tips a hard feeling is imparted and usually the cornea is devoid of sensation owing to the edema. There is no reflex movement of the lids though compression of the globe itself may be painful. The pupil is dilated and moves sluggishly, and the iris is discolored. The pressure of the increased fluid in the posterior portion of the globe forces the lens and periphery of the iris forward so that the depth of the anterior chamber is depreciated. Vision is partly or wholly inhibited and the eye slowly atrophies.

Treatment. The results of treatment are rarely satisfactory and a guarded prognosis should always be given. Myotics are indicated, instillations of solutions of eserine (1:300) or pilocarpine (1:200) being employed every two or three hours. Eserine has the additional advantage of diminishing abnormal intraocular tension. Brisk purgatives should also be administered. Should these measures fail, the only alternative is to practice partial iridectomy as is done in the human subject with variable success, about one-fifth of the muscle being removed up to the ciliary border.

HYDROPTHALMIA.

This condition—so-called dropsy of the eye—is one of excessive secretion of the aqueous humor. It differs from Glaucoma in that the cornea and sclerotic become distended. It is most com-

mon in animals possessing naturally prominent eyes, such as Pugs and Toy Spaniels.

Symptoms and Diagnosis. In the early stages the only symptom is that of prominent bulging. If the condition is allowed to persist, the tension to which the cornea is subjected brings about its dissolution and permanent loss of sight results.

Treatment. To relieve the tension the cornea should be punctured repeatedly if necessary and this followed up with instillations of eserine solution (1:200).

AMBLYOPIA. AMAUROSIS.

These terms are applied respectively in those cases where vision is subnormal or is entirely abolished, but where there is no ophthalmoscopic change. The disorder may be unilateral or bilateral. The causes are manifold. Some cases are due to inflammatory changes or deposits in the retina. Others result from traumatism, encephalic disturbances, severe hemorrhages, and atrophy of the optic nerve as may follow infectious disorders, notably Distemper.

Symptoms and Diagnosis. The eye has a staring look. The pupil is immobile and widely dilated, though there is slight pupillary action in the incomplete form. Ophthalmoscopic examination may disclose a local lesion, particularly in atrophy of the optic nerve when the vessels which are normally numerous and red in appearance, for the most part disappear, the few remaining assuming a greyish color. Excepting in those cases resulting from sudden transitory disturbances the evolution is usually slow, though Distemper cases may develop in two or three weeks. Slowly developing cases have usually graver import than those of the opposite nature, where the condition may disappear with the passing of the provocative factor.

Treatment. By far the best remedy is strychnine. This should be injected hypodermically every three days in the temporal region as advocated by Froehner. Very minute doses must be employed, 1 to 3 mg. sufficing. So effective is this treatment that improvement has been noticed after the second injection, and if the ophthalmoscope is again employed neof ormation of vessels may be observed. In cases due to retinal deposits, iodine is indicated in the form of the iodides internally.

CATARACT.

This term is used to denote any opacity of the crystalline lens or its capsule. It is a common trouble. It is sometimes congenital in origin, and sometimes traumatic from contusions and wounds, but most frequently occurs incident to senility. The nature of its development is not properly understood but it is believed to be due to some condition interfering with the nutrition of the lens, and heredity is known to play a part. Cataracts are also seen in cases of diabetes mellitus. A cataract may be partial or complete, unilateral or bilateral, and according to the stage of its development may be soft or hard and consist of isolated spots, striae, or peripheral, central, or total opacities, of white, bluish, or amber color. Congenital cataracts show little tendency to further development, but those arising in young animals increase in density at a rapid rate. Senile cataracts on the other hand run a protracted course.

A cataract sometimes undergoes displacement or complete luxation.

Symptoms and Diagnosis. The first symptom is impairment of visual acuity and this becomes more and more marked as the condition increases in intensity until total blindness is established. The eye being examined, the telltale opacities are discovered, though these, when slight, may be imperceptible without an ophthalmoscopic examination. Pupillary action may remain normal.

Treatment. As has been observed by Cadiot and Breton, cataract never retrocedes in the dog and its treatment is exclusively surgical and an operation beneficial. Theoretically, removal of the lens could leave the subject capable of but vague sensation of nearby objects. But, in reality, as has been observed by Cocteau and Leroy, Contejean, Randolph, Moeller, and others, recovery of almost perfect vision is the rule. This takes place progressively in one to three months. At first the animal runs into obstacles and scents its food before partaking. Distant objects and particularly persons calling, are seen perfectly, and the animal runs at once; but in approaching, it can no longer see and hunts around guided by the voice. As the improvement takes place, accommodation, which is always within narrow limits under normal conditions, is re-established. Contejean holds that the lens is not regenerated and cites the absence of Purkinje's images as evidence. But this he regards as unnecessary suggesting that certain muscular fibers can

contract and diminish the equator of the eye, and this organ being filled with liquid or semi-liquid, the cornea and retina become separated, thus enabling focussing to take place. This view is supported by Randolph who points out that the dog is not possessed of human visual acuteness, so that few demands are made on the accommodative apparatus and consequently loss of the lens is attended with comparatively little or no inconvenience. On the other hand, Cocteau and Leroy in a series of experiments found that the lens fibers were reformed in a certain length of time after their removal.

There are two methods of producing removal of a cataract in the dog, viz., by *Discission* and by *Extraction*. The best results attend discission, though this method is not adapted to cases of senile or hard cataract. Discission comprehends the laceration of the anterior capsule of the lens with a specially constructed needle, so as to cause the aqueous humor to invade the spaces between the lenticular fibers, which causes the latter to swell and gradually soften and finally undergo absorption. The reparative process is initiated by the surgeon, so to speak, and the rest is left to Nature. It is followed by little or no irritation and an uneventful recovery is the rule. Extraction or immediate removal is not always followed by favorable results; it gives rise to considerable irritation during the healing process and there is an ever-present menace that the animal will irretrievably injure the eye in its efforts to allay this irritation. Still, the operation has several times been performed without untoward results.

LUXATION OF THE LENS.

This lesion occurs through traumatism or as a complication of cataract. The congenital form has already been noted. It may be complete or incomplete and take place into either the anterior or posterior chamber. It necessarily causes partial or total abolition of vision.

Treatment. In anterior luxation the lens may be completely removed by operative measures similar to those for cataract.

STRABISMUS.

Commonly termed "squint" this is a condition where the visual

axis is deviated from the point of fixation. It is a very rare condition but has been seen by Hobday in which case it was congenital, there being a convergent squint in both eyes. It may also result from paralysis of the ocular muscles, their unequal contraction, or from neoplasms of the orbit.

Treatment. Under general anesthesia the abnormally contracting or contracted muscle is divided in a manner similar to that in enucleation with some slight modification of technic. The conjunctiva at the canthus on the affected side only is incised, the probe-pointed hook passed inward and under the muscle, and made to raise the latter which is then severed. Subsequent treatment is directed to maintaining the wound free of infection by antiseptic irrigation. In Hobday's case the condition of one eye only was improved by the operation.

EXOPHTHALMIA.

Reference has already been made to prominent bulging of the eyes seen in Hydrophthalmia and Intraocular Hemorrhage. But these must be differentiated from the protrusion of Exophthalmic Goiter.

Symptoms and Diagnosis. In the latter disease the protrusion is so great that the eyelids cannot close, and the exposure to which the eye is subject results in drying of the corneal epithelium and ulceration. The accompanying and characteristic symptoms, viz., enlargement of the thyroid and palpitation of the heart, serve to distinguish it from other eye lesions.

Treatment. This is described under The Thyroid Gland.

NEOPLASMS.

Growths of the eye are uncommon, but both innocent and malignant types have been observed. Of the former, Pinguecula is a term applied to a small nodule which sometimes appears in the conjunctiva, and Pterygium to a peculiar hypertrophy of conjunctival connective tissue. Granuloma of the cornea sometimes results from a wound of that membrane. Reference has already been made to congenital sequestration dermoid. Sarcoma and Carcinoma represent the malignant types.

Symptoms and Diagnosis. Pinguecula occurs near the margin

of the cornea, usually at the inner side ; it has the appearance of fatty tissue. Pterygium has a similar situation but has a striking shape, being fan-shaped and convergent towards the cornea, upon which it tends to encroach. Granuloma presents a granulating flesh-like appearance and a hard consistence and is painless to pressure. When extensive it may project from the eye and cause separation of the lids. The surface is covered with a slimy secretion. Sarcoma appears first as a small flesh-like wart or polypoid outgrowth on the surface of the globe and spreads over the cornea and posteriorly. Carcinoma is accompanied with swelling of the neighboring lymph-glands.

Treatment. Pinguecula should be excised with scissors under cocaine anesthesia. Pterygium must be seized with forceps, raised from the surface of the globe and carefully severed from its corneal attachment with a knife. It is then dissected from its conjunctival bed and the edges of the wound united with sutures. Minute granuloma may be excised or cauterized with the solid nitrate of silver, but extensive granulomata and the malignant growths require enucleation of the globe.

Surgery of the Eye

In any major operation on the globe complete anesthesia is essential. As far as inhibiting pain is concerned the local use of cocaine is quite sufficient, but there is always danger that an animal in possession of consciousness may start suddenly and cause accidents. It is extremely important that all instruments be rendered sterile as it is very difficult to combat infective processes in the interior of the eye. Where instruments are to be introduced within the eye, the conjunctival sac must also be thoroughly disinfected with a bichloride solution (1:5000). Subsequent to operative measures, the animal should be kept in a small darkened enclosure to prevent active movements and the irritative effect of strong light.

PARACENTESIS.

Puncture can be made under local cocaine anesthesia, and near the lower margin on the outer side with a sterilized broad needle,

the conjunctival sac being previously disinfected with any of the antiseptic solutions indicated in Keratitis. The lids are widely separated either with the finger and thumb or a stop-speculum, and the needle inserted flatwise and manipulated so as to separate the lips of the opening and allow the aqueous humor to escape. It should be withdrawn cautiously to guard against prolapse of the iris as may take place with a too sudden gush.

ENUCLEATION OF THE EYEBALL.

For this operation certain instruments are indispensable to its proper performance, to wit: a stop-speculum, fixation forceps, a probe-pointed hook, and a pair of scissors curved on the flat. The stop-speculum is first introduced to hold the lids apart. Next, the cornea being seized with fixation-forceps (the latter being employed to steady the ball), the conjunctiva and adjacent fascia are divided in a circle close to the margin of the cornea by snipping at them with scissors. The hook is then passed successively under the tendon of each ocular muscle and made to raise the latter prominently to view, when they are divided close to their ocular attachment. To sever the only remaining attachment, viz., the optic nerve, the blades of the scissors are passed between the divided conjunctiva and the eyeball until the optic nerve is reached, when they are expanded and made to cut the nerve squarely off. The hemorrhage is insignificant and can be controlled by pressure or packing. No after-treatment is necessary, nor should any kind of bandage be applied. An artificial eye may be worn, selected to match the sound one, and it should first be introduced about a week or ten days after the operation, but only worn for a few hours at a time at the outset.

DISCISSION OF THE LENS.

For this operation only two instruments are essential, viz., discission needle and fixation forceps. In bilateral cataracts only one eye should be operated upon at a time. The pupil being previously dilated with atropine, the conjunctiva is grasped with the forceps to steady the globe, and the needle is passed through the cornea at a point in its lower and outer quadrant corresponding to the margin of the dilated pupil. It is then directed upward to the upper margin of the pupil, made to enter the capsule and drawn boldly through the latter. A second crucial incision is made in like manner and

the needle is withdrawn. It should be borne in mind that the larger the opening is made in the capsule, the more freely will the aqueous humor produce the desired effect. Following the operation, the iris must be kept well dilated with atropine (1:100) dropped in the eye three times daily, until absorption of the lens is complete. This takes place in varying periods, according to the density of the cataract, three weeks being about the shortest time, the more protracted cases running into months. The operation should be repeated if absorption is slow or incomplete.

EXTRACTION OF THE LENS.

This operation is really an elaboration of the preceding one. Extra instruments are necessary, namely, a Graefe cataract knife and a Daviel spoon. The pupil being previously dilated with atropine, and the speculum inserted, the eyeball is steadied by seizing a fold of conjunctiva below the inferior border of the cornea with the fixation forceps, and drawing it downward. The next step is corneal section and the flap should embrace the upper half of the diameter of the cornea. The point of the Graefe knife with the edge directed upward is made to enter the anterior chamber at the corneo-scleral junction and to emerge at a point exactly opposite and the section completed with a gentle sawing movement. This causes escape of the aqueous humor. The dissection needle is next introduced and with it the capsule is incised crucially as in the preceding operation. The back of the spoon is then laid against the inferior portion of the cornea and firm but gentle pressure exercised with upward motion to coax out the cataract. During the operation the iris sometimes prolapses, when it is to be carefully replaced, or failing in this it may be snipped off with scissors close to the border of the cornea. The after treatment is the same as for the preceding operation, but in this case, to prevent injury to the eye by scratching, it should be bandaged with a piece of lint soaked in bichloride solution and changed twice daily.

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The Eyelids

CONGENITAL MALFORMATIONS.

At birth the margins of the lids are united and they do not separate for some ten days thereafter. When separation fails to take place, the condition is known as Ankyloblepharon. It is also sometimes seen in after life occurring as a result of inflammation of the lids.

Treatment. In the partial form a grooved director is inserted in the opening remaining and made to pass to the opposite canthus in a line with the ciliary border; the tissue is then divided with a bistoury or scissors. In the complete form, a primary incision is made in a fold of skin gathered up with forceps and the operation completed in like manner. To prevent reunion of the severed edges, they must be frequently stretched apart and oil dropped in.

TRAUMATIC LESIONS.

The lids sometimes sustain lacerations which, if not attended to, may result in deformity, entropion, ectropion, etc. Edema of the lids often follows a blow, and abscess formation is an occasional termination.

Treatment. The edges of wounds must be carefully approximated with fine silk sutures.

BLEPHARITIS.

Inflammation of the lids occurs as an idiopathic trouble confined to the free border, often as a manifestation of eczema or follicular mange. It has been known to terminate in ankyloblepharon. Suppurative inflammation sometimes results from contusions and wounds and leads to abscess formation which may discharge spontaneously into the conjunctival cul-de-sac.

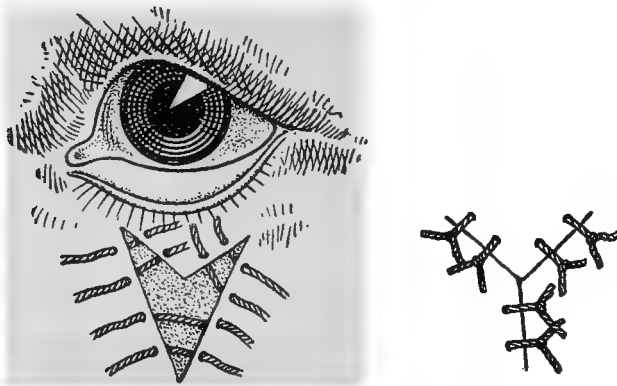
Treatment. In blepharitis confined to the free border remedies must be used to combat the condition present, whether eczematous or parasitic, always, however, with the precaution to avoid irritating applications. In abscess formation, the pus should be evacuated by an incision made just external and parallel to the free border.

ECTROPION.

Eversion of the edges of the lids is a rare trouble, being not nearly as common as Entropion. It results from cicatricial formation following inflammation or injuries to the periocular tissues, but may also be produced by swelling of the conjunctiva. It is generally seen in the lower lid and may be bilateral.

Symptoms and Diagnosis. The condition is recognized by turning outward of the lid coupled with undue prominence of the conjunctiva. Through the constant exposure to which the latter is subjected it is more or less inflamed. Mucus and tears are freely secreted.

Treatment. When due to conjunctivitis, scarification of the conjunctiva will at time suffice, but if this fails, the operation for the cicatricial form must be undertaken. This consists in excising under cocaine anesthesia an elliptical piece of the conjunctiva in the long axis of the lid, or if this fails, in removing a V-shaped seg-



No. 10. Operation for Ectropion.

ment of the lid including all the tissues and skin and bringing the edges of the wound together with silk sutures.

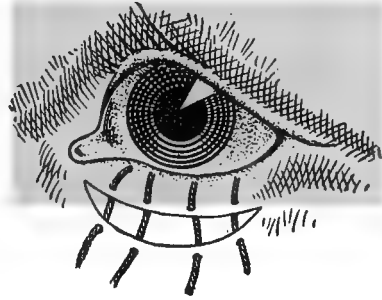
ENTROPION.

Inversion of part or the whole of the edges of the lids is not an uncommon deformity and is frequently complicated with trichiasis. It is most often seen in hunting dogs and dogs of the larger breeds.

As in Ectropion, it may be caused by the formation of cicatricial tissue following wounds, by chronic blepharitis, eczema, follicular mange, etc. Spasmodic inversion accompanying acute conjunctivitis and keratitis must not be confounded with the true deformity. This lesion occurs most often in the upper lid, but both lids may be affected.

Symptoms and Diagnosis. The lid is turned inward and coming in contact with the eye actively irritates the latter, sometimes to the extent of starting up ulcerative keratitis. There is usually convulsive closure of the lids and much secretion of mucus and tears. The conjunctiva are injected.

Treatment. This trouble is remedied by excision of an elliptical portion of skin covering the lid. With entropion forceps a fold of skin is seized, parallel to the ciliary border, of sufficient size to cause the inturned lid to assume a normal position, care being taken to avoid including the conjunctiva. The strip of skin in the grasp of the forceps is then excised with scissors close to the forceps so that at least a quarter of an inch of skin exists between the wound and ciliary border. The margins of the wound are brought together with subcuticular silk sutures.



No. 11. Operation for Entropion.

TRICHIASIS.

Turning in of the eye-lashes occurs as a complication of entropion, but it also takes place independently of the latter trouble. It may lead to serious results as the constant rubbing of the cilia against the cornea causes ulceration.

Treatment. The offending lashes must be plucked out with forceps as often as is necessary. If this proves insufficient total excision of the hair follicle must be practised by making two parallel incisions along the margins of the lids on either side of the row of hairs, and of such depth as to ensure complete removal of the roots.

NEOPLASMS.

The commonest form of growth seen in the eye-lids is Papilloma or Wart. It is innocent but in aged animals may become malignant by assuming epitheliomatous character. Fibroma also occurs, as does Sarcoma.

The Membrana Nictitans and the Orbital Gland with which it is closely associated are frequently the seat of swelling from acute inflammation, hypertrophy from chronic inflammation, or myxoma.

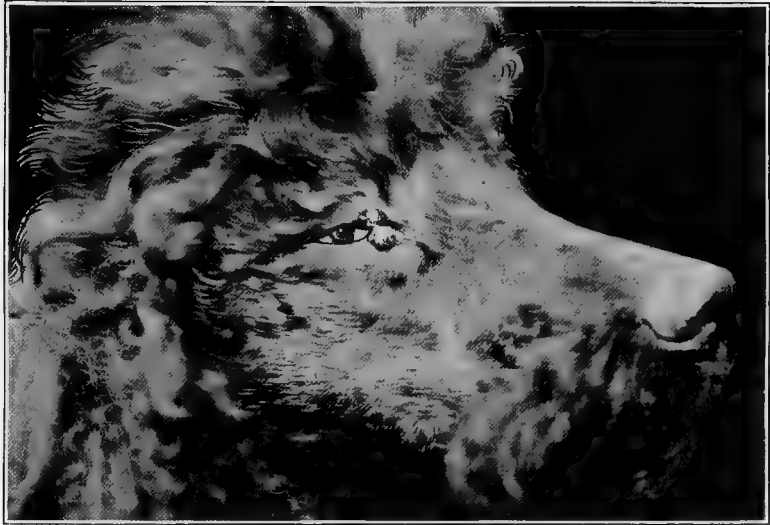
Treatment. Warts are seized with forceps and snipped off with curved scissors. As a rule, no anesthetic is necessary but nervous subjects should previously be narcotized to prevent accidental injury to the eye through sudden movements. The hemorrhage amounts to nothing and soon stops spontaneously. When the growth is extensive it is necessary to remove a wedge-shaped portion of the lid with scissors under cocaine anesthesia and suture the cut edges. In either case, the base should be cauterized with the solid lunar caustic.

Enlargements of the Membrana Nictitans and Orbital Gland call for removal under deep cocaine anesthesia by seizing the membrane with forceps, drawing it forward and snipping it off with fine curved scissors as close to its base as possible. The cocaine anesthesia must be thorough and no attempt should be made to remove the membrane until the full effect of the drug is procured.

LACHRYMAL FISTULA.

This is a very rare affection. It may occur as a sequel to traumatism, through extension of inflammation of the nasal passage causing obstruction within the duct, or through lodgment of foreign bodies. The obstruction occurs where the duct emerges from its bony casing and continues as a membranous tube to the nose. Chronic suppurative inflammation starts up, the pus burrows and perforates the bone and discharges externally.

Symptoms and Diagnosis. Lachrymal fistula appears as a tiny trumpet-shaped orifice with pouting granulations a little below the inner angle of the eye. Tears, muco-pus, or pus exude and soil the hair. The eye swims in tears. To differentiate from maxillary fistula a fine probe must be employed and it should be remembered that in the latter condition the discharge is invariably purely purulent.



No. 12. Papilloma of the Eyelid.



No. 13. Hypertrophy of the Orbital gland.

Treatment. This is a delicate undertaking. An attempt should be made to divert the flow to the nasal cavity by establishing a new opening directly into the latter, and promote healing of the outer wound by cauterizing it.

The Ears

EXAMINATION.

The external ear, when healthy, can be easily inspected in a favorable light if the flap is held aside, but for examination of the external canal and drum an expansible speculum and mirror are necessary. When the parts are inflamed they are very sensitive and the animal usually offers more or less objection to manipulation and it is sometimes necessary to apply a muzzle and even the hobbles.

TRAUMATIC LESIONS.

The wounds most commonly met with are bites by other dogs. Contusions caused by the animal shaking its ear-flaps are not uncommon and these are referred to under Hematoma. Bite-wounds vary in extent and position and are often irregular. Division of the anterior auricular artery can give rise to severe hemorrhage. As a rule, wounds of the ear are tardy to heal through continual scratching and agitation on the part of the animal.

According to Cadiot and Almy, the base of the concha may suffer fracture and as a result the auditory conduit be more or less completely obstructed if reunion should take place with defective position of the parts.

Treatment. The edges, if severed, must be nicely sutured and every effort made to avoid resultant deformity through irregular cicatrization. In some cases it may be advisable to amputate a portion of the flap, when the opposite ear should be treated in like manner. During healing a protective ear-cap and soothing application may be necessary.

ULCERATION OF THE CONCHA.

This disease is most commonly observed in fine-haired subjects possessing long, pendant ears. The lesion is always situated at

or near the edge of the concha. In most cases it occurs as a complication of otitis resulting from the bruising caused by violent or constant shaking of the flaps, and it is then usually bilateral. It may also result from traumatism and may develop as a manifestation of eczema.

Symptoms and Diagnosis. One or more raw or scab-covered ulcers are observed, with sensitive edematous edges. When raw, and the flaps are violently shaken, blood may be swished in all directions. The disease is generally progressive owing to the incessant irritation of the shaking.

Treatment. When uncomplicated with otitis this lesion is very stubborn and unresponsive to treatment. The flap should first be soaked in a moderately hot antiseptic solution, and the same treatment pursued as advocated for otorrhea, viz., application of distilled aqueous nitrate of silver or protargol solution (3:100—5:100), twice daily, supplemented with xeroform or other analgesic antiseptic powder to which a little orthoform may be added to get a more pronounced anodyne effect. At the same time the ears should be securely bound to the head, as further shaking counteracts all good effect of treatment. Failing in this after perseverance a reasonable length of time, a portion of the flap must be amputated in as artistic a manner as possible.

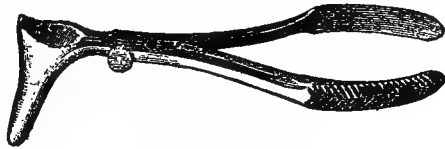
When developing as a complication of otitis, treatment is seldom necessary, the inflammation usually subsiding as the primary trouble disappears with treatment.

OTTITIS. OTORRHEA.

Inflammation of the ear is a very common affection, particularly in long-eared animals. It is usually unilateral but it may be bilateral. It exhibits all the phenomena of inflammation and terminates in ulceration. The disease has been attributed to a variety of causes, such as excessive animal diet or lack of exercise, but these conditions bear little relation to it. In the great majority of cases, it is a purely local pyogenic infection engendered by irritation produced by accumulation of cerumen and dirt. Such accumulation is particularly provocative of irritation in ears with pendant flaps, in which ventilation cannot freely take place. It is for the latter reason that the disease is less common in animals with erect or cropped ears. There is also a parasitic form of the disease caused

by the presence of the *Symbiotes auricularum*, which, however, is extremely rare. Should ulceration once disturb the integrity of the parts a further and constant irritant exists in the presence of the resultant tissue debris which has no chance to escape by drainage. The condition then assumes chronicity, the integument of the auditory canal becoming thickened, sometimes to such degree as to occlude the passage. This thickening is to be distinguished from the not uncommon papillomatous excrescences. While the inflammation may extend as far as the tympanic membrane, it is very rare that the latter becomes involved. When the disease is allowed to become chronic it sometimes gives rise to the neoplastic formation known as papilloma. Complications in the form of hematoma of the concha or ulceration of its borders frequently arise as a result of the violent shaking and scratching.

Symptoms and Diagnosis. In the acute form the animal incessantly shakes its head, scratches its ears, or rubs them along the ground. Examination of the ear reveals a hot, congested, and tender internal integument, which in the inner recesses is generally coated more or less with dirt and wax. A mirror and ear speculum may be employed to facilitate inspection, and the latter is indispensable to permit of free view of the ulcers. As the inflammation progresses, supuration takes place and a fetid purulent liquid



No. 14. Ear Speculum.

is discharged. The presence of ulcers and pus may always be ascertained by the characteristic suction sound given forth by manipulation of the base of the ear. If the disease is unilateral the head is inclined sideways towards the affected sac. Hearing is often impaired. In the parasitic form epileptiform seizures have been observed to take place, usually when the animal was excited.

Treatment. Attention must first be directed towards removing all dirt and wax and tissue debris and thoroughly cleansing the auricle and external canal, particularly the innermost recesses of the latter. This is best accomplished by irrigating the parts with moderately hot water by means of a gentle stream from a fountain syringe. Antiseptic solutions may be used for this purpose but their employ-

ment carries no advantage with it. The animal usually objects the less the further the nozzle is inserted within the passage. Another method, which is, however, more painful, is to grasp a small wad of absorbent cotton with the beak of a hemostatic forceps, dip it in the fluid, and swab out the ear. In either case the passage should be finally freed from all moisture with dry absorbent cotton in this manner. Hair in the vicinity of the passage should be removed with scissors. In cases exhibiting advanced ulceration and which consequently would give rise to much pain upon manipulation, morphine should previously be administered hypodermically.

A great many remedies have been advocated and employed in this affection, but two or three are pre-eminent in their curative power, and with them alone the worst form of the disease may be eradicated. It should be remembered that this disease is an inflammatory one due to the action of pyogenic microorganisms, and differs in no wise from inflammatory disturbances of the same origin and nature in other parts of the surface of the body and requires similar methods of treatment. In the active hyperemic stage irrigation or local bathing with moderately hot water is beneficial followed by soothing applications. As a soothing application a remedy combining antiseptic, dessicant, and analgesic properties is desired and nothing meets the requirement better than the synthetic powder xeroform. The milder ulcers call for gentle stimulation and for this purpose nitrate of silver in distilled aqueous solution (3:100—5:100) cannot be excelled. The employment of such solution for stimulating purposes may be limited, usually to three or four instillations. It should be instilled night and morning into the external meatus and retained there for a few minutes, the animal then being allowed to shake it out, or in the case of a light-coated animal, absorbed with a piece of cotton or sponge to prevent it staining the hair. Indolent and exuberant ulcers may be actively cauterized with the solid stick or powerful solutions. As the action of the caustic is very painful the parts must be well anesthetized with an instillation of a strong solution of cocaine. Local anesthesia being established, the canal is dilated with a speculum to expose the ulcers, which are then freely cauterized. A few hours after the application of the nitrate a more profuse discharge takes place, which, however, soon subsides. Severe and long-standing chronic cases treated in the manner thus outlined may be permanently cured in



No. 15. Papillomata of the Ear.

from two to six weeks, but as the trouble is prone to recur the ears should subsequently be periodically examined.

In the parasitic form, parasiticides are, of course, indicated.

To ensure local applications reaching all parts of the canal the base of the ear must be manipulated between the thumb and finger.

If the shaking of the flaps is violent enough to threaten the production of hematoma or ulceration of their borders the protective ear-cap may be employed.

SINUS.

A very rare form of sinus which is caused by the presence of a dermoid dentigerous cyst in the temporal region may have its orifice of discharge within the auditory canal (See The Teeth). Suppurating lymphatic glands will also sometimes break through and discharge into the auditory canal, thereby simulating otorrhea.

NEOPLASMS.

Two forms of neoplasms are commonly met with in the ear. They are both innocent. They occur as papillomata which develop in the vestibule of the outer ear, and as contusion or extravasation cysts (hematomata) which form beneath the integument of the concha. Sebaceous adenomata have also been observed.

Papillomata. These tumors occur as single or multiple, flat, coin-shaped or cauliflower-like excrescences. When numerous they may extend well within the vestibule and block the canal. From their surface they usually discharge a fetid, greasy matter. They occur as the result of chronic otitis.

Symptoms and Diagnosis. The symptoms are identical with those of chronic otorrhea, and the presence of the growths is ascertained only by close inspection of the auditory canal. The animal is often deaf.

Treatment. By far the most effective method of treating this disease is complete destruction of the tumor with the thermo-cautery. Ablation by snipping at the base of the growth with curved scissors, as advocated by some authors, I cannot recommend, as it is uncertain in result and is usually followed by recurrence of the trouble. Cauterization is effected with the animal in the lateral position under complete anesthesia. The burning process must be thorough. The

ear-speculum should always be inserted while the cautery is in use, partly for the purpose of dilating the canal, but also to protect adjacent parts. A day or two later a mass of resultant necrotic tissue needs to be removed with forceps and irrigation. Subsequent treatment consists in irrigation with antiseptic solutions, thorough drying with absorbent cotton, and insufflation or packing with absorbent powders, such as xeroform, aristol, etc. Any sluggishness in healing or tendency towards unnatural secretion should be treated with injections of silver solution in the strength employed in otorrhea.

Extensive cutting or burning of the canal involving removal or destruction of all or most of the integument leads to obliteration of the canal. It will be remembered that it is the epithelium of the free surface of the body which prevents union of contiguous parts. When a raw surface, denuded of all epithelium, is brought in contact with another similar surface, union of the two takes place by interformation of connective tissue. Even a deep sac-like wound fills up with reparative tissue, because the latter grows more quickly than does the epithelium from the neighboring surface. If the epithelium were the quicker to grow, it would extend over the wounded surface, prevent the filling-up process, and lead to the formation of pits and depressions in all wounds deeper than the skin. And it is exactly this process of connective-tissue reparation which tends to develop as a consequence of radical surgical measures affecting the external auditory canal. A free granulating surface is left, which fills up and coalesces and completely obliterates the canal. The indications in these cases are daily irrigation of the parts and packing with gauze impregnated with desiccant powders, until the epithelium has had time to spread inwards over the raw surface to the depths of the canal. A case presenting complete obliteration of both canals following excessive ablation of the parts, and which I endeavored to remedy by making an artificial opening and canal, terminated in failure after a four months' attempt at keeping it open. Strangely enough the hearing of the animal seemed very little impaired, which suggests that this result is not to be regarded as altogether undesirable since it certainly protects from future troubles of a like nature.

Hematoma. This lesion is characterized by rupture of vessels and an extravasation of blood or hemorrhagic exudate beneath

the perichondrium of the conchal cartilage. It may occur on both sides but it is more often confined to the internal one. Ordinarily the fluid remains unchanged other than to clot but it may suppurate. If it undergoes resorption, which it is very slow to do, the resultant cicatrization usually causes considerable shriveling and deformity. A spontaneous cure is rare.

Its origin is always traumatic, in most cases resulting from the shaking and scratching provoked by otitis or conchal ulceration, but it may also be caused by bites, or bruises.

Symptoms and Diagnosis. The affected ear-flap exhibits a characteristic bulging generally confined to the inner side but sometimes involving both. When of recent origin, the swelling is hot, tense, and sensitive, and the head is depressed towards the affected side. When of long-standing, it is insensitive, devoid of inflammatory phenomena, somewhat indurated at its borders, and fluctuates.

Treatment. The indications are to evacuate the fluid and as speedily as possible promote reunion between the separated perichondrium and its subjacent cartilage. The latter step is accomplished by mechanical or chemical means. Simple lancing and withdrawal of the fluid is ineffectual, for the sac continues to refill for a lengthened period as often as it is emptied, and the longer the healing process is protracted the greater is the resultant deformity of the parts.

The most satisfactory results are obtained by the following procedure: Evacuate the fluid by incision at the most dependent portion of the flap. Then, after the manner first suggested by McQueen, pass interrupted radiating sutures through all the tissues of the flap at intervals of about one-third of an inch, throughout the cystic area, tying the knots on the surface where the flap is free from hair. On each succeeding day examine the flap and squeeze out any little fluid which may have accumulated, through the original incision. Remove the sutures in the course of a week. In some



No. 16. Operation for Hematoma of the Ear-flap.

cases a protective cap will be found expedient but usually the shaking ceases as soon as the irritation which provokes it is allayed, and no further bruising occurs.

Another method for promoting reunion of the tissues is to inject a strong solution of iodine (iodine 1 part, potassium iodide 2 parts, alcohol 16 parts) after the exudate has been evacuated, but it is neither as certain nor as speedy as the preceding one.

AMPUTATION OF THE CONCHA.

Under the term "cropping" this operation is extensively performed on this continent for cosmetic purposes, or in other words, to improve the appearance of the animal. Fashion, led by the fanciers, regards the Great Dane, the Bull Terrier, the Boston Terrier, the Black-and-tan Terrier, and certain French toy breeds as fit subjects for improvement, and while such an operation cannot be regarded as strictly legitimate surgery, yet it is described here so that the practitioner may become conversant with the technic in order that he may fit himself for undertaking it if he so elects.

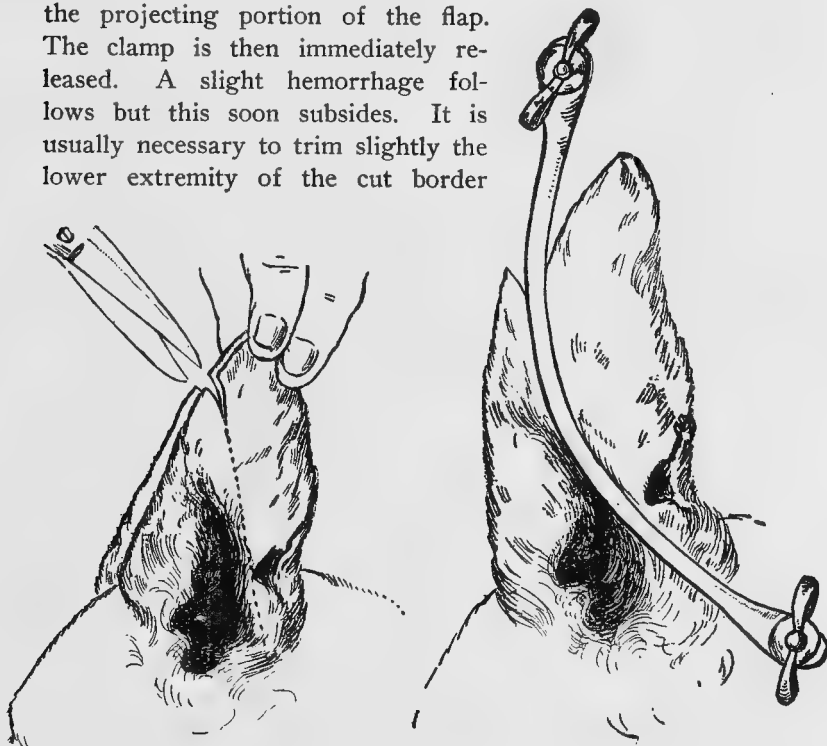
Amputation is also indicated when the flap has suffered irremediable laceration and in intractable ulceration of the concha, in which case both ears should of course be fashioned as artistically as practicable.

Various designs of clamps have been invented to facilitate the operation and they are useful to employ as "markers," so that both flaps may be evenly cut, but there is none wholly satisfactory, for the reason that it is impossible to construct a clamp of such shape as to include in its grasp at one time all the parts to be removed. One of my own design is figured in the accompanying illustration.

The Great Dane "crop" is the simplest of all. It is what is known as a "straight crop," and the straight clamp is employed. It is best done at the age of about three months. General anesthesia may be employed, but as the operation is one which can be done rapidly, morphine narcosis is sufficient.

The first step consists in juxtaposing the flaps above the head and snipping them with scissors together at a spot which is to form the superior extremity of the "crop." This secures equal length to either ear. The clamp is then adjusted on the concha or flap, the outer edge of the upper end of the instrument corresponding to the snip, the lower end being pressed close to the head so as to include

as much of the burr or lobe as possible, and it is then screwed tight. Quickly following, the blade of a scalpel is run along the outer edge of the clamp, thereby severing the projecting portion of the flap. The clamp is then immediately released. A slight hemorrhage follows but this soon subsides. It is usually necessary to trim slightly the lower extremity of the cut border



No. 17. First step in amputation of the Concha. No. 18. Second step in amputation of the Concha.

with scissors. After the opposite ear has been similarly treated, the operation is complete. During healing, however, the resultant scar tissue forming at the wounded edge is very apt to cause the formation of kinks oftentimes sufficient to prevent proper erection of the ears in after life. This must be guarded against by submitting the ears to a "pulling" process, or in other words, tearing apart any too freely contracting cicatrization. For this reason, no animal which has undergone the operation should be dismissed by the practitioner until complete regular healing has been established. It is generally a few weeks, or until all soreness has departed, before the ears are held fully erect.

The correct "crop" for the Bull Terrier and Black-and-tan Terrier differs considerably from that given to the Dane. It is a very close "crop" the greater part of the lobe being removed, and the flap being cut long and narrow. When properly done, this "crop" gives to the animal a very alert and sharp appearance. It is best done at the age of six to twelve months, *i. e.*, not until the flaps are well developed.

Persons who are expert in cropping animals of these two breeds rarely use clamps, depending rather upon their skill to produce an even result. As already stated, clamps cannot be applied so as to render the completion of the operation possible at one step, nevertheless it is wisest for the beginner to make use of them to the extent that it is possible. A curved clamp is necessary in this case, and general anesthesia should also be employed.

The flaps are first juxtaposed and snipped as in the preceding case.

The next step is to apply the *curved* clamp with its concave side towards the portion to be excised, the outer edge of its upper end corresponding to the snip, its lower including as much of the burr as possible. The clamp being screwed tight, the projecting portion of the flap is severed as already described, and the clamp is removed. The burr must now be removed, and this is accomplished with scissors by extending the section from the inferior extremity of the new border. The other ear having received similar treatment the first part of the operation is complete. The after-treatment is no less important than the actual cutting process. A "crop" of this nature can rarely be depended upon to heal as is desired, *i. e.*, with certainty that it will stand properly erect, without some sort of support being afforded during cicatrization, for the reason that kinks are apt to form at the wounded border if the flap is allowed to hang over. Hence, it is necessary to provide some sort of splint. The best device to meet this exigency consists of a strip of stout paste-board shaped somewhat larger than the modified flap. Two such pieces being prepared, holes are bored in them near either end and short lengths of twine or tape are passed through these and fastened by tying. This splint should not be applied until a few days succeeding the operation or until all hemorrhage has subsided. It is then smeared on its side opposite to that from which the tapes project, with ordinary carpenter's glue, and fitted and pressed firmly against

the hairy or outer side of the flap until the glue hardens and firm adhesion is obtained. The two modified flaps are then raised into position by tying together the opposite tapes of each splint. The erect position is thereby secured and should be so maintained until healing of the border has fully taken place, the splints being renewed if necessary. The splints can then easily be removed by "peeling" them from the flap, as, in the meantime, the hair in growing, has forced the glue away from the skin. Some animals will not fully erect the ears until a few weeks have elapsed. The Boston Terrier is given a "crop" very similar to that just described but the flap is cut somewhat shorter and sharper.



No. 19. Amputation of the Concha. Splints in position.

CHAPTER III

The Head and Neck—Continued

The Lips, Mouth, Tongue and Jaws

EXAMINATION.

In docile animals examination of the buccal cavity is easily accomplished. The best way to expose all parts of the mouth is to assume position facing the animal, place the fingers of the left hand over the upper jaw, and extending the thumb, direct its extremity on to the palate through the interdental space immediately posterior to the canine tooth. This causes the animal to open its jaws, and the right hand is then employed to raise or depress the lips or tongue, as desired.

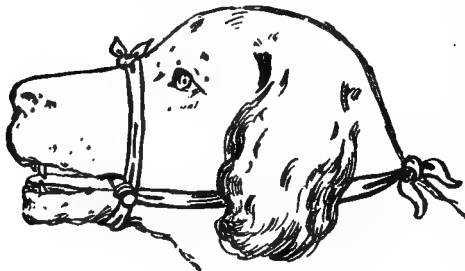
By another method the upper lips are pressed in between the molars and the lower jaw gently forced apart by pressure over the lower incisors.

In vicious animals the procedure may be rendered safe by previous hypodermic narcotization with morphine.

IMMOBILIZATION OF THE JAWS WITH THE SPECULUM.

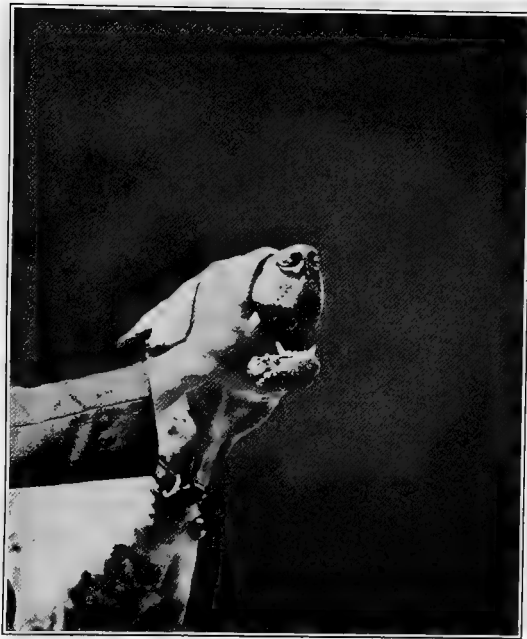
For protracted examination and some operations it is necessary to secure immobilization of the jaws by application of some form of speculum.

The simplest of the various devices in use is the well-known improvised gag of Bourrel.



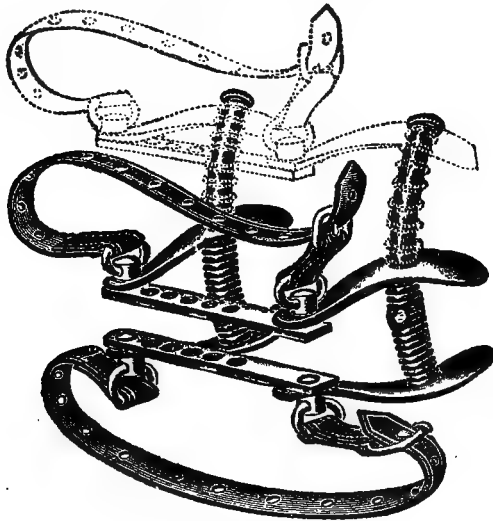
No. 20. Improvised Bourrel Gag.

improved gag of Bourrel. A stick of wood somewhat longer than the width of the jaws is selected and to either end a tape or cord is fastened. The stick is placed transversely between the molars, close to the commissures, and held in position by tying the

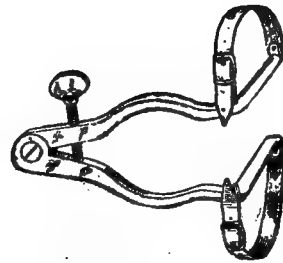


No. 21. Examination of the Buccal cavity.

tape or cord back of the poll. An additional tape or cord is then tied round the muzzle back of the stick to prevent the jaws opening any further. Of the manufactured articles my own device meets all requirements. It is constructed on the same principle as the Wingrave mouthgag used in human surgery. It is very light and strong, can



No. 22. French Mouth Speculum.



No. 23. Baker Mouth Speculum.

be adjusted to fit any sized mouth and is self-expanding. Another good instrument is the Baker speculum. One invented by Hobday consists of spreading horizontal bars supported by perpendicular bars which are secured immediately behind the canine teeth, but it necessarily obstructs lateral passage of instruments and fingers of the operator, and is too clumsy for small animals.

CONGENITAL MALFORMATIONS.

The young of the shortnosed breeds are occasionally born with fissure of the upper lip—the so-called hare-lip. This deformity may be unilateral or bilateral and may exist independently but is generally complicated with cleft palate. It exists by virtue of incomplete fetal coalescence of the parts. It does not occur in the median line but always to one side by reason of the central part of the upper

lip being developed from a different center from that forming the outer part of the upper lip. Cleft palate forms a communicating channel with the nasal cavities so that portions of alimentary matter pass out by the nose. Affected animals in which this occurs suffer emaciation and usually succumb within a few days after birth. In animals that manage to imbibe nourishment there is opportunity for the giving of surgical relief at a later stage.

Treatment. Hare-lip may be successfully remedied at any age. The position of the canine teeth must be noted and if by reason of their prominence they offer any interference are to be extracted. Cocaine anesthesia is sufficient for the operation. The edges of the deformity are "freshened" by cutting away a narrow strip of tissue at their borders and the parts loosened from the subjacent gum by appropriate dissection. The edges are then approximated and secured by stout silk sutures. If the sutures are subsequently torn out by the animal they are to be replaced.

Cleft palate is relieved preferably under chloretone narcosis along similar lines but the technic is a good deal more difficult. Before the separated edges can be approximated, the palate, which owing to its intimate connection with the bone is not extensible like the lips, must be separated from the bone by blunt dissection a short distance on each side of the edges, and incisions made parallel to the latter on both sides at the outer extremity of the freed area. The edges are then "freshened" and drawn together with interrupted sutures, the gaping incisions being left to fill up by granulation.

TRAUMATIC LESIONS.

Wounds of every variety may occur in or about the mouth. Bites by other dogs and penetration by foreign bodies are common lesions.

Treatment. The ordinary methods of cleansing, suturing and giving drainage are indicated.

STOMATITIS. GINGIVITIS. GLOSSITIS.

Inflammation of the buccal tissues may be diffuse or limited to the gums (gingivitis), the tongue (glossitis), the palate, the cheeks, etc.

Catarrhal and gangrenous forms are recognized, the latter be-

ing commonly designated "noma" or "canker." The gangrenous form may lead to fatal termination by production of septicemia.

The disease occurs as the result of local infection, probably through invasion by ordinary pyogenic microorganisms which under normal conditions inhabit the mouth in large numbers together with other varieties which are entirely innocuous. But for these microorganisms to produce pathologic lesions it is essential that some favoring conditions should exist, and such conditions are generally believed to be either a local or general reduction of vitality and diminished resistance of the tissues of the organism, or an increased virulence on the part of the microorganism.

Amongst the local conditions are irritation produced by the prehension or administration of hot or caustic liquids, by traumatism, by penetration of foreign bodies such as needles, bones, etc., by the constricting action of certain bodies such as threads, rubber-bands, and annular objects mischievously placed on the tongue or accidentally prehended, by the presense of calcic incrustations on the teeth, by carious teeth, and by neoplasms. Amongst the general conditions are certain states of infection of the entire alimentary tract such as gastro-enteritis, and toxemias such as distemper.

Symptoms and Diagnosis. Mandibular action is inhibited, the mouth exhales an obnoxious odor, and saliva dribbles and hangs in filaments. In the catarrhal form the mucosa exhibits all the characteristic signs of inflammation and is often covered with greyish sordes. In gingivitis the gums are dark red, swollen, bleeding and separated from the teeth.

In glossitis the organ is considerably swollen and in advanced stages of constriction cases may be many times larger than normal so that it protrudes from the mouth and impedes respiration. In the gangrenous form of stomatitis, the gums, internal face of the lips and cheeks, and sometimes the entire buccal mucosa and even the cuticular border of the lips are studded with fetid, greyish necrotic patches, or round or oval ulcers. In gangrenous glossitis the lesion is partial, being distinctly demarked and confined to the tip and edges, the diseased portion being cold and of brownish black color.

Treatment. In inflammation due to local conditions the indications are to remove the provocative agent and disinfect the mouth, preferably with permanganate of potash solution (2:100). Atten-

tion must also be paid to alimentation when the animal refuses to eat. When the tongue is much tumefied the swelling may be modified by light scarification of the organ. The incisions are made on the inferior surface, the operator being careful not to incise too deeply.

Gangrenous inflammation demands energetic treatment. The sloughing tissue must be removed with forceps and scissors and the entire diseased surface gently cauterized and subsequently treated with disinfectant solutions. Gangrene of the tongue is treated by amputation of the diseased portion, but conservatism should always be observed when surgical interference of this organ is contemplated.

PARTIAL AMPUTATION OF THE TONGUE.

For this operation scissors and wire ecraseur are employed. The animal being anesthetized and its jaws immobilized with a speculum, proceed as follows: Depress the muzzle in order to avoid entrance of blood into the air passages. Insert two ligatures in the healthy tissue, one on each side of the median line, by which draw the tongue forward. If necessary, separate the diseased part from the floor of the mouth by dividing the frenum with scissors. Pass a couple of straight needles or pins through the organ at the proposed line of section and apply the loop of the ecraseur behind these. The needles or pins will suffice to keep the loop in the desired position. Then remove the affected part by tightening the wire. Should any hemorrhage supervene, control it by seizing the stump with fixation forceps and draw it far forward which stretches the lingual arteries, or ligate the latter. Another method is to use only broad-bladed scissors with a dull edge.

It must not be forgotten that an animal which has been deprived of the greater part of its tongue will have difficulty in drinking, and must thereafter be allowed to quench its thirst from a running spigot above the level of its head.

FOREIGN BODIES.

These consist principally of fragments of animal or fish bones, pieces of wood, skewers, fish hooks, pins, needles, or other hard substances, which are usually accidentally prehended with the food.

They may become wedged in between the teeth or perforate the soft tissues. Youngs treated a case in which he found a splinter of wood lodged between the upper gums behind the incisors, and observed also a small wound on the left side of the frenum. Later, an abscess formed in the throat and burst, and this led to the discovery of another piece of wood which had penetrated the tissues from the mouth and had lodged in the subcutaneous tissue slightly to the right of the trachea. Annular bodies, rubber bands, or threads may encircle the tongue, the ends of threads extending into the esophagus. Servais recorded a remarkable case of constriction of the base of the tongue by an annular portion of the aorta of a cow, which had slipped over the tongue while the animal was feeding and had become worked back by muscular movements of the organ. In districts where porcupines abound, it is not uncommon for dogs, in attacking these creatures, to receive a mouthful of quills. The latter make a very awkward foreign body as it is hopeless to extract them without causing extensive laceration. When they penetrate out of sight, they usually work their way through the skin in course of time and cause considerable pain in so doing.

Symptoms and Diagnosis. The presence of foreign bodies in the mouth may be recognized by the persistent attempts of the animal to rid itself of the offending object by pawing at the mouth and shaking the head. The jaws are champed or held open and immobile, and saliva dribbles from the mouth. The presence of pins and needles does not always give rise to indicative symptoms. They may penetrate the base of the tongue so deeply as to be invisible and only discovered by digital exploration, or they may gradually work their way through neighboring tissues and ultimately find exit at some other part of the body.

In Servais's case of constriction of the tongue the latter was enormously swollen and gangrenous.

Treatment. Substances wedged in between the teeth are removed without much difficulty with suitable forceps or they may be displaced by drawing a piece of silk or catgut to and fro in the interdental space. Needles and pins lodged in the tongue are extracted with forceps. The tongue should be firmly grasped and drawn well forward to permit of more easy removal. If the point of the needle has penetrated in an anterior direction, the visible portion is seized with forceps and extracted by traction in the opposite direction. Bodies lodged in the cheeks may be removed by exter-

nal incision if considered advisable. Porcupine quills must be pushed forward through the cheeks, or left to emerge.

NEOPLASMS.

Both innocent and malignant growths occur in the mucosa and submucosa and in the subjacent tissues of the buccal cavity. The former class comprises the wart-like papillomata, fibroma or so-called benign epulis, the buccal and salivary retention-cysts or so-called ranula, and osteoma of the jaw. The malignant growths consist of epithelioma and sarcoma or so-called malignant epulis. The term epulis literally means "situated on the gums," and as it possesses no pathologic signification and is equally applicable to one form of growth as to another, should be excluded from nomenclature.

The **Papillomata** occur fairly commonly in young animals and are undoubtedly contagious or infectious in character (see Chapter on Neoplasms, Papillomata).

Symptoms and Diagnosis. They are observed as small, isolated or confluent, pedunculate or sessile, whitish, dendritic, multiple growths, springing from the mucosa and situated on the inner aspect of the cheeks and lips, on the gums, and sometimes on the tongue and hard palate. When numerous they interfere with mastication and induce a buccal secretion of foul odor.

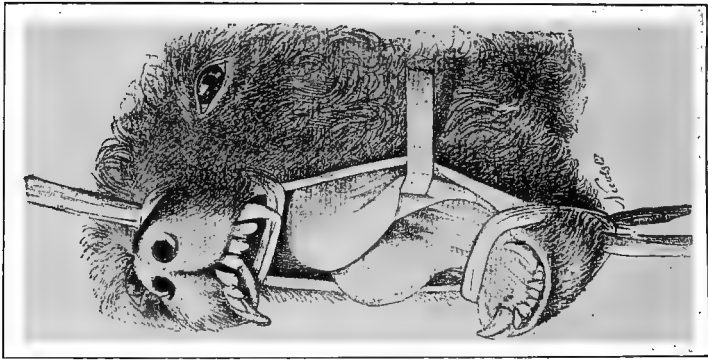
Treatment. This disorder does not actually require any treatment, as after remaining in evidence for a few weeks the growths disappear as spontaneously as they arise. To hasten their removal, the larger ones and confluent masses may be removed with curved scissors. The mouth should be swabbed out daily with deoderant solutions, a solution of permanganate of potash (2:100) answering the purpose.

Fibroma. This form of tumor is a hyperplasia of connective tissue elements which may be a pure fibrous growth or of mixed character, containing cartilaginous matter and spiculae of bone. It has its origin either in the submucous tissue or the periosteum of the maxilla. It occurs as a single growth and is not very common.

Symptoms and Diagnosis. It grows at the edge of the gums as a firm reddish enlargement varying in size from a pea to a hazelnut. Its usual position is the neighborhood of the incisors and it may occupy the entire area between the two canines. Its evolution



No. 24. Papillomata of the Buccal Mucosa.



No. 25. (After Cadiot and Breton) Retention-cyst appearing in the Buccal cavity.



No. 26. Retention-cyst burrowing down the Neck.

is slow and it may remain quiescent for months. This feature serves to distinguish it from the malignant sarcoma of the periosteum.

Treatment. The tumor must be freely excised and the wound cauterized with the thermo-cautery.

Ranula. Retention-Cyst. The term Ranula is generally applied to all cystoid formations appearing in the buccal cavity. The designation is inappropriate and should not be employed in medical or surgical nomenclature. The correct term to employ is RETENTION-CYST and the particular organ or issue concerned should at the same time be specified. Thus, there may be a retention-cyst of Wharton's duct, through cohesion of its margin, or the cyst may be brought about by destruction and dilation of sublingual buccal glands. The latter form is the more common. By augmentation, such cysts may burrow into the neck and have for their external limitation the dermis.

Symptoms and Diagnosis. When the cyst appears in the buccal cavity, one or perhaps two or three swellings are observed adherent to the floor of the mouth on either side of the frenum. The tongue is seen to be raised somewhat and displaced to one side. The swellings may vary in size and shape, being sometimes cylindrical, at other times round or oval, and may attain the size of a hen or goose egg. The surface is glairy and slippery and in some cases so translucent as to render the greyish or reddish-yellow, more or less viscid contents plainly visible.

When the cyst burrows down the neck the formation is characterized by its subcutaneous position in the submaxillary region or at the superior extremity of the neck, the mobility of the skin over the cyst, the viscid fluctuating contents, seemingly hard capsule, and entire absence of inflammation. These cysts grow slowly and develop without apparent cause. They need not be mistaken for any other condition, excepting perhaps hematmata, but the latter develop quickly and have a history of traumatism, and the skin is usually adherent to them. A positive diagnosis can always be made with the aspirator, the thick viscid contents of the retention-cyst not being extractable with a needle of ordinary caliber.

Treatment. Operative measures are followed with good results. The operator must seek to accomplish the complete excision or destruction of the cyst wall, and not merely lance and evacuate the contents. Unless the entire capsule is destroyed, secretion will con-

tinue and the cyst be reformed or a fistula established. While the latter condition is of little importance when the orifice of discharge is situated within the buccal cavity, it is a different matter when the tract opens externally after an external operation.

Small and medium-sized cysts are not difficult to extirpate and the sooner they are attended to the better. They should be seized with forceps, incised throughout their entire length, and the lining membrane dissected out or destroyed with the thermo-cautery, the jaws being immobilized with the mouth speculum. Quite large cysts may in like manner be totally extirpated, but the operation is sometimes rendered very difficult owing to extensive burrowing which may extend behind the esophagus and larynx. In these cases Froehner recommends the establishment of a suppurative inflammation within the sac to accomplish the destruction of the secreting membrane. This may be done by injections of strong solutions of iodine, as follows: Insert an aspirating needle and withdraw the mucoid contents. The needle need not be aseptic, as the entrance of pyogenic microorganisms is desired, and it should be of large caliber to permit of passage of the tenacious contents. In some cases the latter can only be extracted by lancing the sac. Then inject an equal quantity of an alcoholic solution of iodine (2:100—5:100) until the cyst resumes its original size. Local pain and fever will soon be evident. In two or three days' time again employ the aspirator to ascertain the presence or absence of pus. Should supuration have failed to develop, repeat the injection again and again, if necessary at intervals of three or four days. As soon as the desired effect is produced freely lance the abscess to evacuate the pus, and introduce a tampon of antiseptic absorbent cotton to stimulate healthy granulations. Recovery is generally complete in from three to six weeks.

Osteoma. Exostoses or osseous tumors occasionally arise on the jaw bone as a result of diffuse inflammation of the periosteum caused by external violence.

Symptoms and Diagnosis. These growths are characterized by excessive hardness and their attachment to the bone by a broad base. They are differentiated from malignant tumors by their local character.

Treatment. Removal is effected by exposing the growth by incision through the skin and then using a chisel.



No. 27. (After Cadiot and Breton). Epithelioma of the Lip with secondary lymphatic enlargement.

Epitheliomata. This malignant form of neoplasm occurs only in animals of advanced age, growing at the inner edge of the lip, usually the lower one.

Symptoms and Diagnosis. The tumor is observed at the outset as a small flat growth, which later progressively ulcerates. The ulcer has a raw, granulating appearance, or it may be hidden by a thin scab. In some cases it is mammillated. It gradually increases in size and may invade the entire lip or extend to the maxilla. Secondary enlargements of the cervical and submaxillary lymphatic glands generally develop. Differentiation from labial ulcers is not difficult.

Treatment. Total excision must be practised. When the tumor is small it is removed by A-shaped section through the entire thickness of the lip the base corresponding to the free border of the lip. The edges of the wound are then brought together with interrupted sutures carried completely through all the component textures. When the growth is extensive, the autoplasmic operation of Syme should be undertaken. Syme's operation consists in prolonging the A-shaped incisions to form an X and continuing them in an oblique direction downwards. The two quadrilateral sections of skin thus formed are separated from the subjacent tissues by dissection and made to pivot on their base, and are then united by sutures, the margin of each portion becoming the free border of the lip. The operation is completed by stitching the mucosa to the skin. The two small triangular spaces gradually fill in by granulation.

When the lymphatics are only slightly involved they should also be ablated, but when they are extensively involved operative measures are contraindicated.

Sarcoma. This is, properly speaking, a tumor of the maxilla, as it originates either in the periosteum, the medulla, or the endosteum, but as it encroaches on the buccal cavity, it will be considered here. It is observed more often in the upper jaw than in the lower. It may attain great dimensions and tends to rapidly invade neighboring parts, such as the nasal chambers, the orbits, and even the cranium. It often recurs after ablation but is not very metastatic to the neighboring lymphatic glands, though it sometimes undergoes generalization.

Symptoms and Diagnosis. This neoplasm is frequently overlooked in the earlier stages particularly when situated on the inner

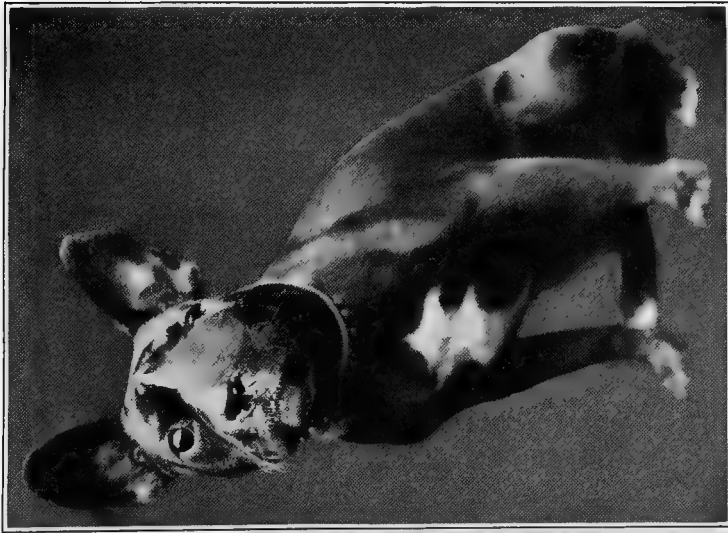
aspect of the jaw. As a rule, it is first noticed when it has attained the size of a nut or small apple and by the animal exhibiting difficulty in the act of prehension. The growth is insensitive and of a pinkish or reddish tint, the size varying according to the stage of development and the breed of dog affected. Its surface is irregular, knotty, or lobulated, and covered with intact mucous membrane. It is generally sessile with broad base and immobile from the surrounding textures, but may be pedunculate. Contrasted with other sarcomata its consistence is firm. In most cases but one rapidly-growing tumor is present; at other times several may be seen with confluent base. It may develop to such extent as to cause separation of the lips. The adjoining teeth are hidden or forced out of their sockets by upheaval.

Treatment. The entire growth should be excised as soon as possible by means of a strong pair of short-bladed scissors or bone forceps and the wound thoroughly cauterized to assist in the elimination of the morbid cells as well as to arrest the attendant hemorrhage. It may be found necessary to remove one or more teeth. It is better to remove too much tissue than too little in dealing with sarcoma. Very large tumors require the use of hammer and chisel, and subsequently the curette to effect their removal from the bone. During the operation, which must be done under anesthesia, the muzzle should be depressed to guard against escape of blood into the trachea.

Rizzieri recorded having treated and completely cured a case in which the growth had invaded the whole of the right face, extending from the inner angle of the orbit to the lips. Cadiot and Almy claimed a definite cure after a second operation in which deep excision, curettage of suspected points, and cauterization were practiced.

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No. 28. Osteo-sarcoma of the Superior Maxilla.



No. 29. Pedunculate Osteo-sarcoma of the perioosteum of the Inferior Maxilla. An example of operable malignant tumor.

The Teeth

STRUCTURE, DISPOSITION, and DEVELOPMENT.

In the typical mouth there are twenty permanent teeth in the upper jaw and twenty-two in the lower.

The structure of the incisors is noticeable for the arrangement of three cusps of which the central is the largest. The four inner incisors of both jaws have these well developed, but in the corner incisors the middle cusp is very large and the lateral ones rudimentary or absent. The base of the crown on the inner aspect is marked by a ledge which is extended to each cusp as a ridge or cingulum.

The canines are large and firmly and deeply embedded in the maxillary bone immediately behind the maxillo-premaxillary suture. Their pulp cavity is capacious and extends almost the entire length of the tooth.

Posterior to the canines are four teeth which were designated by Owen as *premolars*, owing to deciduous or milk teeth being displaced by them. As a matter of fact, the first of this group, counting from before backward, has more the character of a true molar, it having only a germinal deciduous predecessor, which seldom becomes calcified and generally disappears before birth, after being transitorily manifested in the papillary stage. It is the smallest of the four and has a single root and well-defined neck. The second and third premolars resemble one another closely, are considerably larger than the first, and possess two roots, of which the posterior is the larger. The three anterior premolars are not in as close contact as the posterior teeth, being separated by slight intervals. The fourth premolar is the largest and strongest of the premolar series. It is known as the *superior sectorial*. It is implanted by three roots, two external and one internal. The crown is composed of two main lobes supported by the external roots and a small one supported by the internal root. The premolars of the lower jaw are similarly arranged with the exception of the fourth which corresponds in position, approximate size, and number of roots, to the third premolar of the upper jaw.

The true molars of the upper jaw are two in number and are situated behind the premolars. They are permanent from the the outset and do not displace milk teeth. They possess three roots,

two external and one internal, each supporting a tubercle. The first true molar of the lower jaw is the *sectorial* of that series and is the largest tooth in the entire mouth. It possesses two firmly implanted roots. This tooth opposes the fourth premolar of the upper jaw in a scissor-like manner. When the dog wishes to divide tough meat or bones he passes them back to these teeth and makes a shearing movement by several short quick strokes of the jaw. The remaining two true molars are quite small. The second is two-rooted but the last possesses only one root.

The period at which both deciduous and permanent teeth are erupted varies in different races and the sexes. In the larger breeds and in females they appear somewhat earlier than amongst the smaller animals and males. At birth the gums are smooth. Towards the end of the third week the deciduous canines make their appearance, about the twenty-fifth day the corner incisors, about the twenty-eighth day the middle incisors, and about the thirtieth day the pincers. The superior temporary incisors are cut before the inferior.

At two months the permanent inferior pincers are seen to pierce the gum, and by the fifth month all the permanent incisors are up and in wear. The permanent canines are cut between the fifth and sixth months. At the end of the sixth or seventh week the second, third, and fourth premolars are in place, and between the fourth and sixth months they give way to their permanent successors. The first molar is erupted at about the sixth month and the second during the seventh month. The first premolar appears between the fourth and fifth months. Between the sixth and eighth months the dog has acquired a full set of permanent teeth.

During the first few years of life the age may be approximately gauged by the appearance of the four inner incisors of both jaws, the lateral cusps of which gradually disappear. These changes cannot, however, be absolutely relied upon since the extent to which they take place depends more or less on the wear occasioned by the animal's food, and the health of the organs themselves. After the first year the middle cusps begin to wear even with the lateral from the two central incisors of the lower jaw. The same change takes place in the two adjoining teeth in the following year. After the third year the cusps are lost in the two central incisors of the upper jaw, and their two neighbors undergo the same change after the fourth year.

As the animal ages the prominences of the molars are worn away, only the largest tubercles remaining. The posterior face of the lower canine impinges against and abrades the anterior face of the upper, in front of which it closes. The anterior face of the lower canine also comes in contact with the corner incisor and an abrasion takes place at this point. The older the animal the more apparent are these abrasions. The crowns of the incisors become much reduced in size in aged animals, mere stumps remaining after eight or ten years, while they are completely worn away after ten or twelve years, or the whole tooth may be shed, together with the first premolar. Gradual discoloration takes place in late years.

CONGENITAL MALFORMATIONS.

Certain breeds possess defective atypical dentition. This peculiarity was referred to by Darwin and Magitot. The breeds invariably having imperfect dentition are the Chinese, Turkish, and Mexican Hairless. The phenomenon is not to be wondered at when it is remembered that the teeth and dermis have a common epiblastic origin. Individual members of the Mexican breed examined by Waugh were found to have the tricuspid arrangement of the incisors wanting, absence of the canines, and slower and later development of the molars than other breeds. Half-breeds had canines in the upper or lower jaw but not in both jaws. In several members of both sexes of this breed that I have had the opportunity to examine I have found the arrangement generally as follows: In the upper jaw there is a reduced number of rudimentary or fairly well-developed incisors, but without the cuspid arrangement. Well-developed canines are in evidence, and on either side well-developed first premolars and first molars, the animals being thus minus the superior sectorials. In the lower jaw the incisors are developed in about the same degree as those of the upper, but the canines are less constant and sometimes entirely absent. Premolars are also inconstant but first and second molars are often present showing the inferior sectorials to be intact. When the molars have no teeth to oppose them they may cause the formation of indentations in the opposite jaws. As is natural to expect, these animals do not care to eat hard foods, but prefer slops and soft bread and cakes. Meat can only be swallowed if cut fine, as they are without the ability to reduce the size of tough or hard articles of diet, which dogs with nor-

mal mouths accomplish by the scissor-like movements of their sectorials.

In all breeds the deciduous teeth sometimes persist, while supernumerary teeth, usually molars, are not uncommon. As a rule, the larger breeds have a full complement of teeth, while the smaller ones often lack the third molar of the lower jaw.

The teeth may occupy anomalous positions. Distortion of the bones of the skull may throw the opposing jaws out of their proper relationship 'so that the teeth cannot meet. An instance of such deformity was witnessed by Gurlt.

Dentigerous Cysts. Through inclusion of epiblastic tissue during fetal development teeth may occupy obscure positions. These sequestered teeth have been found in the ovaries but their occurrence is perhaps more common in the temporal region, where they give rise to cystic formation. Instances have been observed by Werwey and Cadiot and Almy. Such cysts ordinarily remain quiescent but if pyogenic microorganisms gain entrance into their interior inflammation takes place and a fistula results having its orifice of discharge within the auditory canal. Its presence is first made known by the appearance during the early months of life, particularly about the period of dentition, of a soft, insensitive, hemispherical tumor, which may persist as such or become fistulous.

Treatment. The proper treatment is complete extirpation of the cyst as it is liable to return if any portion of the wall is allowed to remain. If a tooth is found present it should be extracted. In Cadiot and Almy's case simple extraction of the tooth was all that was necessary and healing was complete within a month.

TRAUMATIC LESIONS.

Fracture with exposure of the pulp sometimes occurs in a mechanical way, being generally sustained during a fight or from attempted extraction by inexperienced hands. Darwin has remarked that wild carnivora kept in cages frequently sustain fracture of the teeth through their habit of seizing the bars, and so we find to be the case in dogs under similar conditions. Dogs in jumping over iron fences sometimes get caught in the railing or are impaled, and in their attempts to break loose, tear at the iron with their teeth, and thus sustain fracture. Some animals have naturally brittle teeth which are fractured with very little force, while others suffer from

erosion of the enamel in an unaccountable manner, particularly during a severe attack of Distemper.

Treatment. Fractured teeth where there is evident pain from exposure of the pulp cavity, should be extracted or filled.

INCRUSTATIONS OF TARTAR.

Incrustations of tartar occur very commonly, especially in city dogs. Chemically, tartar consists of calcium and magnesium carbonate, calcium phosphate, and some organic substances, and is regarded as a precipitation of these salts from their soluble condition in the saliva by the action of certain microorganisms. The latter have been isolated by Galippe and cultivated by Vignal.

The effect of tartar on the neighboring tissues is purely an irritative one. By constant accretion, the deposit gradually works its way in between the neck of the tooth and the wall of the alveolar cavity, so that the tooth becomes loosened and may eventually drop out. Should these accretions continue to extend, the periodontal membrane (alveolar periosteum) becomes involved, when a far more severe condition exists, viz., Calcic Pericementitis.

A brief reference here to the popular notion that the gnawing of bones serves to "keep the teeth clean" will not be out of place. This is surely a misconception, since tartar collects round the roots of the teeth where any rubbing process of bone on tooth can scarcely take place. On the other hand, bone-eaters are notoriously prone to suffer from worn teeth, not to speak of other internal disorders engendered by splinters and fragments of bone. Hence, bone can hardly be regarded as a suitable diet for the dog.

Symptoms and Diagnosis. In the early stages tartar is observed on the teeth as a yellowish or greenish-brown deposit. The seat of the deposit is usually the base of the external face, but the whole crown may be encircled. When it has invaded the alveolar cavity the gums assume a more or less livid color and evince tenderness to the touch. At the same time a foul odor is emitted from the mouth.

Treatment. Calcic incrustations are removed by the operation of Scaling.

CALCIC PERICEMENTITIS.

This term is applied to inflammation of the periodontal membrane dependent upon deposits of tartar, sometimes described as

alveolar periostitis. It usually affects a number of teeth, old dogs sometimes losing almost the entire set. The calcic deposit leads to ulceration of the peridental membrane and exposure of the neck of the tooth. The membrane is gradually detached from the root of the tooth, the border of the alveolar wall is absorbed, and the inflammatory process finally leads to separation of the tooth from its socket. This condition is often accompanied with ulcerative stomatitis. Galippe regards it as an infectious disease.

Symptoms and Diagnosis. The gum recedes, becomes livid and swollen, and bleeds easily to the touch. There is a purulent discharge from the alveoli (Pyorrhea alveolaris) accompanied by a foul, penetrating odor. Saliva flows freely, and the animal shows no disposition to partake of food.

Treatment. Extraction of all affected teeth is indicated with ample daily disinfection of the parts, preferably with solution of permanganate of potash (2:100).

ALVEOLAR ABSCESS AND MAXILLARY FISTULA.

Reference has been made to the suppurative process (Pyorrhea alveolaris) occurring in connection with inflammation of the peridental membrane owing to calcic incrustations, and which is manifested by purulent discharge at the edge of the alveolar cavity. Suppuration of the alveolar tissues may also have its inception on the side of the root of a tooth as the result of injury, complicated wounds, or fractures, or it may originate in the apical space independent of any disease of the external parts, the tooth remaining perfectly sound. A sudden jar sustained by the tooth in crunching bones and animal membranes may result in injury to the nerve at the apical space, to be followed by suppuration and subsequent death of the pulp. The fourth premolar, which is the sectorial or masticatory organ in the dog, is the tooth usually affected.

The disease is characterized by burrowing of pus, which may either follow the peridental membrane down the side of the root and find discharge at the margin of the gum or it may set up an inflammation by fistulous tract either through the gums into the mouth or externally on the face to form a maxillary fistula. The last named condition usually takes place in the upper jaw near the lower eyelid, the exact position varying according to the conformation of the head. According to Reul, the condition may be

bilateral through sympathy and may give rise to a symptomatic catarrhal inflammation of the nasal passages through contiguity of tissue. The sympathetic hypothesis is very doubtful.

Symptoms and Diagnosis. A fistula existing in the position mentioned, should be probed. The affected tooth can generally be determined in this manner. The tooth may or may not be painful to percussion. Maxillary fistula must be carefully differentiated from Lachrymal fistula. An animal suffering from the former disease masticates with difficulty and prefers a semi-solid or liquid diet. In some cases the progress of the disease is accompanied with much emaciation.

Treatment. The tooth belonging to the affected alveolus must be removed, and the fistulous tract irrigated. Recovery is usually quick to ensue.



No. 30. Maxillary fistula.

CARIES.

True decay of the teeth with molecular disintegration of the constituent dental tissues, from which mankind so conspicuously suffers, is exceedingly rare in the dog. It has been observed by Baume Moeller, and Hoffman. The disintegration always commences on the surface of the tooth, generally in some pit or crevice in the enamel or at the neck, where protection from the movements of the tongue as well as from the friction produced by the gnawing of hard foodstuffs, bones, etc., favors the lodgment of alimentary particles. The degenerative process having commenced (the spot may or may not be marked by a dark color) it spreads towards the interior of the tooth, and the dentine being more susceptible to its action than the enamel, a cavity is formed whose interior is larger than its orifice. This disease must not be confounded with pericementitis which is very common.

The observations of Miller have established the fact that the degenerative process is due to a direct chemical cause, food par-

ticles undergoing fermentation through the agency of felt-like masses of microorganisms and resulting in the formation of lactic acid. The formation of the acid is dependent on the splitting-up of sugar, the organized or digestive ferment of these microorganisms acting upon cane-sugar in a manner identical with that exhibited by the unorganized ferment of the yeast plant, by converting it into levulose and dextrose and producing the acid as a waste-product. The relative immunity of the dog to this disease may be attributed to the well known inactivity of his parotid saliva and the feeble capacity of the submaxillary. It will be remembered that in the human mouth the ptyalin of the saliva is very active in the conversion of starch into fermentable sugar, thus producing an ample supply of the pabulum necessary to sustain the fermentative potentiality of the microorganisms. But as these conditions do not exist in the dog's mouth the amount of fermentable sugars present is infinitesimal, and in the absence of sugars the microorganism is powerless to effect a decaying influence. Miller found that the particular microorganism is capable of growing in bouillon free from the presence of sugar, but without the production of acid. This experiment was confirmed by Sewill, who found, while making certain experiments in the artificial production of caries, that sound teeth immersed in a mixture of meat and saliva remained alkaline, and even if small quantities of acid were added, rapidly returned to alkalinity. Albumen as white of egg or other form, was acted upon in the same manner.

Caries does sometimes result from a bountiful diet of sweet-meats.

Symptoms and Diagnosis. This disease gives rise to sharp pain manifested by cries, depression of the head towards the affected side, and indisposition to eat. The characteristic cavity should then be sought for by careful examination of every tooth.

Treatment. Ordinarily, carious teeth are extracted, but there is no reason why the disease process should not be arrested by the methods in vogue in human dentistry, when the owner so desires. In this event the services of a competent dentist should be secured, the animal being controlled with anesthetics by the attending veterinarian during the operation.

SCALING.

Removal of tartar is effected with the spring-tempered scaling

chisel commonly used by dentists, the point of which should be kept sharp. It should be used with a pushing motion preferably in a



No. 31. Scaling chisel.

direction away from the gum, but the opposite direction may be necessary to reach out-of-the-way places hidden by the gum. The removal process must be thorough, since any particle left remaining, by acting as a nucleus, favors further accumulation. What cannot be removed with the instrument can be cleaned up with a small piece of wood whittled to the shape of a chisel and dipped in weak acid. The operation should be supplemented with free use of some disinfectant solution, preferably permanganate of potash (2:100). The latter is easily applied by saturating a small piece of absorbent cotton, holding it by hemostatic forceps, and swabbing the parts.

In most animals, if patience and tact are observed, the operation can be completed without muzzling or other means of control. Intractable animals should be narcotized. Dogs of small size are best held in the lap during the operation.

After removal of deposits, the importance of maintaining the teeth clean should be impressed on the owner, otherwise the condition will soon be again in evidence. Some animals seem to be predisposed to the affection and require to undergo periodic cleaning in order to maintain the teeth intact. In these cases the daily use of the permanganate is advisable.

EXTRACTION.

Single incisors or small molars may be extracted in most animals without recourse to anesthesia, but where several of the smaller teeth are to be withdrawn it is well to narcotize with morphine.

Firmly embedded canines or molars, particularly in large animals, should be extracted only with the animal under general anesthesia. The employment of a mouth speculum is usually necessary.

In extracting a tooth, it must be remembered that the operation does not merely consist in "pulling" it, excepting where it has been

already loosened in its socket. The tooth is grasped with the beaks of the forceps, the latter being forced as *far up the root as possible*. Incisors and other single-fanged teeth are loosened by application of rotary motion (a half turn each way). Compound molars are loosened by pressure inwards and outwards. In spite of the exercise of due care, the roots are occasionally broken. This accident need not cause anxiety as they are usually gradually forced out of the socket by thickening of the peridental membrane occasioned by the inflammation the extraction sets up. Their immediate removal may be accomplished by employment of root forceps.

Hobday and Mosley, the latter a dental surgeon, have demonstrated that false teeth may be successfully affixed to the jaws of the dog, thereby enabling him to tear animal tissues.

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The Salivary Glands

TRAUMATIC LESIONS.

Division of Steno's Duct. A clean division would seem to be remarkably free of any untoward result. Harms divided Steno's duct about half an inch from its orifice for the purpose of experimenting with the saliva. For five days the saliva flowed freely. On the sixth day the wound was covered with a scab which the dog scratched off. On the seventh day the scab had reformed permitting but little saliva to escape. In twelve days there was a dry scab under which the wound quickly healed. The animal was killed on the fifty-first day, and examination showed that the continuity of the duct had become reëstablished.

FISTULA.

This condition is very rare. It may develop from the presence

of foreign bodies, such as needles, which have found lodgment in the gland, and certain other conditions. Favresse treated by inunction a year-old female suffering from a fluctuating swelling of the right parotid. In two days the abscess burst and emitted a great quantity of purulent liquid. A second orifice of discharge appeared lower down. Both assumed a fistulous character, and saliva flowed freely when meat was offered to the animal. Treatment by injections of nitrate of silver and inunction of vesicants produced no improvement. The actual cautery was then employed—three times within eight days—and was likewise barren of result. Finally, when the animal had become greatly weakened it was decided to extirpate the gland. The operation being completed, a simple dressing was applied. Two days later this was removed and to the astonishment of the operator, a threaded needle was found lying in the depths of the wound. The needle had evidently originated the trouble and had been overlooked at the time of the operation.

A maxillary fistula, supposed to have been caused in some manner by the buckle of the animal's collar was treated by Brissot with an injection of carbolic acid. The following day the orifice had become closed by peripheral edema thus arresting the discharge of saliva, and in three days was completely cured.

Siedamgrotzky saw a fistula in a seventeen-year-old animal opening by two orifices at the lower angle of the jaw and which it was supposed proceeded from the parotid gland. The animal also suffered from otorrhea. The latter condition responded to treatment but the fistula stubbornly refused to heal. Later the dog died from another trouble, and at the necropsy it was found that a mixed tumor, partly an osteo-chondroma and partly an adenoma of a sweat gland, was filling the tympanic cavity and the outer ear passage.

INFLAMMATION.

Specific inflammation of the salivary gland is a rare disease. It is frequently confounded with the rather common inflammation of the submaxillary and retropharyngeal lymphatic glands. Simple inflammation through infection by ordinary pyogenic microorganisms may take place as a result of external traumatism and the passage and lodgment of foreign bodies. An occasional termination of the disease is cystic transformation.

The specific variety has been described as occurring in epizootic form by Schuessle, Whitaker, and Hertwig. Busquet and Bondeand investigated a couple of cases and concluded that the disease was contagious among dogs, was associated with the presence of a microorganism which assumed the character of a diplo-streptococcus in the saliva, and a diplococcus in the blood, and was analogous or identical with Mumps of the human race.

Symptoms and Diagnosis. After three or four days of incubation, symptoms of lassitude and sneezing appear. Then a cough develops and coincidentally painful swelling of the parotid and submaxillary glands, and edema of the neighboring tissues and lymphatics. Steno's duct is rendered very prominent by swelling and the salivary flow is meager. The general condition is unaffected and the disease runs its course in less than two weeks.

Treatment. Hot fomentations or poultices, preferably the former, should be applied externally. If the swelling fluctuates vent should be given to the pus by lancing, and any further accumulation prevented. If a cyst forms the sac and its contents should be carefully dissected and enucleated, or it may be partially excised, the contents let out, and the wall cauterized or subjected to iodine injections.

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The Pharynx

EXAMINATION.

The pharynx is exposed to view by opening the jaws and depressing the tongue or drawing it forward.

PHARYNGITIS.

This disease partakes of the same nature and is caused by the same conditions which produce inflammation of the mouth. It is also seen in certain specific diseases, such as rabies and distemper. It is sometimes complicated with abscess formation in the submucous

tissue or retropharyngeal lymphatic glands, the lymphatics being the highway of migration of the pyogenic bacteria.

Symptoms and Diagnosis. The symptoms are dysphagia, abundant salivation, cough, retching and fever. The throat is sensitive to pressure. Inspection reveals an inflamed, tumefied mucosa. Soon the retropharyngeal lymphatics swell, but it is not often that they suppurate.

Treatment. Hot fomentations give relief, but unless applied continuously and the throat muffled subsequently, should not be employed. The application of hot salt-bags is preferable. A liniment composed of equal parts of ammonia, turpentine, and olive oil is beneficial. Internally vaseline may be administered with advantage. Foreign bodies must, of course, be removed.

FOREIGN BODIES.

Any of the bodies which may lodge in the buccal cavity are equally liable to be arrested in their passage through the pharynx. When a dog is excessively hungry, or two or more are fed from the same dish, they sometimes attempt to swallow foodstuffs too large for passage of the pharynx which become retained there by muscular spasm and produce the condition known as choking, which, as a rule, quickly terminates in death.

Symptoms and Diagnosis. The symptoms of pharyngeal obstruction are: coughing, dysphagia, dribbling of saliva, and attempts to vomit. Choking is characterized by suffocation.

Treatment. Forceps may be used to remove bodies which are not productive of acute symptoms but when boluses of foodstuffs are lodged in the pharynx no time must be wasted in seeking instruments but the finger must be employed in an endeavor to dislodge the body, preferably by retracting it, or by forcing it onward into the esophagus.

NEOPLASMS.

Myxoma. This form of tumor occasionally occurs as a poly-poid outgrowth of the pharyngeal mucosa. Dierix saw one suspended from the pharyngeal wall at the level of the supero-posterior aspect of the larynx. Moeller mentions the occurrence of one which was two inches in length. During the act of deglutition or even locomotion they are apt to become projected into the esophagus.

Symptoms and Diagnosis. The chief symptom is sudden suffocation with as sudden recovery. Fits of vomiting may be provoked particularly when pressure is applied over the pharynx.

Treatment. Removal should be effected by means of the wire ecraseur.

Epithelioma. Malignant tumor of the Pharynx, while very rare, is occasionally observed in aged animals. It is apt to exist some time before being discovered, long enough for metastasis to the cervical glands to take place.

Symptoms and Diagnosis. The appetite is very indifferent, and the animal has difficulty in swallowing, and a fetid salivation develops. Examination of the buccal cavity reveals the presence of a raw ulcer. This ulcer must not be mistaken for a fistula proceeding from some foreign body which has found lodgment in the subjacent tissues. The animal progressively emaciates and finally the cervical glands become involved.

Treatment. There is no treatment for this disease.

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The Esophagus

EXAMINATION.

The esophagus is examined by palpation over its course on the left side of the neck, by passage of the probang, and by means of the Roentgen rays.

CONGENITAL MALFORMATIONS.

Ectasia has been observed by Cadéac, and Stricture by Smith.

TRAUMATIC LESIONS.

Rupture and Perforation. These lesions are ordinarily caused by bones and foreign bodies owing to the extraordinary peristalsis or violent fits of retching engendered by their presence. Abscess formation invariably results. When the thoracic portion of the organ is pierced, purulent pleuritis results with fatal issue. Siedamgrotzky recorded an instance of this kind where the perforating body

was a piece of bacon rind. Morey witnessed a case where a sharp piece of bone perforated both esophagus and trachea and induced gangrenous pneumonia, and Cadéac saw one where a peach stone perforated the aorta.

Symptoms and Diagnosis. The symptoms of these lesions in the cervical portion are painful swelling of the neck and suppuration. In the thoracic portion, there are early collapse, febrile symptoms and prostration.

Treatment. When the lesion is in the cervical portion it is treated by exposing the gullet as in Esophagotomy and subjecting it to frequent antiseptic irrigation. Unless the rent is extensive it need not be sutured.

Stricture. Stricture sometimes results from cicatrices following wounds by foreign bodies, improper use of the probang, esophagotomy, and fistula. Similar effects are produced by compression of extrinsic neoplasms usually of the bronchial glands, vertebral exostoses, tubercles, goiter, and verminous aneurism of the aorta.

Symptoms and Diagnosis. Characteristic are the efforts at swallowing. Liquids pass more easily than solids, which accumulate above the stricture and distend the esophagus so that the trachea and neighboring vessels and nerves are compressed resulting in dyspnea, etc.

Treatment. Stricture is treated by progressive dilation by daily passage of the probang, a series of graduated instruments being employed. The latter are passed every two or three days and left in place from five to ten minutes, each size being used three or four times.

Diverticula. A Diverticulum was observed by Schellenberg in which a bite and subsequent abscess formation were the causative factors.

Treatment. Diverticula are treated by excision of a fusiform portion of the stretched wall.

FOREIGN BODIES.

In the esophagus, obstructions usually occur either at the proximal end immediately behind the pharynx, at the lower extremity of the cervical portion, or at a short distance anterior to the cardiac orifice where its caliber is smallest. Sharp bodies may lodge at any

part of the tube. Obstructions usually consist of bones, gristle, large pieces of fat, fragments of tendon, skewers, etc. Large bodies remaining in position for any length of time are very liable to produce local pressure gangrene and perforation. Sharp bodies may also perforate at the outset.

Symptoms and Diagnosis. The animal refuses food or manifests pain in the act of swallowing. There are spells of gulping and choking with vomiting, salivation, scratching at the neck, the head held extended, difficult respiration, and frequent outcries of pain. The seat of obstruction, when it exists in the cervical region, is evident from painful swelling of the neighboring parts and this becomes intensified the longer the object remains. Such swelling may interfere with the natural gait of the fore-legs through the edema involving the shoulder muscles. Sometimes the body may be recognized by palpation. In the thoracic portion the symptoms may be obscure, there being absence of swelling and at times merely refusal of food with rapid emaciation.

Treatment. Obstructions are removed by production of emesis, by extraction with throat forceps, by propulsion with the probang, or by esophagotomy or gastrotomy, according as the conditions present warrant the application of either method of relief. Vomiting will often displace a foreign body. It is best brought about by hypodermic administration of apomorphia in doses of 1-40 to 1-10 of a grain. If the object is situated in an accessible position an attempt should be made to grasp and extract it with the curved throat forceps, after the jaws have been immobilized with a speculum. Failing in this and in cases where the object is beyond reach with the forceps, the probang must be resorted to in order to push the body on into the stomach. To pass this instrument the tongue is depressed with the fingers of the left hand and the instrument, previously oiled, is made to pass into the median line and follow the posterior wall of the pharynx into the esophagus. The bristle probang is a very convenient instrument, as it may be used for pushing obstructions into the stomach or equally as well for extracting them by the mouth, when they do not entirely occlude the lumen. It is closed and passed until the bristles are well beyond the point of lodgment, when they by pressure upon the whalebone, are projected, completely filling the tube, umbrella-like, and the probang is withdrawn. In the absence of this or any other special make of pro-

bang a horse catheter may be substituted for propelling the body into the stomach.

Round or smooth obstructions may be pushed onwards but excessive force must on no account be employed. Sharp bodies should always be extracted by the mouth, when possible.

Failing in this, if the foreign body is lodged in the cervical portion it must be extracted by esophagotomy, but this operation should not be undertaken till every attempt at removal with the probang has failed, unless asphyxia from pressure on the trachea is threatened. Cadiot and Breton say that the operator should temporize with the probang for two or three days and that it is rare that the symptoms become alarming enough to render the operation necessary before the fourth day.

It is sometimes necessary to resort to Gastrotomy in order to deliver foreign bodies from the lower third of the esophagus, when such bodies are too large or peculiarly shaped to be voided by vomiting, or when it is feared that violent attacks of retching may lead to perforation of the wall. They are extracted with the aid of forceps or pushed upward into the mouth.

ESOPHAGOTOMY.

Interference with the continuity of the esophagus is borne well by the dog. Billroth has shown that the continuity may be re-established after ablation of a short portion of the tube. Incision of the tube is performed in the following manner: Secure the animal with hobbles in the right lateral position with the head extended. Remove the hair with clippers or razor and administer a general anesthetic. Make the skin incision over the obstructing body and on the left side of the neck on account of the inclination of the esophagus to that side. Cut cautiously in between the anterior border of the sterno-cleido mastoideus muscle and the jugular vein until the great vessels of the neck are exposed. The esophagus is associated with these and is distinguished by its pinkish color and tubular muscular appearance. Grasp the organ with one finger and draw it through the wound at the same time pushing the trachea to one side. Incise its wall on its postero-lateral aspect. The vessels are disposed mostly longitudinally and are more abundant at the upper than the lower part, and the mucosa is recognized by its folds and whitish color. Vomiting may occur at this point. Extract

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the obstruction. Leave the wound in the esophageal wall open to heal by granulation, but if it is extensive suture it with catgut. In ordinary cases the wound is healed at the end of two or three weeks, and seldom later than two months. If gangrene of the wall is present, do not attempt to stitch the latter, but let it heal by granulation, in the meantime subjecting the wound to frequent antiseptic irrigation.

In one case of obstruction by a large bone in a puppy, the body was pushed from the right side towards the left side until it was plainly perceptible under the skin. A simple incision was then made through the skin and subjacent fascia and the wall of the esophagus down on to the bone which was extracted. Nothing further was done to the wound and the animal made an uneventful recovery. The whole procedure was exceedingly simple.

Vomiting sometimes occurs during the operation. No solid food should be given for two weeks and none at all by the mouth for the first few days.

NEOPLASMS.

Intrinsic tumors occur with great rarity. Myxomatous polypi are referred to by Cadot and Almy and multiple cysts formed of dilated mucous glands have been observed by Eichenberg. Fibroid enlargements caused by *Spiroptera sanguinolenta* occasionally occur on this continent and are common in the South of Europe, South America, and Asia. According to Manson, who frequently observed the condition in China, these enlargements may bring about more or less complete occlusion, particularly when they are large or numerous near the cardiac end.

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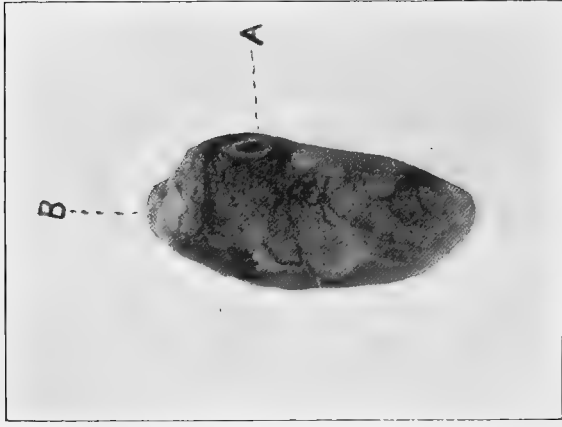
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The Thyroid Gland and Glandules

Before considering the diseases to which the Thyroid is subject and the extent to which surgical interference may be employed, it



No. 33. Golfer.



No. 32. Thyroid gland (natural size (Great Dane) showing (A) internal glandule and (B) external glandule.

will be in order to briefly review the relationship which the Gland and the recently discovered Glandules bear to one another, for it is now known that both Gland and Glandules have each a separate and specific function to perform in the animal economy.

In the immediate neighborhood of the gland, lying in the fascia, are numerous separate nodular bodies, consisting of lymphoid or of true thyroid tissue and designated "accessory thyroids." They are usually enlarged and more easy to find in animals having hypertrophied thyroids, while in perfectly normal animals they are at times so small that they can hardly be seen. Besides these accessory thyroids there are constantly present on each side two bodies—the Glandules, one external to the gland and the other within the gland. The external show considerable variation of position, but usually one of proximity to the thyroids, and union of the two portions is quite exceptional. Gley examined their disposition in thirty-three dogs, and found them situated about the superior third of the external face of each lobe, nearer the anterior border than the posterior, superficially inserted in the face of, but nevertheless perfectly distinct from, the thyroid lobes, in fourteen of the animals. In seven of the remaining nineteen animals one glandule was enclosed in the external face, and the other isolated at the superior extremity of the corresponding lobe. The internal are situated toward the internal or tracheal surface of the lobe, and as a rule are completely covered by thyroid tissue and regularly enter into extensive combination with it. Structurally, neither of these bodies corresponds at any time of its development to the thyroid.

Numerous experimenters, among whom may be mentioned Halsted, Schiff, Gley, Moussu, and Vassale and Generali have demonstrated that suppression of the function of the thyroid gland, including its total extirpation, is not productive of lethal effect but results only in myxedema and cretinism, while removal of all the glandules rapidly leads to a fatal issue. The leaving intact of one glandule is sufficient to sustain life, but it is safer to leave all the glandules possible.

STRUMA. GOITER. BRONCHOCELE.

Enlargement of the thyroid is quite common in the dog. It is sometimes congenital and may be of such dimensions as to hinder delivery. Halsted has seen puppies born with glands twelve

times as large as normal. The lobes and isthmus in these cases were so developed that they formed a single horseshoe-shaped body almost encircling the trachea. The swelling generally disappears later. It is believed that heredity plays some part in its development, but it is also witnessed in puppies whose parents possess thyroids showing no deviation from the normal.

In point of development even the normal gland may show considerable variation in the newly-born animal, the difference depending essentially upon the degree of development of the colloid-containing vesicles.

Very young dogs are often seen with enlargement of the gland. It may commence soon after birth particularly in members of certain breeds, namely, Pomeranians, French Pointers, Dachshunde, Spaniels, and lap-dogs. Greenhow saw it in India, and Bramley, writing in 1833, found it to be quite common as a "lobulated bronchocele" among puppies one month old bred from English dogs in the trans-Himalayan regions. It seldom becomes large when arising in young dogs, but gradually becomes reduced in size, though in some instances will recur periodically.

Enlargements commonly occur during the course of general diseases. In the experience of Zschokke it is a rare thing to find dogs free of thyroid enlargements in some of the cantons of Switzerland.

Several forms of Struma are recognized. The enlargement may be the expression of extreme vascular engorgement (Hyperemic struma). This is of a transitory nature and with little if any pathologic significance. Muehlibach pointed out that it occurs during the estrual period, and Bardeleben saw it in pregnant females. Pflug refers to a remarkable periodic recurrence in members of certain breeds, particularly Blenheim Spaniels, the swelling appearing coincident with even a slight cold, but disappearing within two weeks.

The commonest form is that of diffuse parenchymatous hyperplasia (Hyperplastic, Follicular struma) with or without a certain amount of proliferation of the stroma and increase of gelatinous contents in individual vesicles.

When a hemorrhage occurs in one of the goitrous nodules, the extravasate undergoes an absorptive change, and according to its age there may be anything from true bloody contents.

through dark yellowish to perfectly clear serous fluid. (Cystic struma).

Blood may also be extravasated into and infiltrate the connective tissue adjacent to the gland, or even of the entire length of the neck (Hemorrhagic struma).

Sometimes thick septa of the interstitial connective tissue develop with consequent atrophy of the vesicles (Fibrous struma).

A very rare form of osteochondroma (Osseous struma) has been observed by both Siedamgrotzky and Kitt, and I have also witnessed the same condition in an aged Collie female. There was unilateral enlargement fully the size of the subject's own cranium. The glandular tissue had almost completely disappeared, a few minute isolated cysts and cell clusters marking the areas of functional persistence.

Malignant neoplasm (Malignant struma) not uncommonly affects old animals. It is usually of carcinomatous character. According to Kitt, sarcoma has never been observed for a certainty, but Cuillé and Sendrail have recorded an instance and referred to another case witnessed by Liénaux. Wells, Loeb, and others have recently published observations indicating that not infrequently a curious mixed tumor may form, in parts sarcoma, and in parts carcinoma. Malignant struma tends to infiltrate neighboring structures and to lead to formation of secondary growths in the veins and in the lungs by way of the veins and lymphatics and also within the bones.

Symptoms and Diagnosis. The effect on the organism of the different forms of goiter varies according to the nature, size, and position of the growth. Some of the largest simple goiters hardly affect the animal other than to render him unsightly. On the other hand, quite insignificant growths have been known to produce serious respiratory disturbances, with spasm of the glottis, owing to compression of the vagus and sympathetic nerves. Very voluminous goiters may induce suffocation by causing a narrowing of the lumen of the trachea and larynx. This is true also of the hemorrhagic form. Siedamgrotzky saw the esophagus completely encircled. Moeller has seen dogs with enormous goiters unable to lie down on account of the pressure on the trachea induced by that act. Van Gemmern and Mecke saw vomiting (probably reflex) induced in a one-year-old Italian greyhound when the gland was enlarged, which

however, ceased when the swelling subsided. Cadéac says laryngeal hemiplegia may result from pressure on the recurrent laryngeal nerve. Complete suppression of thyroid function is followed by cretinism and myxedema, conditions characterized by physical degeneracy and deformity and grave nerve disturbances. There occur an increase in the general connective tissue with a mucoid conversion of the ground substance, and marked idiocy. Rougieux has recorded cases of cretinism, and Raynard has seen the congenital form accompanied by imperfect development of the body and legs, thickened head, shortened neck, and feeble mental power. Experimental myxedema and cretinism have been produced by Moussu by complete extirpation of the gland, leaving the glandules intact.

Struma can be comparatively easily diagnosed. Generally the enlargement is bilateral, but not necessarily of uniform development.

This bilateral character is of assistance in making a differential diagnosis from mucous cysts, abscesses, and hematomata. Furthermore, its mobility, sharp demarcation, and freedom from sensitiveness aid in the diagnosis. It can hardly be confounded with any other lesion unless it be lymphosarcoma involving the neighboring lymphatics, but in the latter disease other lymphatics are usually found to be involved. The enlargement may be so deeply embedded that its presence is hardly suspected, and in other cases may be so extensive as to occupy the entire distance between the trachea and sternum. Leisering saw such a growth, it being a carcinoma, with secondary growths in the walls of the internal jugular.

Malignant struma is distinguished from other forms by its tuberculate character and by the cachexia which accompanies it.

The hemorrhagic form involving extravasation of blood into the connective tissue of the neck is sometimes a little difficult to diagnose. It is accompanied by diffuse swelling of the neck with local pain and heat, which may or may not terminate in suppuration.

The accessory bodies may also become hypertrophied, when they receive the name of "aberrant struma." They are often seen in animals possessed of congenital struma. Woelfler and Wagner observed one instance of a veritable enlargement of a nodule of true thyroid tissue in an animal whose lobes only slightly exceeded the normal in size. The tumor was as large as a hazel-nut, and hung from the aorta by a pedicle.

The pathology of the Glandules does not appear to have been studied up to the present.

Treatment. Soft goiters generally respond to iodine medication administered internally and by local inunction. Very large and continuous dosing is usually necessary. Exceedingly large growths may be reduced by these means within a few days, but they tend to recur.

Fibrous goiters should be treated by strictly aseptic intraglandular injections of a few drops of tincture of iodine. After the needle has been inserted it should first be ascertained that the point has not lodged within the lumen of some enlarged vein, otherwise it must be partially withdrawn and then reinserted. The danger consists in the immediate entry of the iodine into the venous circulation. Horsley experimentally injected 15 c. c. of tincture of iodine into the external jugular vein and brought about instantaneous death from cardiac paralysis by plugging of the right heart with a hard clot. The injections should be repeated at intervals of several days as soon as the inflammatory reaction has subsided. In some cases several injections, lasting over a period of some months, are needed to effect a cure. Bizard succeeded in producing absorption of an enlargement in a dog aged five months by injecting the iodine into the neighboring connective tissue instead of into the gland itself.

Cystic struma is treated by free lancing of the sac and evacuation of the contents, but it must be remembered that the secreting membrane needs to be destroyed, which can be accomplished by iodine injections directly into the sac; otherwise a fistula is likely to be established. An antiseptic tampon is then introduced in order to stimulate healthy granulations.

Malignant goiters being so extremely metastatic to important internal organs, and being usually accompanied by profound cachexia, scarcely warrant any attempt at giving relief even by surgical means. Unilateral neoplasm in the early stages would justify unilateral extirpation of the gland, provided the glandules were healthy and left *in situ*.

In any case of surgical interference it is absolutely essential that at least one external glandule together with its blood-supply be left intact and a successful outcome is more likely to take place if both external glandules are allowed to remain undisturbed.

It becomes then necessary, in considering operative measures on the thyroid gland, to speak of unilateral and complete thyroidectomy, and unilateral and complete external and internal parathyroidectomy or extirpation of the thyroid glandules.

UNILATERAL THYROIDECTOMY.

Unilateral Thyroidectomy, without regard to conservation of the glandules, is carried out as follows: Make the skin incision in the median line. This enables the operator to get down easily between and without severing the muscles, which is conveniently done by tearing with the finger or with the aid of a blunt instrument. The lobes are found one on each side under the sternothyroid muscles. Their mobility and slipperiness make their removal somewhat difficult. Draw the lobe up out of the wound by means of a suture passed through it, and secure the ramifications of the superior thyroid artery with a ligature, including the tissue surrounding them, apply another ligature around the anastomosing termination of the inferior thyroid, and, lastly, divide all the attachments on the distal side of the ligatures, leaving as small a stump as possible. It is worthy of note that the necessity of maintaining an aseptic wound in thyroid operations was particularly emphasized by Munk in his experiments, and latterly by Halsted, who found it expedient to devise his "subcuticular suture."

SIMPLE THYROIDECTOMY.

Simple Thyroidectomy, leaving the glandules intact, is thus described by Gley (translation): When the glandules are isolated at the superior or inferior extremity of the gland the operation is not difficult. But this disposition is not the most frequent, consequently it is often necessary to explore for and enucleate them from the thyroid body. Secure the superior and inferior extremities of the lobes by two separate sutures. One of these sutures may often be made to include the thyroid artery, but it is particularly essential that the minute vessel which detaches itself to furnish the glandule be left free. By means of these two sutures have an assistant draw up the lobe in such manner as to render the glandule visible. Separate the latter little by little from the adjacent tissues with a blunt instrument. Now pass a fine ligature behind it, but in such a manner as

not to include a veinlet which receives branches from the lobe at this level. If necessary, a portion of the lobar tissue may be included. Finally, remove the lobe. There is only a slight oozing of blood during the operation.

Moussu found it very difficult to preserve the veinlets, which are necessary for the proper performance of the parathyroid function.

Gley and Nicolas found that the glandules underwent hypertrophy after extirpation of the gland.

Breisacher noticed that dogs fed on raw meat suffered more acutely from thyroidectomy than those fed on milk and boiled meat, and Victor Horsley observed that a vegetarian diet was that which led to the fewest symptoms after thyroidectomy. Moreover, gramivorous species do not show acute symptoms after extirpation.

EXOPHTHALMIC GOITER.

This disease is extremely rare. It has been observed by Friedberger and Froehner, Albrecht, and Jewsejenko. It is believed to be a toxic condition dependent upon hyperactivity or perversion of thyroid function. It is characterized by three principal features, viz., thyroid enlargement, extreme protrusion of the eyeballs with immobility or retraction of the lids, and cardiac palpitation.

Symptoms and Diagnosis. The disease is ushered in by palpitations which generally appear consequent upon some physical or mental shock, such as prolonged exercise, violent emotions, or fright. Its evolution is ordinarily slow and may be interrupted with epileptiform paroxysms (Jewsejenko). In very young animals restlessness, whining, occasional spasms, arrhythmical pulsations and general unthriftiness are apparent. The glandular enlargement is soft and elastic and uniform in both lobes or is more pronounced in one than in the other. The bulging of the eyeballs is so acute that dislocation appears imminent. The cornea is usually ulcerated. Besides these symptoms others may make their appearance, viz., trembling of the extremities, anorexia, emaciation, pruritis, and subcutaneous abscesses.

Treatment. Iodine medication internally and externally is indicated, together with administration of digitalis to combat the cardiac irregularity. A case which terminated in complete recovery was treated by local disinfection of the eyes, and inunction of belladonna

and iodine, supplemented by injections of iodine into the gland with cold baths.

Moussu found that administration of thyroid glandules of the horse (eight *per diem*) materially modified the course of the disease in human beings, though other observers have got absolutely negative results, but it is worthy of note that this form of struma can be cured in the human subject by partial removal of the gland (Wharton and Curtis).

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The Lymphatic Glands

LYMPHADENITIS.

The lymphatic glands in the region of the throat are not uncommonly the seat of acute suppurative conditions, which are entirely different from, and not to be confounded with, inflammation of the salivary glands, which is a comparatively rare disease. The glands most commonly affected are those draining the mucosal areas of the mouth, pharynx, and larynx, viz., the Submaxillary, consisting of a bilateral group of three glands lying subcutaneously between the posterior border of the masseter muscle and the submaxillary salivary gland, and the Retropharyngeal. The disease always results





No. 34. Acute lymphadenitis.



No. 36. (After Cadiot and Breton). Tuberculous lymphadenitis. Fistulous tract.

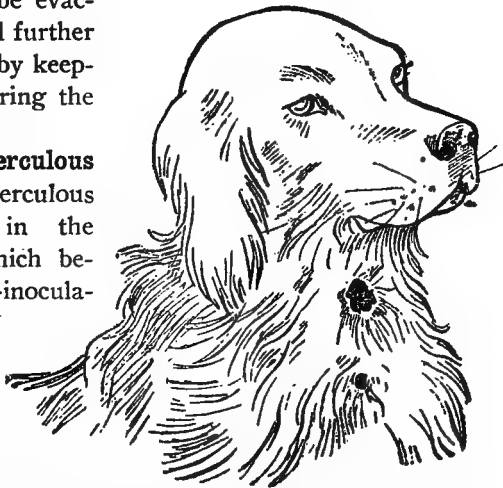
from migration of pyogenic or tubercular bacteria. It commonly develops during the course of inflammations of adjacent mucosal areas, notably during pharyngitis. There would also seem to be a specific form, or the disease may at least be enzootic in certain localities, for Dessart, a Belgian practitioner, wrote that it was common as a phlegmonous angina in the vicinity of Genappe, Belgium.

Acute Lymphadenitis. This, the pyogenic form, always runs a very rapid course and terminates in suppuration, the pus tending to be discharged spontaneously.

Symptoms and Diagnosis. The trouble commences as a hot, painful, unilateral or bilateral tumefaction at the site of either or all the glands, sometimes together with edema of the facial tissues. The head is held stiffly and eating is generally suspended. In severe cases there may be considerable dyspnea and some danger of asphyxia. The inflammation quickly spreads beyond the capsule of the gland to the surrounding connective tissue giving rise to a diffuse peria-dentitis which then obscures the outline of the gland. Suppuration taking place, individual suppurative foci become confluent and form a large abscess, which fluctuates, and if not relieved by lancing, points, bursts spontaneously and discharges a great quantity of pus.

Treatment. Hot fomentations should be employed externally and as soon as fluctuation is perceived, the pus should be evacuated by free lancing and further accumulation prevented by keeping the opening free during the few succeeding days.

Chronic or Tuberculous Lymphadenitis. Tuberculous lymphadenitis occurs in the glands of the neck, which become infected by auto-inoculation in the same manner as in acute lymphadenitis. It may develop as a primary lesion through absorption of bacilli arrested in the upper passages, but more com-



No. 35. (After Cadlot and Breton). Tuberculous lymphadenitis. Fistulous tract.

monly secondary to pulmonary tuberculosis through absorption from the tuberculous matter coughed up into the pharynx. The disease runs a course common to tuberculous inflammations with caseation and eventual breaking down.

Symptoms and Diagnosis. At first but little change is noticeable in the glands, and they appear solid, mobile and freely defined. As the disease progresses the inflammation extends to the periglandular tissue and implicates the skin, the swelling then becoming diffuse, soft, and fluctuating. Discharge takes place and a fistulous tract is formed leading to the trachea or larynx. The external lesion presents a circular, oval, or irregular cavity with a thin, jagged border denuded of hair, and gives vent to a greyish or sanguineous bacilli-bearing purulent matter.

Treatment. This lesion being in most cases secondary to pulmonary tuberculosis, is rarely suitable for treatment and only when it exists as a primary focus in superficial regions should curative measures be attempted, and then only if spread of infection can be guarded against. If the case is presented in the early stages, before the development of periadenitis, and there is undoubted evidence of softening, the entire gland should be enucleated by blunt dissection, without opening its capsule. If the disease process is found to have extended and involved the surrounding tissues, the entire mass must be carefully dissected out. And if discharge has already occurred, the cavity should be thoroughly curetted, enlarged, and irrigated daily with corrosive sublimate solution (1:1000).

NEOPLASMS.

The primary growths affecting lymphatic glands are Lymphadenoma and Lymphosarcoma. Both innocent and malignant types of the former are seen but the latter is essentially malignant. Malignant lymphadenoma occurs in two forms, both characterized by general hyperplasia of the glands, but one of which is also associated with increase of lymphocytes. Secondary growths in the lymphatics are a feature of cancerous tumors, though they are less common in sarcoma than in epithelioma and carcinoma.

Benign Lymphadenoma. Lymphoma. This is a purely local affection occurring as a single nodule or a series of nodules but limited to one region of the body. Such growths occur usually secondary to catarrhal inflammations. The cause is unknown. They do

not affect the health, except in the case of the bronchial glands where they may give rise to impairment of cardiac and respiratory function by compression of the intramediastinal vasculo-nervous structures.

Symptoms and Diagnosis. To the touch they are smooth, hemispherical lumps, firm, elastic, and painless. They are freely mobile one on another in external glands and do not become adherent to surrounding parts.

Treatment. Where these growths appear as a blemish, they may be presented for treatment, when they will be found amenable to arsenic administered internally.

Malignant Lymphadenoma. Hodgkin's Disease. This is a rare disease in which there is an extensive and progressive symmetrical enlargement of the glands throughout the system, including not only external lymphoid tissue, but also that of the spleen, the kidneys, the liver, and the bone marrow. In the human subject it is most common in the young adult male, and this would also seem to be true of the dog, as I have observed it in males of the age of two or three years. The cause is unknown.

Symptoms and Diagnosis. The enlargement develops progressively in one gland after another until a whole cluster of glands is implicated. Another group becomes likewise affected until all the external glands are involved, and finally the internal lymphoid tissue. The submaxillary glands are usually the first to show the change, and at this stage are liable to be mistaken for goiter, then the cervical, then the axillary, and then the inguinal. The enlargements are not painful and show no tendency to break down. They adhere together forming lobulated masses, but do not form adhesions with the surrounding tissues and remain freely mobile. This feature serves to distinguish the condition from acute or chronic lymphadenitis or lymphosarcoma. As the disease progresses the pulse becomes rapid and the appetite capricious. Lethargy develops, the animal showing disinclination to mount steps or to travel far. The abdomen becomes abnormally distended and by careful palpation the internal enlargements can be distinguished, particularly of the spleen.

Treatment. There is no treatment possible and the prognosis must always be unfavorable, a fatal termination ensuing in the course of one or two years.

Lymphatic Leukemia. Leukemic Lymphadenoma. This dis-

ease is also rare and is distinguished from the former by marked changes in the blood, but there is the same widespread enlargement of lymphoid tissue and increase especially in the lymphocytes. Instances have been recorded by Siedamgrotzky, Leblanc and Nocard, and Bouchet. Cadéac says the disease may be mistaken for tuberculosis. The changes taking place in the blood are highly characteristic, the red corpuscles steadily, continuously, and rapidly decreasing in number and suffering a diminution of hemoglobin, while the leucocytes are greatly increased in number. The arteries sustain a diffuse sclerosis.

Symptoms and Diagnosis. Usually there is the same progressive enlargement of the external lymphatic glands, but it is occasionally absent. Conspicuous among the symptoms are: inappetence, intermittent fever, conjunctival injection, anemia, progressive emaciation, increased and throbbing cardiac action, tendency to hemorrhage, languor, and respiration normal at rest but accelerated during movements. The proportion of white to red cells varies at different stages of the disease. In Siedamgrotzky's observations it was as one to fifteen to twenty to thirty, and in those of Leblanc and Nocard as one to eighty-five. The normal is as one to five or six hundred. In Bouchet's case there was abdominal pulsation which was thought to be due to an aneurism of the aorta, but at the necropsy it was shown to have proceeded from abnormal development of the splenic vessels.

Treatment. As in the preceding form, the prognosis is hopeless, death being inevitable within a few months, and seldom later than one year.

Lymphosarcoma. This type of growth differs from the preceding in that it infiltrates neighboring parts and involves the skin and forms metastases. It has also an extremely rapid growth. The most common seat of the disease is the lymphoid tissue of the neck and groin, but it may also occur in the mesenteric glands (Semmer, Hobday), the vagina (McFadyean) and the bronchial glands (Johne). When arising in the neck it is most apt to be mistaken in the early stages for goiter, and also for traumatic and tuberculous abscesses, all of which are prone to form in these parts.

Symptoms and Diagnosis. In external parts the first symptom to be observed is a rapidly growing nodule or tumor, which, though at first firm, elastic and painless, later on becomes tender and painful. The tumor soon gives rise to secondary growths in neighboring

glands and extends to the skin. It then breaks down and becomes a bleeding fungating mass and discharges an ichorous matter. There is usually considerable collateral edema of the head and neck. In internal parts these growths may give rise to ascites.

Treatment. The prognosis must always be unfavorable and no treatment is practicable. Martin attempted the removal of one of these tumors from the groin in a three-year old animal. A month later several small nodular growths were observed near the edge of the almost healed wound, and one larger one situated in the opposite groin. These were not interfered with and the animal succumbed in ten weeks' time.

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The Nose.

EPISTAXIS.

Bleeding from the nasal passages depends upon various causes the chief of which are traumatic influences, local inflammatory and ulcerative changes, or the presence of neoplasms or parasites in the nasal cavities. It is sometimes brought on by violent coughing and it may also take place in cachectic subjects suffering from leukemia or the pernicious anemia induced by the presence of uncinaria in the intestine. It is in every case the result of rupture of the vessels of the mucosa, whether arterial, venous, or capillary.

As a rule the hemorrhage is insignificant but it may be copious and recur at intervals and even lead to fatal termination.

Treatment. When the bleeding is excessive the measures to be adopted are both medicinal and surgical. Medicinally adrenalin chloride solution (1:1000) should be prescribed in ten to twenty drop doses every hour. Surgical measures consist in directing a stream of cold water from a hose over the roof of the nasal passages, or pressing a piece of ice against the same spot.

FOREIGN BODIES.

Foreign bodies and Pentastomes sometimes find lodgment in the nares. Dieterichs recorded a case in which a long bristle of a hog had penetrated the pituitary membrane.

Symptoms and Diagnosis. Respiration is impeded, and there may be epistaxis and fits of sneezing, and later a muco-purulent discharge.

Treatment. The removal of a foreign body is extremely difficult when it is situated at any distance from the orifice. Agents which induce sneezing and warm antiseptic injections are recommended, and if this treatment fails, the nasal chamber should be trephined and the body extracted or pushed forward out of the orifice.

NEOPLASMS.

Nasal tumors are not very common. When present, they are usually found to be of myxomatous nature and polypoid in form. These tumors may exhibit a tendency towards sarcomatous transformation. Polypoid fibromata are also seen. Chondroma, osteosarcoma, and carcinoma occasionally occur, but usually as secondary manifestation of a primary growth which has had its origin in either the buccal mucosa or the maxillary bones and has invaded the nasal passages. These malignant growths are recognized by the upheaval, and eventually, perforation of the superior maxilla which they produce.

Symptoms and Diagnosis. Growths of any size interfere with respiration. Malignant neoplasms give rise to purulent or hemorrhagic discharges, frequently of fetid character. They are painful to manipulation. When of long standing, the facial bones become distorted or necrotic.

Treatment. Constitutional treatment of polypi has been sufficient to cause their disappearance. Gohier verified this in an animal he tried to poison with large doses of arsenious acid after having given up an attempt at extirpation. When surgical measures are employed, the wire snare should be tried, but failing with this, it is necessary, owing to the conformation of these parts, to make an opening in the superior wall of the nasal passage with a trephine, and extirpate the tumor through the same. It is usually futile to attempt the removal of malignant growths.

The Larynx and Trachea.

FOREIGN BODIES.

Though common enough in the pharynx, lodgment of foreign bodies in the larynx is an accident of great rarity. The extreme sensitiveness of the larynx is responsible for this immunity, for if they do not become firmly wedged they are expelled by reflex coughing. Bournay treated a dog one week for sore throat, accompanied by symptoms of dysphagia, whistling and roaring, coughing, and occasional vomiting. It succumbed to asphyxia. The necropsy revealed the presence of a small pebble near the vocal cords which completely obstructed the orifice. The tracheal mucosa was edematous and covered with a fibrinous exudate in which the stone was also embedded.

Foreign bodies may also fall into the trachea, and this accident has happened where the tracheotomy tube has been employed.

As a rule, if an obstruction more or less completely blocks the passage, death quickly follows, but insignificant bodies are often tolerated.

Symptoms and Diagnosis. Where complete obstruction exists, symptoms of sudden suffocation develop. Where incomplete obstruction occurs, the symptoms are those of a subacute type of laryngitis, with dyspnea, coughing, vomiting, and expression of anxiety. There may or may not be spasm of the glottis. Differentiation in the latter case lies between displaced polypi and laryngeal edema occurring as a complication of laryngitis.

Treatment. If asphyxia threatens, immediate tracheotomy is indicated. The opening should be made close to the larynx. If the body is located above immediate relief is obtained, but if the dyspnea persists it is evidence that the body is lower down in the trachea. In the latter case a second opening should be made as low down as possible. The next step is to endeavor to dislodge the body. If it is in the larynx an attempt should be made to extract it by the mouth, but if this fails, to dislodge it by manipulating with the finger through the opening in the trachea. If the object is lower down, it may be necessary to employ forceps, when great care should be exercised not to force it further into the lungs. When bodies reach the latter position they are beyond surgical intervention.

NEOPLASMS.

The trachea and larynx are occasionally the seat of single or multiple papillomata. Cadiot and Almy and Mouguet have seen instances. Tubercles also occur as a manifestation of pulmonary or generalized tuberculosis.

Symptoms and Diagnosis. According to the authorities just noted, dyspnea and violent fits of coughing are prominent symptoms of papilloma.

Treatment. When the growth is situated in the larynx removal by means of a snare is indicated.

FRACTURE OF THE TRACHEA.

This lesion was seen and described by Walley. The trachea had sustained a complete transverse fracture which was supposed to have been caused by violent traction. There was a space of an inch between the severed ends. The first symptom noticed was a slight tumefaction of the tissues round the throat. This was followed by emphysema of the neck, chest, and one side of the body, which increased in the neck at each expiration. An attempt at relief was made by incising and stitching the edges of the aperture to the skin above and below, but the animal died soon after from pulmonary congestion and emphysema of the mediastinal connective tissue.

That it is possible to treat this lesion successfully if attended to in time would seem to be the case in view of the experiments of Mesnard and Gluck and Zeller which are quoted below.

Surgery of the Trachea.

Gluck and Zeller divided and reunited the trachea experimentally with good results. The division was made between the third and fourth rings. Both sections were at first sewn into the skin wound, eight to ten stitches being sufficient for each. Some days later the cut extremities of both sections were brought into apposition and sutured and the animal recovered the use of its voice. These experimenters also practiced extirpation of the larynx. Mesnard also removed two, three, and five rings from different dogs and sutured the cut ends with catgut. Reunion was complete in ten days.

TRACHEOTOMY.

This operation is indicated whenever dangerous dyspnea is induced by the following conditions: acute inflammatory and edematous affections of the larynx and tongue, and the presence of impacted foreign bodies in the larynx and pharynx. It is also resorted to for the removal of foreign bodies from the larynx and trachea. The technic is as follows: Place the animal in the dorsal position and extend the head and neck fully. Divide the skin and subjacent fascia with one firm incision. Quickly separate the fibers of the sterno-hyoid and sterno-thyroid muscles by teasing until the rings of the trachea are exposed. Pass a sharp hook into the lower border of the cricoid cartilage and elevate this. With a sharp curved bistoury cut through two or three rings of the trachea in the middle line but not too deeply. The incision may be simple, the edges of the severed rings being stitched to the cutaneous wound or a circular portion may be removed and a tracheotomy tube inserted, the latter being held in position by tapes tied round the neck. The inner tube must be removed every few hours for the purpose of removing accumulations of mucus which if allowed to take place quickly obliterate the passage. Stitching of the trachea should be avoided if possible, as the stitches tend to cut through the cartilage, and if renewed very often lead to necrosis of the parts. A dog wearing a tracheotomy tube must be closely watched, as some animals make persistent efforts to rid themselves of the instrument.

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CHAPTER IV

The Thorax

The Lungs and Pleurae

EXAMINATION.

Examination of the lungs and pleurae is conducted by means of auscultation and percussion. With the naked ear applied to the chest wall, respiratory sounds can be heard with sufficient distinctness, but the employment of a stethoscope or phonendoscope accentuates them. Percussion is best accomplished by tapping with the second finger of one hand on the corresponding finger of the other hand laid flat against the chest wall. When using these means for diagnostic purposes the position of neighboring and more solid organs must always be taken into account.

TRAUMATIC LESIONS.

Wounds of the lungs and pleurae occur for the most part as a complication of penetrating wounds of the thoracic wall. Their gravity depends upon the degree of resultant hemorrhage and the entry of either atmospheric air or pyogenic bacteria within the sacs. If air beyond a certain quantity enters a pleural sac, the condition known as pneumothorax is established, and both lungs collapse. The animal makes violent respiratory efforts which gradually become less frequent and finally cease, cyanosis meanwhile developing. If, however, an open wound becomes quickly sealed, either spontaneously or by surgical measures, the air is gradually absorbed and the lung again takes on its function. This is also true of hemorrhage exudates. Slight rents in the pleura are not as a rule followed by entry of air. In rents or incisions of at least a half to an inch in diameter the lung may be seen to glide over the incision hole with each act of respiration, the cohesive force of the two pleurae being sufficient to overcome the pressure of the atmosphere through the incision. Delafond probed a wound

with his finger until he felt the heart, and the animal recovered. Theoretically, when only one sac is opened, sufficient for air to gain entry, and the opposite sac remains intact, the condition is not incompatible with life, because unilateral respiration would still be possible. But, though the dog has two separate and distinct pleural sacs, they are separated only by a thin diaphanous mediastinum, and as a matter of fact, as has been established by all those who have experimentally opened the chest-wall, air apparently readily passes through this membrane and causes the collapse of the adjoining lung. At any rate, it has been found impossible to open either sac to any extent without making provision for the maintenance of respiration by artificial means, and this involves the temporary introduction of a tube into the trachea and the employment of bellows.

The other great danger lies in septic infection, which is very apt to take place. In this respect, the pleura offers a striking contrast to the peritoneum, which possesses a well-known relative immunity to infective processes. Sherman believes that this may be due to the fact that the pleura does not, like the peritoneum, offer pockets or recesses in which an infection may be confined, and that constant motion incident to respiratory and cardiac action tends to disseminate pathogenic microorganisms. Were it possible to drain the pleura, sepsis might be combatted, but inasmuch as drainage of the pleura inevitably results in collapse of both lungs, no steps in this direction can be taken.

Symptoms and Diagnosis. Wounds of these parts are difficult of both diagnosis and prognosis. If hemoptysis ensues it is indicative of wounding of the lung. When air is entering a pleural sac in small quantities, the fact is easily recognized by the sound at every act of respiration. In any case, respiration is usually greatly accelerated, and this is particularly true when hemothorax exists. Penetrating or deep wounds of the chest-wall should never be probed for fear of bringing about pneumothorax and introducing microorganisms. Prognosis must always be guarded.

Treatment. Penetrating wounds of the thorax should be closed as quickly as possible by suturing and application of antiseptic bandages. No attempt should be made to evacuate hemorrhagic exudate in the pleural sac because it soon coagulates, and is gradually absorbed even if present in considerable quantity.

Thierry treated a dog whose chest had been ripped open by a wild boar between the seventh and eighth left ribs. At each inspiration a portion of the lung would protrude. He sutured the wound with a rusty needle and dirty suture, and the animal completely recovered within three weeks. Delafond had a similar experience.

PLEURITIS.

(Largely translated from Cadlot and Breton.)

Two principal types of this disease are recognized, viz., the sero-fibrinous and the purulent. Both are believed to be of infectious origin. The SERO-FIBRINOUS form is now known to be most commonly associated with tuberculosis, but it is also known that the disease may follow a sudden chill, such as hunting dogs sometimes sustain when following their quarry into water in mid-winter, or which house dogs suffer after being washed and exposed to the cold air before their coats are sufficiently dry. Cadéac places the percentage of tuberculous pleurisies at ninety. Parasitic infestation may also be responsible. Magnié attended an animal which died suddenly with symptoms of vomiting and asphyxia. In the left sac he found a plastic exudate and signs of pleuritis, but without effusion. A *strongylus gigas* which was present was supposed to have excited violent contraction of the diaphragm and produced asphyxia.

The disease occurs in all ages, but most frequently about the third year. Spring and Fall seem most propitious for its development.

The lesions most commonly found at necropsies are ecchymoses and multiple granulations of diverse form, covered with a fibrinous exudate and macroscopically resembling sarcomatous nodules. On this account this type of the disease was formerly regarded as cancerous pleurisy. The tubercle bacillus is often found swarming in the nodules. In acute exudations of recent origin microorganisms of suppuration, particularly staphylococci are usually also present. The lesions are rarely confined to portions of one pleura, but usually invade the whole of the sac, or the opposite sac may be involved. The lung of the affected side is generally more or less atelectasic.

Contingent lesions are often present. There may be hydrothorax of the healthy side, pericarditis, ascites, and anasarca of the

lower extremities. Mathis saw a complete torsion of the posterior lobe of one lung in an animal destroyed suffering from pleurisy, which he attributed to the varied positions in which it had been placed for examination.

Symptoms and Diagnosis. Pleurisy is ushered in by an intermittent chill lasting three or four days. This is followed by fever and dyspnea, thirst, injected mucosae, accelerated pulsations, and anorexia. The urine is scant, and sometimes albuminous. The dyspnea is very apparent, respiration being superficial and painful, and characteristically abdominal. There may or may not be a cough. When present it is short, dry, and painful. The thorax is particularly immobile on the diseased side, primarily from pain, but later from interference by the effusion. Auscultation prior to the stage of effusion and during the course of resolution reveals friction. After effusion has taken place percussion with the animal in the standing posture shows dullness up to a certain level corresponding with that of the contained fluid. Above this there is a tympanitic sound. If the position of the animal be changed, displacement of the fluid occurs with corresponding shifting of the dull area. The vesicular murmurs become inaudible, bronchial breathing alone being apparent. In the later stages mucous râles may be present owing to pulmonary edema engendered by stasis of the circulation. If the ear is applied to the diseased side and the chest struck sharply, a wave-sound is heard. On the healthy side respiration is labored.

The course of the malady is variable and the prognosis must be guarded. In some cases effusion takes place almost at the outset, in others particularly of tubercular origin, friction sounds are audible for several days. The liquid may fill the sac very quickly, or it may take from fifteen to twenty days. The disease may terminate in resolution, the liquid becoming totally absorbed, or it may assume a chronic character, or death may supervene. Resolution is indicated by progressive disappearance of the functional derangements. It is always slow to take place when the fluid is not removed by thoracentesis. Death may occur through collateral congestion and edema, or through asphyxia when both sacs are involved. Syncope may be suddenly produced by secondary pericardial effusion, myocarditis, or metastatic tuberculosis, particularly of the liver. Should friction sounds continue, it may be re-

garded as an indication of the existence of tuberculous nodules, in which case the animal becomes a menace to its kind, and possibly to the human race. Tuberculin should always be injected to confirm the suspicion. Inoculation tests may also be made on rabbits and covies, but no reliance is to be placed upon them in case of a negative result, for the reason that old effusions are sometimes completely sterile, while the nodules may contain large numbers of bacilli.

A not infrequent sequel to pleurisy is atelectasis or pulmonary collapse, caused by peripheral compression of the lung proceeding from pleural or pericardial effusion. The presence of the fluid interferes with the inspiration of air, and the pressure gradually forces out the residual air in the alveoli. It is usually confined to part of a lung, but may involve the whole.

Treatment. At the outset of the disease counterirritation in the form of mustard plasters should be applied, and the costal and sternal regions protected by a flannel chest jacket. After effusion has taken place medical measures are directed towards producing purgation and diuresis and sustaining the heart. The fluid is best removed by thoracentesis, and this operation should always be resorted to when dyspnea is intense.

Purulent Pleuritis. This disease is always of pyogenic origin through accidental penetration of microorganisms (staphylococci and streptococci) into the pleural sacs. Delafond regarded traumatism as a frequent cause. A violent blow, such as by the hoof of a horse or by the horn of an ox, resulting in fracture of one or more ribs, may so enfeeble the resisting power of the tissues as to permit of incursions by microorganisms. Another manner in which the disease may originate is through perforation of the esophagus by foreign bodies, such as animal or fish bones. In one instance Siedamgrotzky found an ear of wheat in the left pleural sac, the channel of entry of which could not be determined in spite of careful search. In another, Weber found a spikelet of rye which had perforated a bronchus. Leclerc saw a fatal purulent pleurisy caused by the discharge of pus from an abscess in the lung resulting from the presence of a briar thorn. Cancerous tumors are also productive of purulent lesions.

Symptoms and Diagnosis. The symptoms are fever with a temperature of about 105° F., profound prostration, arched back, a slight

thoracic distension and tension of the abdomen. A positive diagnosis of the presence of pus can be made by thoracentesis. The disease is quickly fatal by toxemia or pyemia.

Hydrothorax. This term is applied to a secondary affection, which consists of an effusion of the serous fluid into the pleural sacs as a result of stasis of the circulation. It may be brought about by neoplasms of the bronchial and mediastinal glands, chronic diseases of the heart, pericardium and lungs.

Symptoms and Diagnosis. The symptoms are dyspnea, respiration with open mouth, fainting spells, and incapacity to ascend stairs or move far. It may be distinguished from pleurisy by the physical signs, and by the effusion being bilateral and symmetrical. This affection being dependent on other lesions, thoracentesis can effect but a temporary improvement.

HERNIA.

This is a lesion of rare occurrence. An observation has been recorded by Peuch. The animal at each expiration, presented a soft, quivering, spherical tumor about the size of a hen's egg, at the lower part of the left side of the thorax, between the sixth and seventh rib. When the animal barked, the swelling attained the size of the human fist. Palpation revealed a rent of the entire thickness of the intercostal muscles, about two inches in length. Peuch treated this case by maintaining a pledget of pitch and resin over the seat of hernia by means of a bandage rolled round the chest. In eleven days complete recovery had taken place.

Surgery of the Lungs

A good deal of major surgery has been done on the lungs in an experimental way, showing that interference with these vital organs is feasible.

Wm. Koch experimented to test the susceptibility of the lungs to various surgical procedures. He performed acupuncture with aspirating needles or pointed instruments on over twenty dogs. Later on he injected iodide of potassium in solution of various strengths. On examining the organs some weeks later scarcely any scar could be found, and he came to the following conclusions: (1)

the lung is insensible to wounds with little or no reaction, (2) portions of lung may be destroyed by injections or by the galvano-cautery without killing the animal.

Gluck went further than this. He extirpated the whole of one lung in six animals. The animals were chloroformed, and strict antiseptis and careful arrest of hemorrhage observed. A bow-shaped incision with the convexity towards the sternum was made through the skin and pectoral muscles between the third and sixth ribs, and the edges separated with a tenaculum. The broad insertions of the serratus anticus major muscle were detached, and portions, three to five inches in length, of the third, fourth, and fifth ribs resected, external to the course of the internal mammary artery. The intercostal muscles of the parts noted were also excised, and all bleeding carefully stopped. The intact pleura was now seized with forceps and divided the entire length of the wound. At the same moment the lung collapsed, and breathing became accelerated. Then the entire left lung was ligated at the root and removed en masse, or it was extirpated piecemeal. After extirpation, the entire contents of the mediastinum were visible, including trachea, esophagus, both vagi nerves, vena azygos, ductus thoracicus and heart with great vessels. Most of the animals recovered, though this has not been the experience of experimenters in this country.

Schmid also resected portions of one lung in eight dogs, and of these three recovered and five died. Four of the latter succumbed to empyema, in Schmid's opinion, owing to entrance of septic matter from the divided bronchii.

THORACENTESIS.

This operation consists in removing pleural effusions by means of trocar and canula, or preferably the aspirating syringe. In cases of true pleurisy the necessity for its performance first occurs from the tenth to the fifteenth day after the onset of the disease.

It is best performed with the animal in a sitting or standing posture. Pfeiffer directs that the dog be laid on the table, but Moeller has seen an animal die within a few minutes from being placed on its side. The site of puncture should be disinfected and the instrument rendered sterile.

A fine trocar and canula, or preferably an aspirating needle

may be employed. The latter is best, for the reason that entrance of air into the thorax can be guarded against, and the flow of liquid being more gradual is less liable to interfere with intrathoracic pressure and cardiac action.

The needle should be inserted in a somewhat forward direction at the anterior border of the sixth, seventh, or eighth rib, after first pulling the skin slightly to one side. The intercostal space can be widened by pushing one finger into it. Slight pain is evinced on puncturing the skin. The cavity is reached as soon as resistance to the passage of the needle has ceased. If a canula is used the fluid at first gushes out in a continuous stream, then rhythmically synchronous with respiration. During expiration the flow ceases and air rushes in, which must be prevented by placing the finger over the end of the tube after each inspiration. If the flow suddenly ceases it is through plugging by flakes of fibrin, which can be forced back by reinsertion of the trocar. From two to five ounces of fluid should be withdrawn, and the operation repeated daily at a new site of puncture, until no liquid remains. When the effusion shows no sign of abating, Cadiot and Breton advise irrigation of the sac with normal sodium chloride solution, at a temperature corresponding to that of the body. No other or antiseptic solutions should ever be injected.

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The Heart and Pericardium

TRAUMATIC LESIONS.

Not very long ago it was generally believed that a wound of the heart was necessarily if not immediately fatal, but thanks to the experimental researches of Fischer, Kronecker and Schmey, Elsberg, Ricketts, Sherman, and others, we now know that the gravity of a heart wound depends on its size, location, and certain

other factors, and that even with fatal outcome death may be delayed to the extent of several hours. Between five and ten per cent of all heart wounds terminate in recovery. It is known, however, that there is a spot in the septum, between the ventricles, where simple puncture with a fine needle is followed by immediate arrest of cardiac action. In other respects, when a heart wound proves fatal it depends upon either of two factors, viz., acute hemorrhage or intracardial pressure. In either case the same result ensues, viz., starvation of the organ. In the former case the wound in the pericardium is sufficient to allow the escaping blood to pass out through the external wound or into the pleural sacs in such quantity that it no longer enters the organ in sufficient volume to stimulate the muscle of the latter to contract. In the latter case the rent in the pericardial sac becoming sealed from one cause or another, the accumulating blood reacts on the organ by compression. Cohnheim has shown this by injecting various quantities of fluids into the pericardial sac, the pressure being mainly sustained by the auricles and great vessels at the base of the heart. The ventricles continue to contract, but the auricles and great vessels being compressed the entry of blood gradually decreases until the heart pumps itself dry, and finally the ventricles also cease.

Wounds may be penetrating or non-penetrating, but the hemorrhage from the former is usually more copious than from the latter, though from the latter a hemorrhage may be as serious in its results as from the former. The hemorrhage usually takes place during systole, but it may also occur during diastole when the wound is very large. Wounds of the right ventricle bleed more freely than do those of equal size in the left, the latter closing by coagulation more rapidly than the former, owing to the greater length of the wound canal and thickness of the wall. For the same reason perpendicular penetrating wounds bleed more freely than do oblique. Hemorrhage is more severe in wounds from sharp instruments than from bullets. When a penetrating body plugs the wound, so to speak, a fatal outcome may be averted, or at least delayed, some hours. In Nocard's clinic at Alfort a dog was received whose heart was transpierced by an arrow. Its master had endeavored to extract the missile, but the latter had broken off short in the wound. The animal had then run for miles, and did not succumb until the following day. Nocard remarked that had

the owner succeeded in extracting the arrow the animal would have died almost immediately from acute hemorrhage.

Symptoms and Diagnosis. Heart wounds are recognized by the location of the external wound, the general evidence of hemorrhage, the acute anemia, the disturbance of cardiac function, and the local signs of filling of the pericardium and pleura.

Treatment. For the class of wounds in which the hemorrhage is confined to the pericardial sac the operation of pericardicentesis is theoretically indicated, but it must be remembered that even if the pressure is successfully removed the hemorrhage may begin anew.

For the other class of wounds in which the blood escapes externally or into the pleural sacs there is only one alternative, and that is to open the thorax and suture. Modern surgery has shown that suture of the heart is a perfectly feasible operation. But, there are certain difficulties to be overcome in the case of the dog which are likely to cause even the most skilful and progressive operator to hesitate.

PERICARDITIS.

The term pericarditis comprehends any inflammation of the external serosa of the heart and roots of the great vessels. Every inflammation of this membrane is essentially of infectious origin, the inflammatory products invariably disclosing the presence of microorganisms. Idiopathic pericarditis is an unknown entity, aseptic lesions always cicatrising without inflammation. The process of infection is said to be primary when the pericardium is the original seat of attack by microorganisms; it is said to be secondary when the pericardium is invaded during the course of a general infectious malady.

The disease may be acute or chronic, and two principal types are recognized, viz., the sero-fibrinous and the purulent, depending upon the properties of the causative microbe.

Sero-fibrinous inflammation of the pericardium, while being rarer than that of pleura and peritoneum, is, nevertheless, by no means uncommon. Its development is usually secondary, either from pyemia, rheumatism, pneumonia, or distemper, but most often from tuberculosis, when it may occur either singly or complicated

with pleural and pulmonary lesions. Trasbot and Rousseau have observed it to occur primarily as the result of a chill, such as an animal may receive on entering water during the heat of the chase. Such instances are probably due to the attack of microorganisms already present in the blood, under a condition of lowered vitality of the animal. The investigations of Porcher and Desoubry have demonstrated that bacteria are constantly entering the circulation by way of the alimentary canal under normal conditions.

In the acute form the sac is filled with a sero-fibrinous liquid, which is often blood-stained. At times a profuse hemorrhage takes place, causing extreme distension, which may lead to rupture. Both parietal and visceral layers are beset with villousities and false membranes, and the presence of tubercle bacilli may usually be demonstrated.

The slowly developing chronic form is commoner, but it frequently succeeds the acute. Most tuberculous dogs affected with pleural lesions also suffer from chronic pericarditis. The effusion is liquid, serous, more or less profuse, clear or yellowish, transparent, and often free from microorganisms. The surface of the visceral membrane is studded with bacilli-containing neoplasms, varying in size from a grain of millet to a pea. In the vicinity of the base of the heart, where there is least mobility, it is usually consolidated with the parietal layer, and sometimes there is complete fusion of the two membranes. When the latter condition is present the heart sustains compression and atrophies, so that its chambers can no longer contain the normal quantity of blood. When there is considerable effusion present the lungs frequently suffer from atelectasis owing to compression.

Pyemic pericarditis is characterized by miliary whitish foci of suppuration. Both conditions usually lead to more or less myocarditis, softening of the muscle, and dilation of the chambers, or there may develop a diffuse fibrosis, particularly in narrow-chested animals.

The chief secondary complications to which pericardial effusion may give rise, are: venous stasis owing to partial collapse of the veins entering the heart through pressure of the fluid in the pericardium; impairment of cardiac action; mechanical valvular insufficiency; one or all of which may give rise to hydrothorax, ascites, and anasarca, the latter sometimes limited to the posterior ex-

tremities, and to the sheath in males. In two animals examined post-mortem by Siedamgrotzky there were also hepatic cirrhosis and interstitial nephritis.

Rupture of the sac may take place when there is much distension and softening of the wall during hemorrhage or tuberculous pericarditis.

Symptoms and Diagnosis. The disease is rarely detected in its incipency. It may continue until the end of the animal's natural life without being suspected, its existence being only discovered post-mortem. When effusion commences dyspnea is observed, which becomes very marked as the amount of fluid increases. Later, when it is present in profuse quantity the interference with the heart's action becomes a serious matter, the animal is prostrated, its orbits project, its expression is anxious, it breathes with great difficulty, cyanosis develops, and distension of the jugular takes place at the slightest exertion. The pulse is frequent, small, and feeble, or it may be slower than normal and irregular. There is an active thirst, but infrequent micturition, and the animal progressively emaciates.

In making a diagnosis pericarditis must not be confounded with pleuritis. With a phonendoscope or good stethoscope the heart beat can be plainly heard when the effusion is exclusively pleural, whereas it can scarcely be detected when the effusion is confined to the pericardium. In the latter case a splashing sound isochronous with the cardiac movements can generally be heard, and there is an area of dullness corresponding to the distended cardiac sac. It must be remembered that both pleuritis and pericarditis may co-exist. Accordingly, in every instance where thoracentesis is practiced, auscultation and percussion over the region of the heart is indicated after removal of the pleural effusion.

A test injection of Tuberculin should also be employed for prognostic purposes.

Treatment. Medicinal treatment is directed towards sustaining the heart, reducing the inflammatory process, and preventing complications. Vesicating agents, such as mustard and blisters are said to produce good results. Digitalis, caffen and diffusible stimulants are administered to combat cardiac asthenia. The best way to remove the effusion is by the operation of pericardicentesis, but many practitioners place much faith in hypodermic injections of

pilocarpin. When the symptoms are grave operative measures are imperative. (See Pericardicentesis.)

HYDROPERICARDIUM.

By this term is meant any non-inflammatory, passive effusion of serous fluid into the pericardial sac. Like any other hydropsy this condition is always of a serious nature, developing through local stasis of the circulation owing to valvular lesions, auricular tumors, pulmonary affections and chronic pleurisy, whereby starvation of the pericardial capillary cells and filtration of some of the fluid constituents of the blood take place. It may also develop through capillary poisoning incident to chronic nephritis and cancerous and tuberculous cachexia, and more or less during the agonal period. It is nearly always associated with hydrothorax, the origin of which generally precedes it, and very frequently with ascites and anasarca.

The exuded liquid is clear and yellowish, or slightly tinged by admixture of hemoglobin or blood. It contains less albumin than blood serum, and a certain quantity of fibrinogenous material, which causes it to undergo coagulation when exposed to the air. The walls of the sac are pale and lack inflammatory adhesions. Benjamin saw a case of hydropericardium associated with thoracic adenopathy, in which the parietal serosa was beset with slightly granular patches.

Symptoms and Diagnosis. The same physical and functional signs are present as in pericarditis proper, but without elevation of temperature.

Treatment. The same treatment is indicated as for pericarditis.

Surgery of the Heart

That the heart is capable of sustaining operative interference with subsequent perfect recovery of the animal has been amply proved experimentally. In 1895, Rosenthal, who up till that time was the first to attempt treatment of a wound of the heart by direct means, exhibited to the Medical Society of Berlin a dog, which had survived and fully recovered from resection of the sternum and an experimental cardiac wound. Shortly after, Del

Vecchio succeeded in saving a dog which had sustained two experimental perforating wounds of the left ventricle and subsequent suturing of the same, and since then, Salomoni, Philippov, and the other experimenters previously mentioned have determined the feasibility and usefulness of suture of the heart and pericardium with various results. More recently Tuffier and Hallion have made a very interesting demonstration. They anesthetised a dog until respiration and cardiac pulsation had ceased. After a minute's waiting, with no sign of return of life, they incised the sixth intercostal space and forced the ribs apart. The heart was seen to be perfectly still. It was then seized between the fingers in such a manner that the apex lay in the palm of the hand, while the ventricles were encircled by the fingers. The next step was massage of the organ by compression. For a period of one minute it remained motionless; then very feeble intermittent contractions were apparent. It progressively recovered its functions and respiratory efforts recommenced. The thorax was closed, and the animal eventually recovered.

As has been pointed out under Traumatic Lesions of the Lungs, it is impossible to open the pleural cavity to any extent without resorting to artificial respiration, and for the same reason provision cannot be made for drainage, and since it is rare to accomplish surgical interference with this part of the organism without the introduction of pathogenic microorganisms, in spite of the utmost care, the usual termination is a lethal one from septic infection. However, there have been several recoveries from experimental wounding and opening of the pleura and pericardium, and a clinic case has been recorded by Delafond in which the pericardium having been perforated by a wild-boar, the wound in the thorax was closed with sutures, and in eight days the animal recovered.

SUTURE OF THE HEART.

The technic of this extremely delicate operation is as follows: Every aseptic precaution being observed and the animal being secured and anesthetised, the first step is to perform tracheotomy, insert a tube in the trachea and connect the same with bellows, which must be entrusted to the hands of a capable assistant, whose whole attention must be bestowed on this important part of the operation. A free longitudinal incision is made on the left side

through the skin and pectoral muscles along the border of the sternum from the third to the sixth ribs. The broad origin of the serratus anticus major muscle is dissected, and the third, fourth and fifth ribs divided beyond the course of the internal mammary artery, and the intercostal muscles carefully severed. The edges of the wound must then be retracted, or about an inch of each rib may be removed. The intact pleura is now observed. All bleeding being absolutely stilled, the pleura is incised along the course of the wound. At the same moment the lung collapses and respiratory efforts become labored. At this point artificial respiration must be started up. The pericardial sac is quickly grasped, drawn up into the wound, sutured to the muscles round the edges of the thoracic wound, and opened by longitudinal incision. There is no bleeding from the pericardium. The heart is brought up into the opening in the chest wall by means of two long traction sutures inserted on either side of the wound, and carried deep into the ventricular wall, such manipulation in no wise interfering with its function. Bleeding from the wound can be immediately stopped by crossing the sutures and holding them taut. The permanent sutures of silk are next placed, and these should be continuous, superficially inserted and tied during diastole, the knots being firmly secured. The next step is to make a complete toilet of the sac. The latter is then closed by continuous silk suture, the chest wall is sutured, including the divided muscular tissues, and finally a subcuticular suture is inserted in the skin. The bellows should be forcibly blown up just as the chest is closed, in order to expel all the air possible. Natural respiration shortly recurs, the bellows are withdrawn, and the tracheotomy wound closed.

PERICARDICENTESIS.

This operation is resorted to whenever extinction of life is threatened through distension of the sac by effusion, or when secondary hydropsies have developed. There is little or no danger attending it, as Elsberg has shown in his experiments that needle punctures are always small, and though there is slight hemorrhage, which is more considerable in the auricles than in the ventricles, it soon ceases, and is never enough to endanger life.

The operation should be performed with an aspirator provided with a short needle of minute caliber thoroughly sterilized. Em-

ployment of such a needle reduces the danger of syncope from too rapid or sudden withdrawal of fluid to a minimum. The instrument is used in the following manner: Shut the cock and withdraw the piston to form a vacuum within the barrel of the syringe. Select a portion of skin inferior to the area of dullness and disinfect it as thoroughly as possible. Introduce the point of the needle under the skin at this spot, open the cock, and press the needle slowly inward until resistance ceases and the liquid is seen to gush into the syringe. Shut the cock and empty the syringe, and repeat the same action until the fluid is nearly all removed. Perform the operation again and again if the effusion recurs.

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CHAPTER V

The Abdomen

Abdominal Section. Celiotomy. Laparotomy

The operation of opening the abdominal cavity of a healthy animal is ordinarily remarkably free from any ill-effect. It is exceedingly rare that peritonitis supervenes, even when the precautions amount merely to an observation of the ordinary rules of cleanliness. In fact, it may be unreservedly asserted that the necessity for antisepsis, so far as fear of infecting the peritoneum is concerned, has been greatly overrated. Numerous experiments and abundant clinical observation have demonstrated beyond any doubt that the peritoneum of the dog possesses extraordinary refractory power against the action of pyogenic microorganisms. (See The Peritoneum). There is little risk of peritonitis resulting from introduction of any limited infection from without, such as may occur during the course of an operation when the peritoneum comes in contact with even the unwashed hands. Neither is there any greater risk after it has been sealed by suturing of the muscular wall. This is due to the well-known fibrinoplastic property of the peritoneum. Wounded peritoneum possesses a remarkable power of adhesiveness when brought in contact with peritoneum. This fact is beautifully demonstrated during suturing operations of the peritoneum, when fibrinous adhesions may be observed to form and firmly bind apposed surfaces within a period of some half-dozen minutes. The chief danger arises from the presence of much putrescible matter, such as large blood clots and portions of organs isolated from their vascular supply by ligature, etc., and allowed to remain. The slightest infection sustained by quantities of such matter is very liable to lead to general peritonitis. Extravasations from the alimentary tract following imperfect apposition or suturing of surgical wounds of the intestinal walls are always highly dangerous. In the various visceral-suturing experiments that have been

carried out on dogs these conditions have been chiefly the cause of fatal termination. But even when infective processes have started up the disposition of the membrane with its pockets and recesses offers opportunity for localization.

While the above remarks are true with regard to the dog in health, the conditions are changed when, for instance, the peritoneum has already been subjected to infection, as may occur in cases of intestinal obstruction, and there is then some risk to be considered. Infective processes are then more likely to arise, not only by direct migration of bacteria, but through their deposit from the circulation. When an intestinal obstruction has existed for any length of time a state akin to septicemia is produced, namely, copremia, or in other words, the blood is charged with the products of intestinal putrefaction, together with the bacteria causing the same. Under these and like circumstances, the wound may tend to heal unkindly, and may even lead to unfavorable termination, but even here the risk may be greatly reduced by adequate provision for drainage.

Because of this remarkable tolerance of abdominal section, the practitioner need never shrink from undertaking the operation as an explorative measure. It is not always possible to corroborate a diagnosis of internal lesion by external appearances or palpation. Especially is this the case in plethoric animals and where the lesion is situated in a position remote from the surface of the body. For instance, an animal may exhibit all the symptoms of acute impermeability of the intestinal canal—intractable vomiting and suppression of defecation, with extreme prostration—and yet the abdominal wall may be so tense as to preclude the possibility of diagnosis by palpation. Again, it is very difficult in gunshot cases to decide whether the intestine or any other organ has been perforated or not. The appearance of the external wounds has no diagnostic value, since there is no gaping of the parts owing to contraction of the abdominal muscles, and it is often impossible, and in most cases inadvisable, to use a probe. Sometimes the sexual impulse is manifested after ablation of the ovaries. This is generally due to the persistence *in situ* of a portion of the ovarian tissue, which can be ascertained by an explorative operation. It is recognized that the sudden accidental application of a violent compressive force to the abdomen when the bladder is distended is very apt to cause rup-

ture of the latter or even of other organs and bloodvessels. In such cases it is a wise procedure to open the cavity when there is evidence of systemic collapse. Internal hemorrhage through rupture of even lesser vascular branches is always dangerous. Divided vessels of the abdominal cavity possess a remarkable tendency to bleed persistently. If, however, air be admitted through abdominal section the conditions are quickly altered, clots commencing to form. Such vessels, however, should always be secured to guard against a recurrence of the hemorrhage when the cavity is closed and it thereby returns to its former condition.

The operation should invariably be performed with the subject under the influence of an anesthetic. Not only do humane considerations demand this, but the accurate conduct of a delicate operation on a struggling animal is an impossibility. Before the abdomen is opened every possible contingency must be fully considered, so that the necessary instruments, surgical aids and sutures be prepared, rendered aseptic and laid handy.

If it be possible to arrange, the animal should receive no food for twenty-four to forty-eight hours previously, and also receive a purgative. A distended bowel is always a particular annoyance to the operator by reason of its tendency to extrude itself.

With regard to the selection of a site for section, it may be said there are two main positions—the lateral and the median. Each has its advocates, and without doubt each certain advantages over the other. But it must be borne in mind that no absolute rule can be laid down in the matter. Neither position is peculiarly suitable for reaching every organ, and the operator must be governed by the conditions present. Most of the organs can be reached by the median line, and this position has much to commend it. It can be performed almost bloodlessly, it can be easily enlarged, it affords better access to all parts of the cavity for explorative purposes, and it permits of perfect drainage. Further, any resultant scar is not observable when the animal is in the standing position. The chief objection offered against it is said to be the greater risk of the dissected parts failing to become united. I cannot concur in this opinion, never having experienced the misfortune of hernia. La Torre holds that such risk is reduced to a minimum if the incision is made through the muscular tissue of the rectus abdominis, slightly to one side, and not through the aponeurotic

tissue of the linea alba. Union of muscular fiber, particularly by first intention, is always stronger than union by granulating cicatricial tissue. Human surgeons recognize that the commonest factor in the development of hernia is an infection causing the wound to fill in slowly with scar tissue. Median section has a disadvantage in males, in that the wound may become soaked with urine. Even if the incision be made posterior to the preputial orifice, and this difficulty thereby avoided, there still remains a pronounced tendency to the development of suppurative processes. The reason for this is to be attributed to the proximity of the penial mucosa, which is so often the seat of catarrhal discharges, and whence microorganisms can so easily be transmitted to the wound during the course of an operation, and later by the animal licking the parts.

In the lateral position the risk of hernia is almost *nil*, but among the drawbacks are: the greater thickness of muscular tissue which must be divided; the necessity of securing the epigastric vessels; and the tendency of pus to burrow between skin and wall, and even into the peritoneal cavity in the event of the wound suppurating during healing. Should purulent peritonitis intervene, either from such burrowing or incident to secondary operations on internal organs, the chances of recovery are remote, in consequence of absence of drainage.

Generally speaking, the organs are best reached as follows: the stomach, spleen, pancreas, and liver, in the anterior third—*i. e.*, immediately posterior to the thorax; the ovaries and intestines exactly in the center of the distance between the ensiform process and the symphysis pubis; the uterus, bladder, ureters, and rectum immediately anterior to the pubis.

When the operation is undertaken as an explorative measure the surgeon is, figuratively speaking, groping in the dark. In such instances the middle third should be chosen.

Instances have been recorded where it has been found necessary to close the first incision and make a second one before the seat of lesion could be reached. Venneholt described an operation for fecal impaction, the mass of which was lying in front of the pubic bone. The mass was mobile, and the operator expected to reach it without any trouble. The first incision was made in the linea alba, but the obstructed portion of the bowel could not be extracted. It was then necessary to make a second incision to the side of the prepuce.

Gluck, in his experimental extirpation of the liver, found the organ could be reached most conveniently by incising from the ensiform process to the costo-vertebral articulation of the eighth rib, and resecting the eighth and ninth ribs. Griffiths, in his experimental surgery of the pelvic viscera, found he could expose the latter to better advantage by dividing the symphysis pubis and then separating both sacro-iliac synchondroses by forcibly turning the iliac bones outward. The bones can be separated two inches or more.

The animal being secured in the proper position with hoppers, the skin in the immediate vicinity of the contemplated incision is clipped or shaved of its hair and scrubbed with warm water and soap. The incision is made with a sharp scalpel, and should not be less than two inches in the smallest animals, while in the larger breeds it may be found necessary to make the wound large enough to admit the whole hand. To reach the cecum and kidney always requires a large incision, owing to their remote position. The skin, subcutaneous connective tissue and muscles are successively divided, the fibers of the latter being separated according to the direction in which their course runs. Three muscular coats require to be divided in the extreme lateral position—the obliquus externus, the obliquus internus, and the transversalis. In the median line there are the aponeuroses of these muscles and a single true muscular coat—the rectus. In the male prepubic median section is made by incising the skin immediately to one side of the penis and dislocating the latter—*i. e.*, by pushing it in the opposite direction. In making this incision one must avoid wounding the posterior epigastric vein—a prominent vessel which runs on either side a short distance from the penis. There is always slight hemorrhage in this region. Section of the muscular wall can then be made in the median line as in females. Froehner believes he can guard against contact with urine and secure better prospect of healing *per primam* in males by making always a lateral incision about one and one-half to two inches to one side of the linea alba, and subsequently painting the surface of the wound with a solution of iodiform in ether (20:100). Stoss opens the muscular wall by thrusting a grooved director through at one commissure of the skin incision, after making the latter, and passing it with the groove uppermost in contact with the inner surface of the wall along a

line corresponding to the contemplated incision. There is no danger of piercing the bowel with a blunt director, and if any portion of the former should be caught up it is perceptible through the wall as a slight elevation. In that case the director is withdrawn far enough to release the gut and again passed. With the director as a guide, the incision in the muscle wall is made with a bistoury.

Any vessel being divided, it is grasped with hemostatic forceps, which generally suffices to arrest the flow within a minute or two. The epigastric vessels should always be ligated. All hemorrhage being under control, the peritoneal coat may be picked up with the dissecting forceps and pierced with the scalpel, or it may be gently incised *in situ*, and the opening enlarged with the finger. Beneath is found the omentum major, excepting just in front of the pubic border. It may be gently pulled away from the hypogastric region and stowed away in the epigastric, or an opening may be made in it by tearing at a point opposite the incision.

The viscera are now exposed to view, and the necessary supplemental operations demanded by the exigencies of each particular case are immediately undertaken.

There is generally some tendency to protrusion of intestinal coils. This must be guarded against as much as possible, though it is rare that any evil effects follow prolonged exposure. It may be prevented by temporarily inserting flat sponges or small cloths (sterilized) just within the wound. The radiation of heat incident to prolonged exposure tends to lower the vitality of the peritoneum, whereby its eliminative or absorptive power is checked. Vincent in his experiments found that there was more likelihood of peritonitis developing after exposure of the bowel, and regarded it as important not to let any escape. Should it be necessary to allow of any considerable protrusion of viscera it is advisable to carefully protect the exposed organs with sterile gauze wrung out in hot water and repeatedly applied. It is a good plan, when an operation is likely to last a considerable time, to employ a "celiotomy cloth." This consists of a piece of cloth with a slit in it made to correspond with the skin incision, and sterilized. It is laid over the abdomen, and thus prevents contact of protruding organs with the skin. A full bladder, which is often an interference, may be emptied by direct pressure.

The pelvic cavity is opened by extending the skin incision to

the hinder border of the symphysis pubis (passing to one side of the penis in the male). The symphysis is cut by means of a strong knife or small hand-saw. One must avoid injuring the dorsal veins of the penis in the male and the plexus of the veins from the clitoris in the female, as hemorrhage therefrom is somewhat difficult to control. A small block of wood is placed under the sacrum, and the iliac bones forcibly turned outward so as to produce a fracture-dislocation at the sacro-iliac synchondroses. Restitution of continuity of these parts is accomplished by wiring the bones at the symphysis according to the methods employed in bone suturing.

When it is desired to close the abdominal wall a careful inspection must be made to ascertain whether any blood clots or other putrescible material or sponges remain in the cavity. These are to be removed, as their presence is conducive to peritonitis.

No antiseptic solution for cleansing purposes should ever be allowed to come in contact with the delicate peritoneum. Sterilized water is the only permissible liquid.

If the omentum has been misplaced it should be returned as nearly as possible to its original position. Any rents in this organ should be sutured, otherwise there is risk of a loop of bowel passing through the same, when the condition would be ripe for strangulation. Though I have never known strangulation to result from such conditions, once, while performing a necropsy, I found a coil of small intestine protruding through a rent I had made some two weeks previously in the course of a resection experiment.

In intestinal operations the omentum is sometimes soiled, in which case it may be advisable to remove the contaminated portion, but it is very important to securely ligate any bleeding vessels. In one of Senn's experimental cases it was deemed advisable to remove a portion of the omentum. The animal died the next day owing to hemorrhage of the omentum by slipping or loosening of a catgut ligature. Senn advises against ligaturing of the omentum or mesentery *en masse*, but each individual vessel should be searched for and secured separately with aseptic silk. One reason for this is that tissues often shrink after operation, whereby ligatures become loosened, so that it is dangerous to include a large area in a single ligature. Parks has also pointed out that the stumps of

ligated omentum tend to give rise to trouble through mortification of the occluded end. But, unless the conditions actually demand its removal, *it is bad surgery to excise this organ*. For the omentum performs an important function in the healing of abdominal and visceral wounds. It plays the part of an operculum, invariably becoming adherent to the internal face of the wound or to wounded surfaces of organs. In certain cases of hernia where its reduction would present considerable difficulty it may be removed with advantage.

Because of this protective capacity of the omentum, which is in reality a fold of peritoneum, it is quite unnecessary to stitch the parietal peritoneum.

In certain cases provision must be made for drainage. I have reference to conditions threatening to give rise to peritonitis. Wherever perforation of the bowel or infected uterus is on the verge of taking place, or has taken place, or microbic invasion has already occurred, the necessity for drainage becomes imperative. The method is simple, and requires only the insertion of a strip of sterile gauze in the course of the wound, one extremity being placed within the peritoneal cavity, the other being allowed to protrude through the skin. This should be left in place some five or six days.

In bringing the edges of the muscular wound into contiguity some operators apply independent sets of sutures to each of the divided coats. Others use but one set of sutures to include all the coats. In the median position there is but one small muscular coat to unite, though the aponeuroses of the others should be included. Much of the strength of the abdominal wall lies in the fascia in front of the recti muscles. When interrupted sutures are used no stitch should be tied until all are inserted, the curved needle being employed, and then tying is to be commenced at each commissure and gradually completed toward the center. When the opening has been made directly through the linea alba, La Torre advises that the aponeurotic tissue be removed as far as the muscular substance of the recti muscles, owing to the yielding tendency displayed by cicatrices of the former class of tissue.

When the epigastric artery and veins have been tied, the ligatures are very apt to become displaced or slip while the sutures are being applied to the wall. This accident may escape the operator's

notice, and a fatal hemorrhage result. Znamensky lost a case in this manner. Wherefore, careful attention should be paid to this matter.

I consider the best way to suture the muscular wall is to employ the continuous suture of silk and allow both ends to protrude through either extremity of the wound in the skin, along with the ends of the buried skin suture. At the end of seven or eight days the stitches may be removed by pulling sharply on one of the protruding ends with forceps. Permanent sutures, *i. e.*, sutures which are desired to remain permanently in the tissues, are capable of giving rise to further trouble, hence it is always advisable to employ temporary ones.

Divided muscle unites very readily by first intention, *i. e.*, by adhesion of the cut edges through organization of inflammatory serum by fibrin, provided the edges are brought into accurate approximation by sutures, and no suppurative process takes place in the subcutaneous connective tissue to hinder. If reunion of the divided muscle takes place with a minimum formation of connective tissue, the strength of the wall is little impaired, and the chances of a resultant hernia are remote.

The importance of securing accurate approximation of all divided subcutaneous tissue cannot be overestimated. The formation of spaces must be guarded against as much as possible, for, as has already been pointed out, such spaces, if infected, form suitable foci for suppuration. The reason why pus is so apt to form in males is owing to the proximity of the penial mucosa, which is so commonly the seat of catarrhal disorder, and the ease with which bacteria are carried thence by the tongue of the animal or by the surgeon during the course of an operation. The wound made when the penis is dislocated in order to reach the median line is particularly prone to suppurate. The connective tissue in this locality is deep, and when divided tends to form quite a cavity under the sutured skin. Therefore, it is always a wise precaution to draw the divided subcutis together with a few sutures whenever any gaping is evident. For the skin by far the best suture is the subcuticular, insuring, as it does, the utmost protection from infection from without. Any of the non-absorbable material may be used, as it is easily removed, but silk is to be preferred.

The wound should be examined closely for the succeeding day

or two for signs of suppuration, and if such be discovered it must be promptly opened and the matter evacuated. A subcutaneous abscess without drainage is always dangerous. Indeed, fatal terminations have been recorded where such seemed to have been the sole cause of death either through septicemia or pyemia. Peterson lost two cases in this manner, eight and thirteen days after the operation, respectively. Froehner says they are productive of septic endocarditis. Where there is no infectious disease of the teeth, or no discharging wound or disease process present, whereby infection of highly virulent microorganisms could be transmitted by the tongue of the animal, anything in the nature of a protective bandage is best dispensed with, particularly when the subcuticular suture is employed. As a rule, a dog soon learns to work its muzzle in under a bandage to lick the wound. But, in the excepted instances noted, it is advisable to protect the wound as much as possible with gauze and linen bandages and a plentiful supply of antiseptic powder.

An animal that has been subjected to laparotomy should be restrained from taking active exercise for a few days, so that no risk be run of the sutures tearing out from some sudden movement.

Occasionally, if non-absorbable sutures have been inserted in the muscular wall, they fail to become encapsulated, and a sinus is established long after apparent healing of the skin has taken place. In such cases a director must be passed into the extremity of the tract, and by means of a curved bistoury sufficient of the parts laid open again to permit of the offending thread being extracted.

As has already been stated, purulent peritonitis occurring as a result of intestinal perforation owing to imperfect suturing in secondary operations, or from the presence of putrescible material, or other causes, is an occasional sequel. If from symptoms of collapse or local manifestations such condition can be diagnosed, no time must be lost in reopening the cavity to establish drainage, either in the same position or a new one. Internal lesions must be attended to and the cavity irrigated with moderately hot water.

Kummer related an instance of a dog tearing out the abdominal sutures three weeks after operation, and succumbing as a result thereof in thirty-six hours, and Moeller recorded a similar occurrence. Caution must be observed in the feeding of an animal

subsequent to this operation. Hobday found that a hearty meal of solids is apt to induce violent peristalsis after the bowel has been at rest for a longer or shorter period, and may cause tearing out of the sutures and protrusion of the intestines through the abdominal wound. For similar reasons vomiting must be guarded against.

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The Peritoneum, Mesentery, and Omentum

The Omentum and Mesentery being but duplicatures of the Peritoneum will be considered together with the latter.

TRAUMATIC LESIONS.

Wounds of the peritoneum occur as a complication of penetrating wounds of the abdominal wall. So long as such lesions do not bring about the presence of putrescible material they usually terminate favorably, repair by fibrinoplastic formation quickly following.

Treatment. In general, uncomplicated peritoneal wounds should be left to themselves, the only indication for surgical interference being the presence of putrescible material, when removal of the latter and irrigation should be practised. It would seem as if Nature had destined the Omentum to play the part of a reparative or protective operculum, for this organ invariably becomes adherent to the site of peritoneal wounds.

Mesenteric and Omental wounds should always be sutured as they predispose to strangulation by passage of a loop of bowel through them. But omentum and mesentery should never be ligated *en masse*, but each individual vessel should be searched for and sutured separately, because tissues often shrink after operation

whereby ligatures become loosened, and because the stumps tend to give rise to trouble through mortification.

PERITONITIS.

It will be remembered that the peritoneum is a large lymph sac normally possessed of a remarkable absorptive capacity. Provided this property remains unimpaired it is rendered but moderately susceptible to the action of pathogenic microorganisms. The experiments of Wegner and Grawitz have shown that considerable numbers of the ordinary forms of pyogenic microbes may be introduced into the peritoneal cavity without any particular effect on the animal, provided the absorptive power of the peritoneum is not impaired. Reichel found that peritonitis developed only when the quantity of putrescible material exceeded that amount which could be eliminated within a limited time. Waterhouse injected 6 cc. of cultures of staphylococcus aureus, streptococcus, and intestinal bacteria, respectively, and found the animals survived. He then tried to produce the same conditions which sometimes exist after operations by introducing 8 cc. of urine and small quantities of blood with the cultures, and still the animals lived. But the presence of considerable quantities of putrescible material, such as blood clots 3 cc. in size when the cultures were introduced, was followed by death in twenty-four hours. Cats suffering from ascites quickly died from peritonitis, owing to diminished absorptive activity of the peritoneum and the presence of a favorable culture medium. Halsted introduced pieces of sterile potato, and found they became encapsulated without producing any disturbance, but when infected with pyogenic organisms invariably caused peritonitis. Welch made similar observations, and found further that an infected wound readily and uniformly suppurated when it contained masses of tissue strangulated by ligature. He made a large number of experiments by ligating portions of omentum and then injecting cultures of staphylococcus aureus into the peritoneal cavity. In most cases general peritonitis developed, in some cases localized peritonitis and in others no peritonitis followed the inoculation.

The conditions which impair the refractory power of the peritoneum are: General systemic conditions producing a lowering of vitality, and presence of putrescible material in quantity in excess

of a certain amount which can be eliminated within a limited period. The actual cause of the disease is always a septic infection. It is customary to speak of a plastic type of peritonitis but this is purely a regenerative process produced by aseptic causes, such as traumatism or the passage of an aseptic fetus from the uterus (Blanc). It attends every healing of aseptic wounds. Certain cysticeri also provoke inflammatory secretions, but this is very rare. Pathogenic microbes gain access to the peritoneum through penetrating abdominal wounds, including septic surgical wounds, perforation of any part of the gastro-intestinal tract, the spontaneous opening of an abscess into the cavity, the perforation of the uterine wall in cases of pyometra, by migration from contiguous tissues in septic inflammation of the latter or following a sudden lowering of vitality as may take place when a chill is sustained, and even by localization of circulating bacteria as occurs in tuberculosis.

The disease may be acute or chronic, circumscribed or diffuse. Contrasted with the other great serous sac of the body, the pleura, the peritoneum offers opportunity for localization of infection by reason of the coils of viscera forming pockets and recesses wherein it may be and often is confined. The prognosis of the acute diffuse form is always grave.

Symptoms and Diagnosis. In the acute form the disease is ushered in by depression, coldness of the extremities, rapid pulse, and tenderness of the abdomen to palpation. In the early stages the temperature is elevated but later becomes subnormal. Soon retching or vomiting appear and death takes place by toxemia. In some cases the symptoms closely resemble those of intestinal obstruction, but the distinguishing feature of the latter diseases is the stercoraecous vomiting. The circumscribed form is often unrecognizable on account of the absence of any indicative symptoms.

Treatment. As this disease is caused by pyogenic microbes the early removal of pathogenic foci which threaten to rupture into the cavity is indicated. If septic material is already present or the conditions are such that accumulation of putrescible material is likely to ensue the cavity must be opened, flushed with warm sterilized water, and free drainage established by means of folds or strands of aseptic gauze introduced well within the cavity and the dependent extremity carried outside the skin wound. These should be left in place some four or five days. At the same time efforts must be di-

rected towards keeping up the heart's action, and encouraging the elimination of morbid matter through the excretory organs.

ASCITES.

This is a trouble of purely mechanical nature, the result of impaired circulation. It must be remembered that there are two circulatory systems in connection with the abdominal cavity—the systemic and the portal, and that anything which arrests the circulation in either of these is liable to lead to ascites. The most frequent cause would seem to be cardiac lesions, producing altered relationship between arterial and venous blood pressure and blood flow. There then follow venous stagnation, capillary starvation and distension, and transudation of certain of the fluid constituents of the blood. Cadiot witnessed thirty-seven cases in less than three years and based thereon statistics of the relative frequency of occurrence of the various causes of the disease. Of twenty-eight cases, ten of the animals were afflicted with cardiac disease (pericarditis-7, mitral lesions-2, tricuspid lesions-1). The next most frequent factor was tuberculosis of the liver, omentum, or mesentery, eight of the animals being thus affected. Pleuritis was responsible for four of the cases, malignant tumor of the liver and lungs two, hepatic cirrhosis without cardiac lesion three, and carcinoma of the liver one. Of the remainder of the animals, five suffered primary ascites proceeding from chronic peritonitis, and in six which were seen but once, the causative disease was not definitely diagnosed. Chronic renal diseases and compression or obliteration of the portal vein by neoplasms may also cause ascites.

The amount of accumulated fluid in ascites may be very considerable, sometimes amounting almost to the actual body-weight of the animal. Hobday removed five and one-half gallons from a Mastiff by canula. It may be clear or yellowish and opalescent, and sometimes contains white and red cells and endothelium. It rarely coagulates. It is often of a pinkish tint when malignant neoplasm is the causative factor, owing to rupture of vessels on the surface of the tumor. A remarkable condition known as chylous ascites may result from traumatic rupture of a lymphatic trunk whereby the cavity becomes filled with a thick opalescent or milky fluid rich in proteids and fine fatty globules with a tendency to coagulate.

Symptoms and Diagnosis. Ascites is recognized by the gradual enlargement of the abdomen together with a sinking in of the flank and the acquirement of a pronounced concavity by the vertebral column. A wave or fluctuation of the contained fluid may be perceived by placing the hand on one side of the abdominal wall and tapping the side opposite. Percussion gives rise to a tympanitic sound superiorly where the intestines are floating, and a dull one inferiorly. In very chronic cases there may be edematous swellings of the abdominal wall, prepuce, and extremities. It is important to differentiate from hydro- and pyometra. In these latter conditions the outlines of the bicornate uterus can generally be made out, percussion always calls forth a dull sound and fluctuation is imperceptible. Differential diagnosis from such condition as chyle-cyst is extremely difficult, but this form occurs with suddenness. Ascites is occasionally confounded with other conditions. It is distinguished from the enlargement of gestation by palpation, and from obesity by palpation and negative results attending aspiration.

Differential diagnosis between the various causative factors is comparatively easy in some cases, while in others it is almost an impossibility. There is little difficulty in diagnosing pericarditis, pleuritis, and valvular lesions, by auscultation, but when the condition is the result of primary inflammatory changes, or secondary to lesions of the abdominal cavity, the fluid must be first drawn off to make palpation of value. If much emaciation or cachexia is present, malignant tumor or tuberculosis may be suspected. To differentiate between the two latter diseases, tuberculin should be employed.

The prognosis must be guided by the causative factors present. Only when the condition is idiopathic of simple peritonitis or is dependent on the simple forms of hydrothorax or hydropericardium, or compression of the portal vein by benign neoplasms, may any permanent amelioration be expected by eradication of the primary cause. With these few exceptions, treatment can give but temporary relief.

Treatment. Diuretics and saline purgatives are employed to lessen the amount of fluid. A case is on record of apparent recovery by the daily internal administration of pilocarpine hydrochlorate. Cadiot and Breton favor the employment of this drug. Paracentesis is a more certain and rapid method and is employed when the distension and dyspnea are very considerable, but with the exceptions

noted above the cavity fills up again in three or four days' time. When the condition is secondary to pericarditis or pleuritis the pericardium or thorax must also be tapped.

Numerous cases by Morrison and others are on record in which ascites due to portal obstruction has been overcome by ligaturing the omentum to the chest wall, whereby anastomoses between the vessels are set up and the blood finds its way to the heart without passing through the liver; but this does not succeed in every case.

PARACENTESIS.

For this operation a relatively large trocar and canula should be employed. They should be previously sterilized and the skin over the area of puncture disinfected. This is important because the introduction of pyogenic microbes into the peritoneal cavity when its absorptive capacity is inhibited may be followed by rapid infection, the intra-abdominal fluid acting as a highly favorable culture medium. The instrument is introduced at the most dependent part of the abdomen, the animal being made to assume the standing position, and the trocar immediately withdrawn. There is no danger of wounding the intestine as the latter is floating on the surface of the fluid. Only part of the fluid should be removed and that gradually as sudden and total removal has been followed by syncope. Interruption of the flow indicates obstruction of the canula by false membranes or coagula and is corrected by again passing the trocar. When the condition is secondary to pericarditis or pleuritis, the pericardium or pleura must also be tapped. (See Pericarditis and Pleuritis).

FOREIGN BODIES.

Three classes of foreign bodies may gain access to the peritoneal cavity. They consist of inanimate objects, verminous parasites, and fetuses.

Inanimate Objects. Comprised in this class are: missiles which have perforated the abdominal wall, bodies which have traversed part of the alimentary canal and finally perforated the gastric or intestinal walls, and surgical requisites such as sponges, which have been inadvertently left in the cavity after being introduced during the course of operations. Their presence is not neces-

sarily productive of ill-effect. There are many cases on record of the passage of such bodies as needles and skewers from the stomach and intestines to the surface of the body without inducing any untoward symptoms, and it is well known that aseptic absorbable bodies are removed by phagocytic action within comparatively short time. There is always risk, however, that their exit from infectious centers may establish tracts by which pathogenic microbes may invade the peritoneum. Moreover, they may provoke epileptiform symptoms by reflex irritation of nerves. (See The Stomach and the Intestines).

Symptoms and Diagnosis. When the passage of foreign bodies is attended with infectious processes the symptoms are those of peritonitis. There is often a history of the previous swallowing of a body. As already stated, epileptiform seizures may attend the presence of non-absorbable bodies unaccompanied with infective processes. An explorative celiotomy may be necessary to establish a diagnosis.

Treatment. Inanimate objects of all kinds should be removed by celiotomy, as by remaining in the abdominal cavity they are always potent pathogenic factors. Tracts by which they have entered must be sealed by suturing, and if peritonitis is present the cavity must be irrigated and free drainage established. Cases have been recorded which have been successfully treated by operative measures. (See The Stomach).

Vermineous Parasites. The parasites which may enter the peritoneal cavity by perforating tract are teniae, ascarides, and the giant eustrongyle. Cysticerci and pentastomes have also been found present but their mode of ingress is undetermined. Instances of perforation of the intestinal wall by teniae and ascarides have been recorded by Cadéac, Lahogue, Dell, Morey, and others. A case was brought to my notice where a multitude of round-worms had ascended the bile-ducts and emerged through the liver tissue. These parasites generally produce sub-acute peritonitis or rabiform symptoms. The giant eustrongyle enters by perforating tract by way of the kidney. It is also productive of rabiform symptoms (Lisi).

Symptoms and Diagnosis. The symptoms being those of peritonitis or nervous seizures, are naturally obscure, and a pre-mortem diagnosis could only be established by explorative celiotomy.

Treatment. The indications are to remove the parasites, close



No. 37. Extra-uterine gestation showing two pseudo-uteri and numerous cysts.

perforating tracts, irrigate the cavity, and establish drainage; in fact, treat such a case exactly as if it were peritonitis.

Fetuses. Fetuses may find their way into the cavity through a rent in the wall of the uterus at any stage of their development, but most commonly at the parturition period through operative bungling, or they may pass the whole period of their existence there by reason of the fecundated ova escaping from the ovary at the fimbriated extremity of the Fallopian tube. True ectopic gestation due to implantation of the ovum in the oviduct, which is common in the human female and which is frequently associated with rupture of the tube when the embryo has grown to a certain stage would seem to be an extremely rare condition if the absence of recorded cases is to be taken as indicative.

When a fetus falls into the cavity during parturition it may or may not carry pathogenic microbes with it, according to whether the uterus is infected or not. If it is aseptic it macerates and is absorbed, though the hard parts take considerably longer to disappear than the soft. This process may have cachectic and even lethal effect by autointoxication. Blanc recorded a case which proved fatal within a month. A septic fetus produces peritonitis.

In extra-uterine gestation a sac or pseudo-uterus develops around the fetus by formation of fibrous tissue. Such sacs have been found attached to various portions of the peritoneum such as the neighborhood of the ovaries, the omentum, and broad ligament. The fetus may continue to develop to full term and then decompose and develop into a suppurative focus, probably by becoming a *locus minore resistentiae* to the action of microorganisms circulating in the blood, but it usually macerates and is partially absorbed. The internal surface of the sac sometimes undergoes a sort of calcification. An animal may conceive in the uterus while having a macerated skeleton of a fetus in the peritoneal cavity. Undoubted cases have been recorded by Vernaux and myself.

Symptoms and Diagnosis. As in the case of perforating inanimate objects, so with fetuses, when they are accompanied by pathogenic microorganisms in their passage from the uterus, the symptoms are those of peritonitis. At the time of parturition the lesion is sometimes discoverable by digital palpation. In Blanc's case referred to above, a fibrinoplastic peritonitis had been provoked which had caused an enlarged fluctuating abdomen.

In extrauterine gestation there may be entire absence of any indicative symptoms, but on the other hand rabiform symptoms may be induced by reflex nervous irritation. In these cases the fetus can generally be palpated as a firm tumor-like body.

Treatment. In all cases of this nature the fetus together with any adventitious tissues should be removed. When rupture of the uterus has occurred the operation should be undertaken as speedily as possible.

NEOPLASMS.

Neoplasms occasionally develop on the peritoneum as primary growths but they are more often secondary. The primary manifestations are both innocent and malignant types. Of the former, fibroma of the gastro-colic omentum and chyle-cyst of the omentum have been observed, and emphysematous cysts of the mesentery, cysts containing pentastomes; and hydatids of plerocercoides and echinococci have been recorded as rare occurrences. Of the latter, tubercular growths are comparatively common. Sarcomata of the omentum, mesentery, and of the peritoneum have also been described, while a neoplasm growing on the mesentery, the histologic identity of which was not determined and which was surrounded by secondary growths with metastases in the liver was witnessed by Born.

Secondary neoplasms are of the malignant type. Miliary carcinoma has been observed by Cadéac in an animal from which he had previously removed a mammary tumor. Secondary chondroma of the peritoneum occurring as a metastasis from a tumor of the same nature in the mammary gland has been described by Boutelle. Metastatic venereal granulomata occur occasionally, and the mesenteric glands are often involved in cases of lympho-sarcoma.

Symptoms and Diagnosis. Innocent primary tumors if of sufficient dimensions produce abdominal enlargement. The parasitic hydatids usually provoke inflammatory secretion which may cause an ascitic appearance. Growths of both innocent and malignant types generally give rise to cachexia. The diagnosis of all forms of tumor is aided by palpation.

Treatment. Innocent growths are eradicable by opening the peritoneal cavity and removing them by appropriate surgical methods. Malignant growths are best left alone.

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CHAPTER VI

The Abdomen—Continued

The Stomach

EXAMINATION.

No satisfactory examination of the stomach can be made by palpation owing to the remote position of the cardiac and pyloric extremities, though it is sometimes possible to distinguish neoplastic changes in emaciated animals. Pressure over the region of the organ is productive of pain in some conditions. The character of the vomitus is of considerable assistance in the establishment of diagnosis, and must always be taken into consideration, while the Roentgen rays can always be employed for the detection of the presence of foreign bodies.

TRAUMATIC LESIONS.

Wounds caused by the passage of projectiles and sharp or pointed implements are of occasional occurrence. Perforation of the wall is always dangerous owing to escape of infective matter into the peritoneal cavity and resultant peritonitis. In general, it may be said that injuries of the stomach are far more serious than those of the intestine, bladder, or uterus.

Symptoms and Diagnosis. Hematemesis usually takes place, and there may be escape of contents of the organ through the external wound if the latter is large enough. Any decided penetrating wound of the abdominal wall should be explored by celiotomy.

Treatment. Inversion of the edges of the wound and gastrorraphy are indicated. The peritoneum, if soiled, must also be cleaned or irrigated with sterilized water.

PEPTIC ULCER.

Ulceration of the mucosa of the stomach in conjunction with

that of the intestine is fairly common as a result of specific infections, the ingestion of foreign bodies and corrosive substances, and the presence of spiroptera, but true peptic ulcer is a lesion of great rarity. It is the latter which may be dealt with surgically. Nothing is known with certainty as to its etiology, though it is probable that some local defect such as an embolus may give rise to an ulcer through the action of excessive hydrochloric acid secretion. Mathes, by daily administration of hydrochloric acid, succeeded in producing a peptic ulcer in a dog in which an artificial defect in the mucosa had previously been made. Other experiments have shown that contusions through the abdominal wall are possible factors. A peptic ulcer always has a sharp contour as if it had been cut out with a knife or punch, because the dead and necrosed part has been digested out by the gastric juice, which has no effect upon the living mucosa. If an artery is involved death may occur from hemorrhage (Johns). An always possible termination is perforation into the peritoneal cavity, but this does not necessarily take place, as the area involved may become adherent to the neighboring viscera through formation of inflammatory lymph.

Symptoms and Diagnosis. The most prominent symptom is hematemesis, though the lesion may exist and terminate in perforation without producing any definite diagnostic symptom prior to dissolution. Walley conducted a necropsy, at which the presence of a perforated ulcer of this nature was demonstrated. Symptoms of sudden collapse succeeding a history of chronic hematemesis are suspicious of perforation. Explorative celiotomy is then indicated. A gastric lesion which does not respond to medical treatment after a reasonable length of time is also an indication for explorative celiotomy. The location of an ulcer cannot always be determined from the serous side of the organ, and it may be necessary to make an initial explorative gastrotomy, but there is usually some thickening of the wall and discoloration of the serosa at the seat of lesion.

Treatment. This consists in resecting the diseased portion of the wall (Partial Gastrectomy) and suturing the cut edges.

TORSION.

This lesion is observed exclusively in the dog, probably on

account of the great mobility of its stomach. It occurs when the stomach is empty and is characterized by rotation from right to left, the esophageal and duodenal orifices being completely occluded. The vessels are compressed, stasis of the circulation takes place, and internal hemorrhage follows. Kitt has witnessed two instances of this lesion at the necropsy of one of which I had the good fortune to be present, and Cadéac states that he has seen three cases.

Symptoms and Diagnosis. The organ becomes enormously distended by accumulation of gas, and this causes asphyxia within a few hours by compression of the diaphragm. This lesion need not be confounded with any other internal trouble, excepting perhaps hernia of the diaphragm, Caparini having seen such a case, accompanied by enormous gaseous distension of the stomach, because extreme meteorism is peculiar to either of these conditions, and also because there is entire absence of vomiting.

Treatment. The asphyxia must be promptly relieved by paracentesis, the gas being allowed to escape gradually so that no evil result may follow from sudden release of the pressure. A right celiotomy must then be quickly performed in order to return the organ to its normal position and re-establish its circulation.

FOREIGN BODIES.

There is scarcely any limit, excepting size, to the shape, character, and consistence of articles which the dog will swallow. They are mostly swallowed together with the food or by subjects with abnormal appetites suffering from gastric disorders, or accidentally in play. Among recorded articles may be mentioned: fragments of bone, wooden and metallic skewers, stones, play-balls, cork-stoppers, tops, coins, rope, needles, marbles, and fabrics. Hair when swallowed is apt to form into balls. Bruckmueller observed a prevalence of the latter condition in dogs kept in barber-shops. This authority also observed that pigeons when swallowed whole acted as foreign bodies, and might cause death.

Such bodies are often vomited, but may remain in the stomach or pass on to the intestine. It is noteworthy that foreign bodies may be retained in the stomach for considerable periods without materially affecting the animal's health. Cadiot and Ries saw a dog which had swallowed two peg-tops. During the following eleven months there was no manifestation of sickness. Finally,

one of the tops reached the duodenum and caused the animal's death, the other top being found free in the stomach at the necropsy. Nichoux recorded an instance of a dog swallowing two coins, which remained in the stomach for twelve years. On one occasion I gave an emetic to a dog suffering from chronic gastric trouble and freed the animal of a large flint stone, which the owner averred had been swallowed six months previously. Sometimes the pylorus becomes blocked. Greaves, in conducting a necropsy, found a mass of small angular bones completely blocking the passage, and Hulme and Morrison found a large piece of liver in one animal, and a large tightly rolled ball of brown paper in another, obstructing it in a similar way.

Sharp bodies may perforate the wall. Most commonly needles and skewers work their way into the abdominal cavity and lodge in some other organ. Petit found a needle embedded in the liver, and cites three other similar cases. He also found a needle embedded in the spleen of another animal. Sometimes such bodies ultimately reach the surface of the body, not, however, without inducing the formation of an abscess or fistulous tract. Straub incised an enlargement, occupying nearly the whole surface of the left abdominal wall, and removed some gangrenous tissue in which was lodged a small piece of wire. Viramond mentions the passage of a skewer some seven inches in length, and its exit in the region of the xiphoid cartilage. Labat found a skewer free in the peritoneal cavity, but without trace of perforation. Norrit treated a dog which had swallowed a fork. The animal showed some slight indisposition, but apparently recovered. Celiotomy was performed and the pronged end was found free in the abdominal cavity and the handle encapsulated at the origin of the mesocolon. Recovery followed in three weeks. Hamoir incised an abscess in the right costal region. A long hat pin was found present, the head of which was buried within the peritoneal cavity, which rendered its extraction impossible. Celiotomy was performed in the immediate neighborhood, when the head was found to be within the stomach. It was pulled out, and the wound in the stomach wall closed. Recovery ensued. Lignières held a necropsy, at which a fine piece of wire one and one half inches in length was discovered embedded in the omentum. For some time before death the animal had exhibited epileptiform convulsions. Lignières thought the latter were

provoked by indigestion of food and drink, which, distending the stomach, caused pressure on the body and consequent irritation of the ramifications of the pneumogastric and celiac plexus. Labat opened the abdomen of a Dane twenty-four hours after it had swallowed a kidney together with a skewer eleven inches long, which was sticking in it. The skewer was found partly free in the peritoneal cavity. Recovery ensued.

Symptoms and Diagnosis. In some cases there is complete absence of any symptoms, but usually there is intense thirst, anorexia and persistent vomiting, together with hematemesis when erosion of the mucosa exists. During movements sharp bodies may prick the wall, causing sudden cries of pain. The animal prostrates itself, or walks with arched back. On other occasions there are fits of coughing, colic, restlessness, epileptiform, and even rabiform symptoms. In this country I have found the practice of feeding peanuts a fruitful source of violent seizure. Descôtes witnessed rabiform symptoms in a case of impaction by raw carrots. Pressure over the gastric region is usually productive of pain. When any doubt exists, the Roentgen rays should be employed.

Treatment. Emetics, such as apomorphia, hypodermically administered, should first be tried when the character of the body is known for a certainty. Emesis is contraindicated when sharp or pointed bodies are known to be the cause of the trouble. Delivery should then be accomplished by the operation of gastrotomy. Venneholt delivered the fibula of a horse from the stomach of a large dog by this operation, and Porcher and Morey removed a spoon, only the handle of which had reached the stomach, the other extremity being still in the esophagus. At the Munich School in 1877 a leaden ball measuring some two inches in diameter and weighing some nine ounces was successfully removed.

NEOPLASMS.

Neoplasms of the stomach occur with great rarity. Carcinoma of the pylorus has been recorded, as has multiple Sarcoma of the organ. Kitt refers to verrucose Adenoma. Vogel has observed fatal termination from hemorrhage. Non-malignant cicatricial Stricture occasionally results from pyloric ulcer or by wounding induced by some foreign body.

Symptoms and Diagnosis. Chronic vomiting, accompanied by

progressive emaciation, are prominent symptoms. Pyloric neoplasms may be palpated in the later stages when the animal is reduced to mere skin and bones through inanition. The stomach is usually much dilated. The symptoms are very similar to constriction-obstruction of the intestine, and explorative celiotomy may be necessary to enable the practitioner to arrive at a correct diagnosis.

Treatment. Non-malignant strictures are amenable to treatment, but malignant neoplasms are best left alone. The simplest way to remedy occlusion by stricture and render the tract again permeable is by the operation of gastro-enterostomy.

Surgery of the Stomach

It has been repeatedly demonstrated that it is possible to successfully perform severe operations on the stomach, even to the extent of removing the entire organ. In 1810 Merrem attempted resection of the pylorus on three dogs which, however, died. In 1876 the operation was again attempted by Gussenbauer and Von Winiwarter. Their experiments proved that the operation was not necessarily dangerous, but they lost most of their animals from peritonitis. Levy resected the pylorus, using the Murphy button, and experienced a mortality of fifty per cent. It was then found that the operation of resection of the pylorus was more complicated and took much longer than that of Gastroenterostomy, and that subsequent perforation was more common owing to insufficiency of the sutures.

Kaiser, Czerny, Carvallo and Pachon, Monari and Filipi, Fisher and Frouin tried total ablation of the organ, but they all left a portion of the cardia, as it was very difficult to effect reunion of the esophagus and duodenum. A small sac usually developed from the remnant and fulfilled gastric functions. In one of Czerny's cases the animal survived the operation five years. In one of Monari's the animal lost weight steadily. A great difficulty lay in the fact that traction on the esophagus led to rupture of the adhesions between esophagus and diaphragm, which gave rise to pneumothorax.

On the other hand, physiologists and clinical operations have shown that simple incision or Gastrotomy with Gastrorrhaphy is by no means a very serious undertaking.

GASTROTOMY.

This operation is performed for the delivery of foreign bodies from the interior of the organ. It is also sometimes necessary in order to extract bodies which have found lodgment in the lower third or thoracic portion of the esophagus.

To reach the organ, open the abdomen in the median line immediately posterior to the xiphoid appendage, and extend the incision as far as the umbilicus. Grasp the organ and draw it out as far as possible. When empty, it is separated from the abdominal wall by parts of the liver and small intestine, and is covered with omentum. When distended, it comes in contact with the abdominal wall. Pack it securely with sponges and cloths round the part to be incised to prevent escape of its contents into the peritoneal cavity. If the animal has been fed a short time previously the walls are seen to be intensely injected, but if it has fasted they are pale. Before making the incision insert a couple of "securing" stitches on either side of the contemplated opening, by which the organ may be easily retained outside the cavity. These stitches must not penetrate the mucosa. The walls are thick and vascular, but the larger vessels can be avoided by making the opening midway between the greater and lesser curvature, and at right angles to the long axis. The organ may be opened with a sharp pointed curved bistoury, or it may be punctured with this instrument first and an enlargement made with scissors. When the muscular coat is divided it contracts and becomes considerably inverted, and this causes projection of the mucosa. The latter bleeds very easily on slight irritation.

The delivery of sharp or hard bodies must be accomplished with very careful manipulation. Hobday recorded a death from rupture of the posterior aorta, occurring during removal of a hard piece of gristle from the lower part of the esophagus by way of the stomach.

The margins of the opening are united by continuous suture, of catgut or silk, throughout all the coats. The wound is then inverted by bringing the serous borders into apposition with a second row of mattress or Lembert silk sutures, which must not penetrate the mucosa. Lastly, the "securing" stitches and cloths are removed and the organ allowed to slip back into the cavity.

Sutures and suturing of the wall of the alimentary canal will be found more fully described under Enterorrhaphy.

GASTRO-ENTEROSTOMY. GASTRO-ENTERAL ANASTOMOSIS

These terms are applied to the operation, by which an anastomotic opening is established between the stomach and intestines. Such operation is indicated whenever the onflow of the gastric contents is obstructed by structural changes of the pyloric or duodenal regions. The indications have their limitations, however, for in canine practice the operation should only be attempted in the presence of benign disease. The union should be effected between the stomach and jejunum, and care must be exercised that in establishing the union the peristaltic movements are in the same direction. Some sort of device is necessary to facilitate the operation, and either the Murphy button or my hair-pin method may be employed in the same manner as described under Entero-ental Anastomosis.

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The Intestines

EXAMINATION.

In the diagnosis of intestinal lesions palpation is of great aid. The animal should be in the erect position, the practitioner standing behind and compressing the abdomen between the fingers of both hands. In some cases it is necessary to make a direct ex-

amination by explorative celiotomy, while the Roentgen rays can be employed with advantage in the detection of the presence of foreign bodies.

TRAUMATIC LESIONS.

Wounds of the intestine occasionally occur from external violence. There are several instances on record where a fall from a great height, the kick of a horse, or a wheel passing over the abdomen, have resulted in rupture of internal organs, generally the liver or bladder, and while the bowel seldom suffers this lesion, I have seen rupture of mesenteric vessels occur from a run-over. Probably the commonest form of traumatic injury is wounding by projectiles or implements. The effect of perforating bullet wounds is always uncertain. Experimental research would seem to indicate that they are usually followed by serious results, though there can be no doubt that this must depend largely upon the caliber of the missile. Parkes intentionally wounded thirty-seven dogs by firing bullets of 22, 32, 38, and 44 caliber from Smith and Wesson revolvers into the abdomen at short range. Three succumbed immediately afterwards from the effects of profuse hemorrhage from main vessels. Twelve died inside of twenty-four hours either from severe primary or recurring hemorrhage. In these cases the bullet was of the size of 38 or 44 caliber. Two cases of the series were subjected to the expectant treatment. Both died, the first in one day, and the other in five days. Necropsies revealed extensive extravasation of contents of the bowel and septic peritonitis. Ten other cases died, living from three days to three weeks, mostly from peritonitis, while only nine cases recovered. As a result of these experiments Parkes reached the following conclusions: Hemorrhage following shot-wounds of the abdomen and intestines is often so severe that it cannot be safely controlled without abdominal section; it is also sufficient in amount to endanger life by secondary septic decomposition, which cannot be avoided in any other way than by the same treatment, and extravasations of contents of the bowel after shot injuries thereof are as certain as the existence of the wound.

In another series of experiments conducted by Chaput forty-six cases were treated by expectation, of which thirty-one died (68 per cent) and fifteen survived (32 per cent). Of the thirty-

one, three perished immediately from hemorrhage, and another died very soon from perforation of the bladder. Of the twenty-seven, eighteen succumbed in less than twenty hours. Of this number four died from peritoneal infection after severe hemorrhage, and the other fourteen from peritonitis without hemorrhage. Of the remainder, six died on the second or third day and three on the fourth. In most of the animals the perforations were numerous, there being in none of them fewer than six, and in one twenty-six. Chaput advocates immediate surgical intervention. When he operated within three-quarters of an hour after receipt of the injuries he saved one hundred per cent. Seven cases operated upon later than this terminated in four deaths and three recoveries.

McGraw shot four dogs through the abdomen with balls of 22 caliber and one drachm weight. All lived, and had apparently recovered on the twelfth day after the shooting, when they were killed. In one animal there was no trace whatever of the ball, either in the abdominal cavity or the skin and muscles. In another the ball had penetrated the spleen and cut four holes in the small and one in the large intestines. The omentum, which was wounded and injured, and intestines were bound together by adhesions. On separating the coils of the intestines, the wounds were found to have united, but a pouting projecting portion of the mucosa showed where the ball had passed through. The third animal had suffered perforation of the spleen and the small gut in several places. Many of the places had healed, as in the second animal, but in one part there remained two orifices lined by everted mucosa, which prevented discharge of the contents by adhesion to neighboring coils of intestine. In the fourth animal the spleen alone was injured. In all the spleen wounds had healed without suppuration. These experiments would indicate that bullet wounds of 22 caliber may be left to natural processes of repair with safety.

With regard to wounds produced by implements, it may be said that they are usually dangerous. Anything of the nature of a bayonet stab is certainly so, but Stockfleth has recorded a case of a dog being pierced transversely through the abdomen by a hay-fork, the animal recovering fully without any sign of suppuration having taken place.

Symptoms and Diagnosis. In perforating wounds of the abdomen it is very difficult to decide whether the intestine or any

other organ is involved or not. The appearance of the wounds has no diagnostic value, since there is no gaping of parts, owing to contractions of the abdominal muscles, and it is often impossible and in most cases inadvisable to use a probe. Systemic collapse from shock or hemorrhage is one of the principal symptoms of perforation.

Treatment. In all perforating abdominal wounds the cavity should be opened as soon as possible. There need be no hesitancy on the part of the practitioner, because the dog is remarkably tolerant of abdominal operations. Divided vessels must be ligated, rents in the bowel wall sutured, and blood and other putrescible material carefully removed, and the cavity thoroughly irrigated with warm sterilized water or the physiologic salt solution. The search for rents and hemorrhagic foci must be systematic, every inch of the bowel being passed through the operator's hands and closely examined. The remoter glandular organs must also be inspected, and to accomplish this with facility it is necessary to make a fairly extensive incision in the abdominal wall.

INTESTINAL OBSTRUCTION.

Under this term it is convenient to consider all cases in which the onflow of the contents of the intestinal canal is obstructed. The minor degrees of constipation which are amenable to medication do not properly form part of a surgical consideration, and will not be discussed. Obstructions, using the term in a surgical sense, occurred in Froehner's clinic in about two per cent of all cases treated.

All forms of obstruction may be classified into three principal groups:

I. From **OBSTACLES**, obliteration of the canal by obstruction within its walls.

II. From **COMPRESSION**, obliteration of the canal taking place from pressure without.

III. From **CONSTRICION**, obstruction by causes developing in connection with the wall itself.

I. **OBSTACLES.** This is the most common of the three forms in canine practice, and may be subdivided into two groups: (a) Fecal Accumulation (Coprostasis), and (b) Foreign Bodies.

(a) Obstruction by Fecal Accumulation. (Coprostasis).

This is of a chronic type, and occurs principally in the rectum and colon, but may extend to the small intestine. This condition is commonly observed in old dogs of sedentary habits that have become subject to enfeebled contractility of the bowels and consequent infrequent movements, and from which evacuations have been regularly obtained by purgation. Dogs whose diet has consisted largely of bone or meat are frequently sufferers. Fragments of bone that have failed to become dissolved by the gastric acid, and have escaped into the intestinal canal, pass to the colon and rectum, where the velocity of the peristaltic waves is sluggish, particularly in old age, and there become favorable nuclei for further accretion (coprolith). In like manner, undigested fragments of meat may accumulate. Such matter, gradually increasing, stretches the wall past its power of contractility and paralysis of the bowel follows. Coprostasis may also result from certain affections of the nervous system, notably paraplegia, and from proctitis.

Beyond a catarrhal disorder, set up by irritation of the mass, there is rarely any inflammation present, the accumulation simply piling itself up before the dam, though it may lead to chronic troubles, such as proctitis, dilation, etc. The duration of this trouble may be of weeks. Skerritt recorded a case of fecal impaction in which the dog had not evacuated the bowels for a period of five months, and Zuill saw a dog in which suppression of defecation had lasted three months.

Symptoms and Diagnosis. The animal is dull and listless, seeks seclusion, and assumes a reclining posture most of the time. It rises with apparent effort, and moves with head and tail depressed. It usually makes futile attempts at defecation, the while giving vent to cries or groans. Perhaps some fluid matter is passed, which generally misleads the owner into a belief that diarrhea is present, an error which must not be shared by the practitioner. In reality, this is but the catarrhal discharge initiated by the presence of the accumulation. Food is entirely refused, but water is frequently swallowed. Emesis soon appears, and later becomes stercoraceous. Abdominal palpation reveals the presence of a hard cylindrical mass, of greater or less proportions. In one instance, in which I relieved a St. Bernard by enterotomy, the fecal concre-

ment had a diameter of very nearly five inches. Rectal obstruction is felt in the sacral region, that of the colon in the center, or on the floor, of the abdomen. Digital pressure over the parts sometimes calls forth expression of pain.

Treatment. It must be remembered that there are many degrees of constipation, which can be remedied medicinally. Vella estimated by experiment the time taken by ingesta in traversing the distance between the mouth and anus, and found it to be approximately forty-five hours. Hence, we may regard constipation as existing when defecation has not taken place within the period named. At this stage, withdrawal of constipating foodstuffs and proper medication supplemented with enemata, may abort a graver issue. Failing in this, an examination of the rectum should be made, by means of a metallic sound. The uterine sound used in human surgery answers the purpose admirably. The instrument can be inserted as far as the sigmoid flexure, and enables one to tell whether the obstruction is within reach by the anus or not. By sounding in this manner a pretty accurate idea of the location and consistence of the feces may be obtained, and the unpleasant digital process avoided. This procedure must be carried out with due care, as it is usually vigorously objected to on the part of the animal. The best way to avoid any accidental wounding of the internal organs is to huddle the animal securely and prevent undue movement of the hind parts by firmly grasping the root of the tail with one hand. When the obstruction is found to be within reach the rectal scoop is employed to disintegrate the mass piece by piece. In some cases the rectal speculum facilitates the operation. I use a scoop, the stem of which is hollowed to permit of a steady flow of water on the point of the mass being attacked. The extremity of the handle is shaped to receive the rubber tubing



No. 38. Rectal Douche-curette.

of a syringe, and the water escapes at the base of the bowl. The stem is made in two sizes, either of which is screwed into the handle as desired. By means of this contrivance the double operation of scooping and irrigation can be carried out at the same

time, and the mass may be more easily disintegrated and softened. The water should be injected by means of a bulb syringe, as a fountain syringe lacks the requisite force. It has been a matter of observation that if a considerable volume of water can be conducted beyond the obstructing mass the bowel will often become sufficiently distended and stimulated to produce evacuation without any further assistance. The instrument referred to being of good length and fulfilling the part of an irrigator may be employed to achieve this object. Rectal forceps are also useful.

In one instance where the impaction was in a Great Dane and I was experiencing considerable difficulty in effecting its removal with instruments, a small boy was employed to pass his hand, well-oiled, within the rectum and seize and withdraw the coproliths one at a time.

It is advisable to persevere with rectal clysters and purgatives administered *per orem* until vomiting absolutely precludes their employment, particularly when any progress at all of the impaction towards the rectum is noticeable. It is well-known that foreign bodies and coproliths may take weeks to travel but short distances. By daily removing the mass collected in the rectum with the forceps or scoop, the accumulation lying on the proximal side of the same has a chance to gradually work its way onwards, and this it generally does, although it may take several days to do so.

When impactions are beyond reach *per anum* there is small hope of affording relief without operative procedure of a major nature. The advent of pronounced vomiting is the chief diagnostic symptom warranting surgical interference by celiotomy. Thereafter purgatives should be strictly avoided, for further prolongation of temporising therapeutics is, as a rule, utterly useless. Nothing is retained by the animal's stomach, and its strength is rapidly impaired. It is a mistake to await stercoraceous vomiting, which is evidence that the impaction has already been of some duration, and that collapse is imminent.

After the abdominal cavity has been opened and the rectum reached, an attempt should first be made to force the mass along by determined but not too forcible manipulation, in order that it may be extracted through the anal orifice. The latter part of the operation should always be conducted by an assistant, so that the operator's hands may not become soiled. In this manner by persistent

effort it is often possible to push obstructions which are situated in the colon past flexures into the rectum. When the mass is too hard or of such enormous dimensions that this method of delivery is quite impracticable, nothing short of enterotomy offers any hope of success.

Administration of eserine in the presence of considerable tympanitis has led to rupture of the bowel.

(b) Obstruction by Foreign Bodies. This form of obstruction is generally of a sub-acute type and accompanied sooner or later with inflammatory changes in the wall, leading to gangrene and perforation. The duration of this trouble is never long. The animal may last for one or two weeks, to die from toxemia through absorption of the inflammatory products or of microorganisms themselves. The manner in which this takes place will be discussed under the next group.

It occurs mostly in the narrowest portion of the small intestine—the ileum. Any foreign body that has remained in the stomach for a longer or shorter period may ultimately find entrance into the bowel. The rapidity with which such objects may travel depends upon a variety of factors, chief of which is probably their character. Fibrous material would seem to be capable of very rapid passage. Delperier treated a case where a dish-cloth, which had been used to enwrap a hare, had been swallowed. On the third day a portion of the cloth appeared at the anus. This was seized, and the animal in pulling away, supplied the traction necessary to effect its complete withdrawal. Smooth and hard substances may remain for weeks, all the while slowly traveling in response to the peristaltic waves, and without other reactive effect than to induce some local ulceration. Senn introduced tubes of glass and other material into the lumen, a few inches above the ileo-cecal region, and found that it took thirty to forty days for these objects to pass *per anum*.

Among the articles that have from time to time been recorded as forming obstructions may be mentioned: pebbles, buttons, portions of bones, rubber-balls, coins, spinning tops, fruit-kernels, nuts, marbles, tacks, cork, and cork stoppers, and even infant's shoes; in fact almost every conceivable article. Cork is particularly dangerous, as what would otherwise pass safely through will swell by absorption of moisture in the canal. Mathis, how-

evér, saw a champagne cork passed. Compressed sponges are sometimes given by malicious persons. In other instances masses of leaves, straw, and grass have been found. Animals suffering from eczema tear at and consume their hair, with the occasional result that impacted hair masses form. Bruckmueller has remarked that dogs kept in barbers' shops are very apt to suffer from impacted hair masses. Siedamgrotzky removed a hair ball by enterotomy, and Gurlt found eighteen in another animal. Puppies sometimes swallow balls of yarn. These are apt to lodge in the pylorus or upper bowel, and gradually become unraveled, the free portion being carried the length of the bowel. When a threaded needle is swallowed it may lodge at any part, while the thread is carried along.

Symptoms and Diagnosis. Foreign bodies are productive of varied symptoms. A mobile body advancing by stages, is often the cause of violent colicky pains. Sometimes it produces nervous phenomena of a convulsive or rabiform nature. In some instances primary vomiting has been observed, but it is probable that this lasts only as long as the body remains in the stomach, or at the most in the upper bowel. Vomiting of this nature is to be distinguished from that induced by an impacted body, which does not occur for some hours later. All food is refused, and there may be expression of considerable pain, with arching of the back. Symptoms of icterus may also appear.

Characteristic of complete occlusion by an arrested body are the following symptoms:

The animal becomes dull and listless, seeks secluded and cool spots, and reclines most of the time. There is no apparent pain. Its appetite becomes capricious, and it finally refuses all food, and rapidly emaciates. Vomiting appears, becomes more frequent and violent, bile-stained, and lastly, stercoraceous. Hoare recorded a case where the animal retained liquid nourishment forced upon it. Thirst is apparent from the outset, but every draught of water provokes a spell of vomiting. Defecation is suspended, and this, together with stercoraceous vomiting, are the most typical symptoms of obstruction. Some writers speak of tympanitis, but I have never seen this a very marked symptom. If one examines the intestinal tract of an animal dead of this form of obstruction, it is true that the bowel for some distance above the seat of lesion

will be found to be much distended and often hypertrophic, but the distension is not from gases, but from semi-fluid fecal matter.

Unless a dog be abnormally fat, all forms of intestinal obstruction can, as a rule, be diagnosed as such by patient and persistent external palpation of the abdomen between the fingers of both hands. Foreign bodies may be felt in any part of the cavity, but generally in the center. Most of them may be rendered visible with the Roentgen rays.

Treatment. This differs according as the obstruction is mobile or fixed. Mobile obstructions are treated by therapeutic measures, our object being to hasten their exit from the canal with the aid of purgatives. But when their passage is arrested and they become firmly lodged at any part of the canal, purgation is not only useless but decidedly harmful. In a few hours the wall at the site of an obstruction is in a state of inflammation. The muscular layers become edematous, and their activity is impeded, if not altogether arrested. Should even slight inflammatory process have started, any further peristalsis is at once checked, and cannot be awakened by the action of drugs, and if we remember that it is only through the return of normal peristalsis that we can hope for the natural removal of an obstruction the reasons for avoiding purgation become self-evident. It may be laid down as a rule that the administration of purgatives should be persisted in until the advent of vomiting. As already stated, however, it is a mistake to wait for stercoraceous vomiting, which is evidence that the obstruction has been of some duration, and that collapse is imminent. In Senn's experiments vomiting occurred about five days after artificial obstruction had been established.

At this stage a prompt and careful enterotomy offers the only possible chance for recovery. With modern surgery no dog should be allowed to die without an extreme attempt being made to render the canal permeable. It is only after the inflammatory changes at the seat of lesion have developed into gangrene that the percentage of recoveries is reduced to a minimum, but even then, life may be saved by excision of the mortifying portion. Whether or not resection of a portion of the bowel is necessary will depend upon its viability. Congested bowel, even if dark red, may be safely regarded as viable, but a greenish tint indicates the presence of gangrene. All doubtful cases should be treated as septic.

A peculiar case was recorded by Morey. He operated and withdrew from the bowel over six yards of cord, but found it impossible to extract the entire length from the distal side of the opening he had made, even with energetic traction. He closed the wound, hoping the remainder would be voided, but the animal succumbed forty-eight hours later from peritonitis, occasioned by two perforations in the lesser curvature, which he believed were caused by the sawing action of the cord occasioned by the peristalsis.

II. COMPRESSION. This form of obstruction may arise by (a) Direct compression of the gut, or (b) Indirectly by suspension of peristalsis owing to arrest of the mesenteric circulation by compression or torsion. Both these pathologic conditions may exist together.

(a) **Obstruction by Direct Compression** may be due to adhesions or slits in the mesentery or omentum, occurring as the result of traumatic influences, or following visceral operations. Wounds of the bowel-wall, during the process of healing, invariably become adherent to, and matted together, with neighboring coils, omentum, and mesentery. This results in the formation of unnatural flexures and curves, and even sharp angularities, and thus are produced theoretically all conditions favorable to hindering and obstructing the onflow of the contents. But, as a matter of fact, such conditions rarely affect the bowel to such an extent as to produce occlusion. The muscular coat of the dog's bowel is developed to a high degree, and seems especially able to overcome obstructions of this nature.

Reichel endeavored to produce occlusion experimentally by sewing knuckles of bowel in the form of an S, but could not succeed. Nevertheless, a single sharp flexure is capable of producing fatal obstruction. In one of my resection experiments where successful reunion took place, adhesions formed between the line of coalescence and one side of the wall immediately beyond, where by an acute flexure was developed. This, together with the stenosis formed at the site of the operation, was sufficient to completely occlude the lumen from the first, and death resulted in ten days' time. I have also experienced a case of this kind where the intestine and uterine cornua became matted together in consequence of peritonitis supervening on an oophorectomy operation. A great amount of inflammatory fibrous tissue had developed, and this

contracting compressed the gut and produced flexures. I have found another case of obstruction recorded by Parkes, which resulted through a fold of intestine becoming adherent to a stump of ligated mesentery left free in the cavity. Acute flexure was produced at the point against which the contents of the bowel accumulated in large quantity. Jaffe referred to an instance of partial obstruction through the small intestine becoming adherent to the omentum after an experimental intestinal operation.

Compression resulting from passage of a loop of bowel through a slit in the mesentery I have not found recorded as having occurred clinically, with the exception of an instance mentioned under Torsion, but the possibility of its taking place is fully demonstrated by the results attending a series of experiments conducted by Barącz in which knuckles of bowel were isolated but left *in situ*, the margins of the cut extremities being inverted and sutured, and the remaining upper and lower portions of the tract anastomosed. It was found very difficult to so dispose of the mesentery that rents did not remain, and in seventeen dogs five died as a result of such rents by portions of bowel slipping through and becoming twisted.

Hemorrhoidal nodules, suppuration of enlarged anal glands, enlarged prostate, abdominal abscesses, neoplasms of the viscera and retroperitoneal glands (Siedamgrotzky), and ascites, may each and all bring about compression-coprostasis. These conditions will be discussed under their respective headings elsewhere.

Symptoms and Diagnosis. The symptoms of obstruction by direct compression resemble those of constriction-compression or simple coprostasis, in greater or less degree. Explorative laparotomy will alone enable the practitioner to arrive at a correct diagnosis of adhesion-obstruction, but before taking this step, all other conditions named must be taken into consideration as being possible factors in the production of the trouble.

Treatment. Intervisceral adhesions must be broken down by gently tearing them apart, or with the aid of a suitable instrument.

(b) Obstruction by Suspension of Peristalsis Through Arrest of the Mesenteric Circulation. Familiar examples of this form of obstruction are Incarcerated and Strangulated Hernias, Torsion, and Intussusception.

Incarcerated and Strangulated Hernia. A hernia is said to

be incarcerated when the peristalsis of the herniated portion of bowel is interrupted, generally through formation of adhesions, and the passage of fecal matter is arrested, but without impairment of circulation. The commonest exciting causes of this condition are constipation and improper foodstuffs. A hernia is said to be strangulated when in addition to incarceration there is interference with circulation of the parts. Strangulated hernia may arise from any cause which induces local venous congestion, such as incarceration, elastic compression at the neck, inflammatory disturbance in the wall of the retained loop, torsion of the latter, and greatly increased peristalsis. In one fatal case which I saw, the animal had partaken of a very heavy meal a few hours previously, which led to accelerated peristalsis and congestion within the sac, though the hernia had existed undisturbed for four years. Venous congestion in a hernia leads to edematous thickening, serous exudation, and reactive compression at or near the neck, and thus the circulation becomes arrested. Once the nutrition of any portion of the bowel is cut off, microorganisms quickly migrate from the lumen through the wall, and local infectious peritonitis is established. The fluid bacteria-laden exudate is rapidly absorbed, and the animal dies within a few hours from toxemia. In the case mentioned above death occurred at the expiration of thirty-six hours. In many cases of artificial strangulation produced by Tietze death took place in ten or twelve hours. Boenecken found that bacteria commenced to migrate four hours after a loop of intestine was very tightly ligated. Ziegler made twenty-nine artificial strangulations. In eight of these, bacteria were found within the first ten hours. In three, which had lasted over fifteen hours, bacteria were very plentiful, and consisted of colon bacilli and ordinary pyogenic staphylococci and streptococci, the cocci being the first to migrate. Tietze made seventeen artificial strangulations, and nine of these showed migration in from six to twenty-four hours. In this connection, it is interesting to note that the dog exhibits a remarkable tolerance of simple occlusion by single ligature. Jaffe found that when he ligated the small intestine with a silk ligature the latter cut through little by little until it reached the lumen, the bowel meanwhile becoming reunited by linear cicatrization without its permeability being at all interfered with. Kirstein had the same experience with rubber

ligatures. With the colon, Jaffe did not have similar results, for in this part of the tract ligaturing was followed by local necrosis and diffuse peritonitis. This is probably to be accounted for by the fact that bacteria are believed to be present in greater numbers in the large intestine than in the small.

Symptoms and Diagnosis. The symptoms of incarcerated hernia are of a chronic type and very similar to those of fecal impaction, which have already been sufficiently discussed. Those of strangulation are of an extremely acute character, appearing within a very few hours. The breathing is accelerated, the temperature somewhat elevated, and there is an anxious facial expression. The cardiac impulse is scarcely perceptible, and the animal is soon in a state of collapse. The collapse is believed to be due to the profound impression sustained by the sympathetic system through the compression. Food is entirely refused, but there is intense thirst. Vomiting occurs very early, and becomes frequent and copious, and finally feculent. The greater the degree of strangulation and the higher the lesion occur in the tract, the more pronounced are the symptoms. Such symptoms, coupled with the presence of hernia, which is tense, hard, and painful, may be taken as indicative of strangulation.

Treatment. Incarcerated hernia may generally be relieved by taxis supplemented with purgative doses of castor oil and enema of olive oil. The application of ice-bags is also useful, to cause contraction of the vessels. Where such measures fail of effect, recourse must be had to enterotomy and further operative measures to effect permanent reduction. Strangulated hernia is treated by the operation of herniotomy, and if the viability of the bowel is no longer apparent, by resection and anastomosis.

Strangulation being an extremely severe lesion, the chances of recovery are always very slight. An early diagnosis and immediate operative interference offer some hope.

Torsion. Volvulus. Ileus. These terms signify twisting of the bowel about its mesentery or around its own axis. This lesion occurs very rarely in the dog on account of its short mesentery. Liénaux witnessed a case in a fox terrier which had been thrown up and turned about a great deal by some children. The animal suffered severe abdominal pain, and died fifteen hours later. The necropsy revealed a torsion of the mesentery around an axis co-

inciding with the origin of the superior mesenteric artery, and which had involved the whole of the intestine extending from the duodenum to the level of the transverse colon. Pécus observed a case, but in this instance the torsion was preceded by a natural or accidental rent in the mesentery, which permitted of the passage of a knuckle of the bowel. Robinson tried many times to produce it artificially, without success, except when it was sutured in position, and even then the sutures were frequently torn out by the forcible self-reduction of the volvulus. Tietze had similar experience. Kirstein and also Mall proved that the mesentery could be twisted 180 degrees without the circulation of the same being affected. This they did by resecting and reversing portions of the bowel.

Symptoms and Diagnosis. The same pathologic changes take place, and the same symptoms are in evidence, as occur when the bowel becomes strangulated outside the abdominal wall in strangulated hernia. The disturbance in the circulation is followed by migration of microorganisms and lethal peritonitis. Arrest of intestinal circulation, be it within or without the abdominal wall, may always be differentiated from obstruction of the lumen if it is remembered that the symptoms of the latter condition are slow and gradual in appearance, that vomiting comes on in the later stages or not at all, and that unless there be perforation by a foreign body, there will rarely, if ever, be inflammatory effusion into the peritoneal cavity; whereas in the former, the prostration is great and immediate, there is early and copious vomiting, intense thirst, rapid pulse, and bloody effusion into the peritoneal cavity.

Intussusception. Little is known of the causes of this condition. It is generally attributed to irregular innervation of the muscular coat. In Nothnagel's experiments it was observed to occur normally in some animals like the rabbit. He also found that when an electric current was carried to a point in the bowel it not only caused a contraction of that spot, but also a dilation below it. The bowel below the point of contact gradually worked itself over the contracted portion, and thus produced an intussusception. Senn's experiments render it conceivable that if this condition occurs more often than is suspected spontaneous reduction may also take place in a short time. In many artificial invaginations made by him the intussusception disappeared of its own accord. In

fact, so common was this self-reduction, that in order to maintain the condition he desired he found it necessary to so suture the artificial invagination that disinvagination was made impossible. F. B. Robinson classes it as one of the commonest sequelae to resection operations as performed by the end-to-end methods. Out of two hundred and twenty-five dogs he used for such experiments, he lost eight from intussusception. Hobday has recorded its occurrence after an enterotomy operation, and in another instance after celiotomy, massage of the bowel, and removal of a fecal impaction with a scoop the contractions of the healthy portion having brought about its invagination within the dilated and paralysed area of previous obstruction. Kitt found much entangled masses of packing thread in the invaginated portions, and refers to instances of its occurrence in connection with tumor of the wall. Neumann states that invagination may be provoked by the presence of ascarides. Cadéac says it may be brought about by the ingestion of cold water during the heat of the chase. Dudfield believed it might be caused by supercatharsis induced by overdoses of sulphur. Kowaleski found a piece of wood in the duodenum and three invaginations in the ileum. It has been observed by many veterinarians that a certain relationship exists between icterus and intussusception. Some of the earlier writers regarded the latter as one of the causes of the former. In forty dogs dead of icterus Reynal found twenty-one with complication of intussusception. As late as 1886 Rancilla, having conducted necropsies on the bodies of sixty dogs dead of icterus concluded that intussusception was the cause in four out of every five dogs affected. But Trasbot ligatured a portion of the bowel and could not produce icterus, and in Senn's description of all his artificial invaginations I find no reference to its development. A more plausible theory is that the invagination occurs as a result of the long agonal period characteristic of icterus, possibly owing to loss by the bowel of some guiding or restraining influence exerted by the bile, since physiologists teach that one function of the latter is to maintain normal peristaltic action. Trasbot has suggested that it may be a consequence of biliary intoxication whereby the sympathetic ganglia are violently excited and provoke spasmodic contraction of the muscular layer.

Intussusception occurs mostly in young dogs, probably owing

to the greater fermentative changes occurring in their bowels, such changes stimulating inordinate peristaltic movements. It is not uncommon to find multiple invaginations existing at one time. Varnell cited two instances observed by Leach, the subject being two pointer puppies of the same litter which had died about the same time, the intestine of each showing four separate invaginations. The vessels of the most inferior ones only were strangulated suggesting that the others might possibly have been of agonal or post-mortem origin.

The duodenum may become invaginated within the stomach. Peuch recorded an instance, the invagination forming a non-adherent reddish cylindrical tumor some two and one-half to three inches in length.

The small intestine may work its way into the colon and even protrude from the anus. Such cases are apt to be mistaken for simple procidence of the rectum unless carefully differentiated. Dudfield saw a case of ileo-colic invagination. Petit found seven instances of ileo-colic invagination of probable agonal origin at a number of necropsies conducted by him in less than a year. Death in these cases resulted either from pneumonia or icterus. Cases have been recorded of the healthy bowel intruding itself into a dilated portion following the removal of a fecal obstruction.

When an intussusception is established, the mesentery which contains the blood-vessels is drawn into and included in the tumor. There is necessarily pressure with consequent stasis of the circulation in that part and gangrene of the entering and returning layers may follow. Gangrene is less apt to affect the intussusceptum than the intussusciens. The mucosa of the latter becomes extremely red or blackish and congested, while the mucosa of the former may be almost normal, though all the coats are usually somewhat blanched. A clot of blood may exist between the two mucosal membranes. The mesentery being attached to one side of the bowel it draws on that side so that the tumor has a more or less curved appearance. The length of an intussusception generally varies between five and ten inches. The lesion may be acute or chronic. The acute form is accompanied with severe colic but the chronic condition may exist without causing any apparent inconvenience to the animal. In some of Senn's artificial invaginations no symptoms of obstruction were witnessed, and when the animal was killed weeks or months

afterwards the lumen of the intussusception was not larger than an ordinary lead pencil and yet the bowel on the proximal side was not distended.

The greatest danger in the acute form arises from the constriction of the intussusceptum at the neck of the intussusciptum. Petit saw a case terminate in perforation. Spontaneous cure may take place by the formation of adhesions between the neck and sheath and the sloughing mass be voided *per anum*.

Symptoms and Diagnosis. There is no distinctive symptom that will enable one to differentiate from acute obstruction from other cause. An offensive sanguineous matter may be evacuated *per anum*. Biot saw a case accompanied by marked and continuous colic. Hill claims that a peculiar diagnostic symptom of this condition is the action of the animal in lying on the top of its back continuously for an hour together and seeming in that position perfectly at ease and free from pain. When the animal is not too fat to permit of palpation the nature of the tumor may be surmised from its curved and elongated shape, its sensitiveness, and free mobility.

Treatment. The safest and most effective treatment consists in opening the abdominal cavity and treating the lesion in a direct manner. An attempt should first be made to retract the investing layer. This is often impossible since adhesions will form between the apposing serous surfaces within a very few hours. Sometimes these may be broken down with a probe or fine straight bistoury. Biot made a successful reduction in this manner. Should the condition of the parts preclude the advisability of such a course, nothing then remains but to perform resection and anastomosis. Tremper cured four out of seven animals by forcing them each to swallow three leaden balls supplemented with intervening doses of castor oil. They were then made to run about when possible, or were suspended by the fore-legs. The two following days they were drenched with a decoction of linseed meal in water to the amount of one quart.

Forcible rectal administration of fluids may also be given a trial. Senn, in view of the unfavorable results attending his experiments of this nature on cats, believes that it should only be resorted to when the tumor can be positively located in the large gut. He regards it as unsafe to attempt to force liquids beyond the ileo-

cecal valve, owing to the weight of the water exerting too strong lateral pressure for the intestine safely to bear. While this may be true as regards the cat it does not hold good for the dog. In the latter animal the valve is nearly always patent and fluids can be forced up as far as the stomach without any risk of damaging the bowel wall.

In one of Senn's cases of artificial invagination of the ileum into the colon the abdomen was reopened on the third day and the neck of the intussusciptiens exposed so as to observe the mechanism of disinvagination by rectal injections of water. As soon as the colon was well distended the adhesions at the neck of the intussusciptiens began to give way and complete reduction followed. The animal recovered.

III. CONSTRICTION. Under this heading are included all obstructions arising by causes developing in connection with the wall itself, namely, all forms of neoplasms, strictures, and cicatrices.

Tumors of the intestinal canal proper are rare. Adeno-carcinoma and sarcoma have been observed. Organic strictures are of somewhat more common occurrence and offer an admirable field for surgery. Unlike cancerous tumors they are not productive of cachexia and are lethal only to the extent that they lead to starvation by occluding the tract, or to autointoxication. The duodenum is a favorite seat for the development of stricture but it has also been found in the colon. Cicatricial strictures may result from healed ulcers and may follow coalescence of the resected bowel after end-to-end anastomosis. The rectum occasionally becomes occluded in puppies suffering from chronic diarrhea, the epithelial lining degenerating and adhesion taking place between the submucosa layers. According to Cadéac, lipomata may develop in the submucosa and cause projection of the mucosa.

The mesenteric lymphatics are also occasionally affected with growths, such as lymphadenomata, lympho-sarcomata, and tubercles.

Obstruction is sometimes seen in puppies owing to congenital occlusion of the canal, generally in the region of the anus. This condition will be referred to under The Rectum and Anus.

Symptoms and Diagnosis. These vary according to the character and position of the growth. Malignant tumors have a profound effect on the entire organism, often of extreme and fatal

marasmus. They may otherwise terminate life by metastasis to other and vital organs. Non-malignant and circumscribed growths and strictures generally give rise to symptoms of chronic obstruction. For some time there is no disturbance in the general condition of the animal, and it is possessed of its usual activity. The only difference noticed is a gradually failing appetite, but this is unaccompanied by emaciation. As soon as complete occlusion takes place all food is refused and there is still no appreciable falling off in flesh. In a few days' time thirst and vomiting appear and it is then that emaciation commences and rapidly pursues its course. Vomiting is not a constant symptom, however. In the resection case referred to under Compression Obstruction the animal died without having shown any sign of vomiting. This was probably due to the fact that the bowel above the seat of occlusion was distended for a distance of only fourteen inches and from there onward to the stomach was contracted. Kirstein mentioned having a similar experience in an experiment where he completely severed the gut and closed the cut ends separately by suture. The animal lived six weeks. At the end of the third week its appetite failed, but in all this time it did not vomit. After death it was found that but fifteen inches of the gut above the lesion showed distension, the remainder being collapsed. In my other clinical cases and in the experiments of Tietze and Reichel, the distension was greater just above the seat of lesion and gradually decreased towards the stomach, and all of these cases were characterized by vomiting.

The advent of dissolution is usually somewhat slower than in obstruction by foreign bodies. Much depends upon the position of the stricture. The higher its position the more quickly is it fatal. Death may occur by starvation in protracted cases, but it is probable that it is more often directly due to absorption of microorganisms by the dilated lymphatics and vessels in the hypertrophied portion of the bowel immediately above the occluded area, such microorganisms rapidly increasing in numbers in the blood.

Symptoms and Diagnosis. As a rule, explorative celiotomy can alone enable the practitioner to arrive at a correct differential diagnosis.

Treatment. The only possible method of treatment is ablation by enterectomy, and anastomosis.

Surgery of the Intestines

For all intestinal operations the animal should be secured in the dorsal position with hoppers and a general anesthetic administered, the opening in the abdominal wall being made in the median line.

ENTERORRAPHY.

The coats of the dog's bowel are composed of the following layers: (1) Mucosa, consisting of the gland follicles and muscularis mucosa, (2) Submucosa, which according to Clason is formed of two relatively thin layers of inelastic connective tissue fibrils, which cross at acute angles and run in a spiral manner around the intestine, (3) Muscularis externa, a well-developed coat of thick inner circular fibers and of thinner outer longitudinal fibers, and (4) Serosa.

The mucosa can easily be scraped away with the aid of some blunt instrument, and the serosa and muscularis externa can also be removed with a little trouble. There then remains the white fibrous submucosa, which is a very important layer and may be regarded as the framework of the canal, the other tissues forming adjuncts for the performance of its functions. This submucosa constitutes the so-called "sausage-skin", from which catgut is manufactured. It is regarded by Halsted as most important in suture of the intestine, because it affords a better hold for the stitches than does the muscular coat.

In applying sutures it is highly important to guard against sepsis from the interior of the bowel. While experience has taught that simple celiotomy on the dog rarely terminates unsuccessfully through infection, it is a different matter when the continuity of the bowel-wall is interfered with. No stitch which passes to the outside of the serosa must penetrate the mucosa. The reason for this is obvious. A communicating channel would thereby be formed through which bacteria-laden intestinal contents would find egress and rapidly infect the peritoneum. Septic peritonitis has often followed experimental operations where such precautions have been neglected.

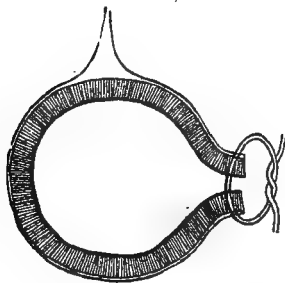
A strong point made by Halsted is that each stitch should pass through part of the fibrous submucosa, which is far stronger than the combined thickness of the serosa and muscularis, but must on no

account puncture the mucosa. With practice, Halsted believes that one can soon learn to include the submucosa in stitching.

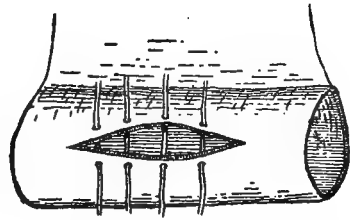
The entire row of stitches should unfailingly preserve a straight line, and each stitch should be drawn only sufficiently to bring the apposing surfaces fairly in contact. Tightly drawn sutures lead to necrosis of the approximated edges.

Milliners' needles Nos. 8 and 9, which are somewhat longer than the ordinary cambric needles, should always be used on the intestine. The best suturing material is the finest No. 2 black sewing silk, sterilized, and it should be tied in the eye of the needle. Nearly every surgeon of note who has experimented on dogs recommends silk. Thick catgut remains unchanged not over seven days as a rule, which cannot be considered a period of sufficient duration for certain coalescence to take place, and when tied the knots interfere with accurate approximation. Fine catgut disappears in less time, while aseptic silk threads can be tied with greater accuracy and the knots never become loosened, and its permanent presence in the parts never exerts any ill-effect. Where silk was unobtainable at short notice I have used ordinary sewing cotton (sterilized) with good results.

Of the various intestinal sutures it will only be necessary to consider those figured in the accompanying illustrations. The first of these, the simple interrupted suture, should never be employed be-

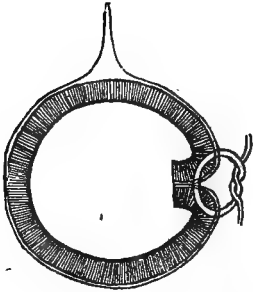


No. 39a. Simple interrupted suture.

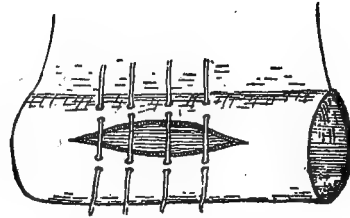


No. 39b. Simple interrupted suture.

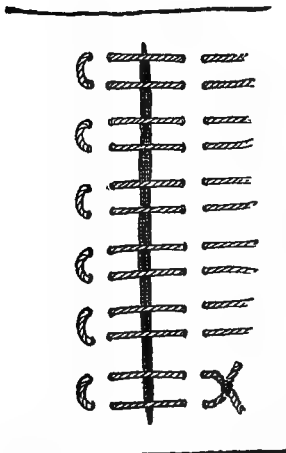
cause all the coats are thereby pierced, which permits of possible exudation of intestinal contents. The Lembert suture is very commonly used. In this, the serous surfaces are brought into appo-



No. 40a. Lembert suture.



No. 40b. Lembert suture.



No. 41. Halsted's Mattress-suture.

sition and the cut edges of the mucosa inverted. Halsted's suture is otherwise known as the "mattress stitch." Halsted claims that it is preferable to Lembert's because one row is sufficient, it tears out less easily, and constricts the tissues less. It is interesting to note that several well-known British surgeons have conceded this claim, having observed that the Czerny-Lembert suture generally gives rise to the formation of a ridge in the interior of the bowel which acts as a diaphragm and contracts the lumen. The stitches are inserted about one-third of an inch from the divided edges, and are brought out just free of them.

ENTEROTOMY.

Incision of the intestinal wall is performed for the relief of obstruction by fecal concrement or foreign bodies, provided any inflammatory process that the object has induced is not of such intensity that gangrene is threatened, when enterectomy is the only hope of a cure.

The abdominal cavity being opened and the omentum pushed aside (see Celiotomy), distended loops of intestine usually appear at the wound. These are always on the proximal side of the obstruction. For some distance above, the gut is dilated about one and one-half times, or twice larger than below the seat of obstruction,

the bowel on the distal side being usually collapsed. The obstructed portion being found, it is drawn out of the cavity, retained well outside and away from the opening in the wall until the completion of the operation. At the same time it should be protected and kept warm with sterilized gauze wrung out in warm water. The condition of the tissues in the immediate neighborhood is to be carefully noted and according as to whether the bowel is viable or not will depend the necessity of simple incision or excision of a part. At this stage some writers recommend application of bowel clamps a few inches above and below the lesion in order to restrain the outflow of fecal matter through the opening. A simple clamp can be improvised out of a piece of rubber tubing held in position by artery forceps. But there is some danger of causing unnecessary injury to delicate tissues and it is certainly useless on the distal side of the obstruction where the bowel is invariably empty. Barącz lost a case by compressing the bowel too tightly with a metal clamp. On the proximal side a considerable quantity of feculent matter may be found. I believe it is better to speedily evacuate the gut of this putrefactive matter from as great a distance as possible beyond the seat of an artificial opening, than it is to leave such dangerous filth in close proximity to a wound we desire shall rapidly heal. An incision is then made longitudinally at the greater curvature, and immediately over the obstruction. No advantage is gained by trying to force the latter back to another part of the bowel for delivery, for if the tissues at the seat of obstruction are in such state of mortification that they will not stand interference, enterectomy is the only alternative. Where the obstruction is fecal and of such bulk and extent as to occupy the greater part of the colon or rectum, necessitating opening of a large tract, it is better to make a series of interrupted incisions along the greater curvature. The obstructing body being removed, the operator gently compresses the bowel between thumb and first finger for a good distance above and towards the seat of lesion, so that all fecal matter may be expelled from the neighborhood, care being taken that none of it enters the peritoneal cavity. The parts are then thoroughly washed with warm sterile water, sutured (see Enterorrhaphy), again washed, and returned to the cavity, the omentum replaced as nearly as possible in its normal position, and the wall closed (see Celiotomy).

It has been suggested that the insertion of the sutures may be

simplified by placing within the lumen of the bowel a piece of bread moulded to the shape and circumference of the latter.

**ENTERECTOMY and ENTERO-ENTERAL ANASTOMOSIS
or ENTERO-ENTEROSTOMY.**

This operation becomes necessary when a portion of the intestine has lost its viability. Such condition arises most commonly consequent upon acute intestinal obstruction or strangulation.

Removal of more than one-third the length of the small gut is dangerous to life. Parkes found that recovery occurred most readily when the portion of bowel resected did not much exceed six inches. Experiments showed that extensive resection where the resected portion exceeded one-half the length of the intestinal tract, and where the animals survived the operation, was followed by marasmus as a constant result, though the animals consumed large quantities of food. The operation is a difficult one and demands great precision and attention to detail, but if undertaken in good time, offers reasonable hope of success.

It is highly important to have a clear conception of the blood supply of the bowel. It will be remembered that the intestine is suspended by the mesentery which also supports the blood-vessels. The latter divide some distance from the bowel into two branches and these by union with neighboring branches form a chain of loops running parallel with the bowel. From these loops are given off terminal twigs to supply the bowel. Most of the twigs run in the muscular coat. Some two inches of bowel include the area supplied by one mesenteric branch.

There are two operations by which anastomosis may be effected, viz., the end-to-end and the lateral. The end-to-end operation is more commonly performed than the other, but it is not feasible if there is much difference in caliber between the two severed ends, as might occur when a large tract of bowel is excised. There is always risk of subsequent formation of stricture at the site of operation, for the continuity of the muscular wall is broken by a band of inert cicatricial tissue. Myles has pointed out that the contents of the bowel are necessarily forced past this point by mechanical pressure from above and not by contraction. The expansile character of the gut is lost here, and with a sudden and pronounced contraction just above this point the conditions are ripe for an

intussusception. Frank examined specimens of anastomosed bowel and observed that no true regeneration of the muscular coat had taken place. There had been some proliferation of muscle cells and an attempt to regenerate but fibrous connective tissue had filled up the interspaces like a weed, crowding out the more delicate structures.

In the lateral operation each cut end is first closed by invaginating its margins and suturing with continuous suture. By incision, an opening is then made in the wall at the greater curvature, about two inches from each closed end. Senn claims that the lateral operation is particularly advantageous in that the point of contact is always made on the convex surface, so that the means employed to secure coaptation do not interfere with the blood supply from the mesenteric vessels, and that it requires much less time than end-to-end enterorrhaphy. The openings are brought into apposition by inter-suturing of their respective margins, or by employment of any of the devices used for the purpose, as in the end-to-end operation, and are thus made to form the intercommunicating channel between proximal and distal portions of the bowel. Passage of bowel contents is also by mechanical pressure from above, but there is less liability to intussusception.

A great many devices have been contrived to facilitate anastomosis. Some of them are merely intended to assist in holding the cut ends in apposition while sutures are being applied, and take no further part in affecting the reunion. Others allow the operator to dispose with all or most of the suturing, but must necessarily remain in position, holding the cut ends in apposition sufficiently long for reunion to be established. Some of the latter, particularly those which are unabsorbable, like the Murphy button, hold the ends together by compression, thus producing more or less gangrene. This feature of pressure-gangrene production constitutes a pronounced defect, and all mechanical devices depending upon it for the desired effect are necessarily active irritants and a menace to the reparative capacity of the parts. In fact, the best method must be that which dispenses altogether with the presence of any foreign body, except it be to lend temporary support to the parts during suturing.

But without the employment of some kind of supporting device, the operation is rendered vastly more difficult. When the in-

testine of the dog is severed, the muscular coat immediately begins to contract. The diameter of the tube is often diminished more than one-half. The circular layer which is thickest causes the sudden narrowing of the lumen, and the longitudinal layer then coming into play brings about a pronounced eversion of the mucous membrane. This action can be overcome to a considerable degree by gently inserting the tip of the little finger within the lumen of the severed ends, but even then it is a matter of extreme difficulty to maintain the cut ends in apposition while the suturing is being carried out.

For the veterinary practitioner a simple uncomplicated method is needed, one which does not involve the employment of specially manufactured devices, which excepting in large cities, are usually unobtainable at short notice. The necessity for performing this operation invariably arises as an emergency, hence it is indispensable that the technic be as simple as is compatible with favorable results, and that any device necessary to facilitate the work be such as may be fashioned out of material at hand and at short notice. With this end in view I have contrived a method which I believe to be peculiarly adapted to canine practice. The sole device of which it is necessary to make use is a lady's hair pin, bent as



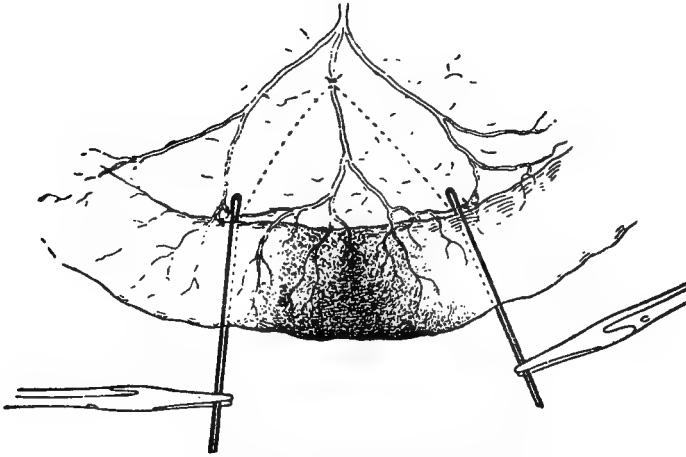
No. 42a. Hair-pin method of anastomosis. Showing the manner in which the pin is bent.

figured in the accompanying illustration. Two of these are required, together with three or four pairs of hemostatic forceps to act as clamps. Pieces of wire may be substituted, but not having as much spring, they do not answer so well.

In order to follow each successive step in a complete enterectomy and end-to-end anastomosis by this method let us suppose that on exposing the viscera a tract of small intestine is found to be in an advanced state of gangrene from the presence of some obstruction, or owing to strangulation. The operator must first carefully investigate the local blood-supply, bearing in mind that no mesenteric vessel must be obliterated other than those supplying the area of intestine it is intended to remove. This precaution must be rigidly observed, because it is of the utmost import-

ance that the circulation be preserved up to the very row of sutures. All the circulation possible is needed to effect rapid coalescence of the parts, and to ward off gangrene. The area of intended resection and the blood supply of the same being mapped out, the mesenteric vessels are first secured by ligature, which is best done by means of a curved needle and fine suture passed through the mesentery and around them. The anastomosing loops running near the mesenteric attachment are secured at a point level with the proposed line of resection.

One prong of the hair-pin is passed through the mesentery at the upper point of resection, and both are brought transversely

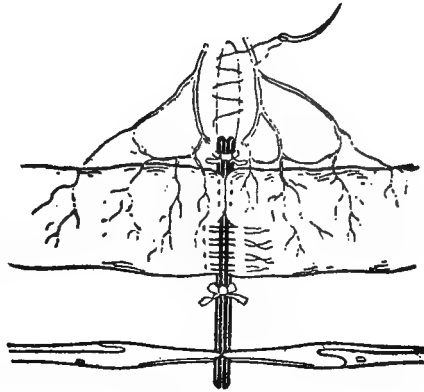


No. 42b. Hair-pin method of anastomosis. First stage.

across the gut. The other pin is affixed in the same manner at the lower line of resection. No other bowel clamp is needed when the pins are used, as the lumen is closed from the outset.

The intestine is severed with scalpel quite close to the clamped prongs of the pin. The pin effectually inhibits all vermicular action of the wall. The incision is extended to the mesentery, so as to remove a wedge-shaped portion. The two pins are approximated and tied tightly together, or they may be locked by means of additional hemostatic forceps. The sutures are now placed on one side, starting at the mesenteric attachment. They are tied before pro-

ceeding to the other side. The bowel is turned over and the sutures are applied in the same manner on the other side. The pins are then severed at their bent ends with bone forceps or stout scissors, untied and unclamped, and withdrawn, one prong at a time. The remaining openings are closed with one stitch each, particular care being exercised that the margin is properly turned in at the mesenteric attachment. Finally, the incision in the mesentery is closed with continuous suture.



No. 42c. Hair-pin method of anastomosis.
Second stage.

The bent pin method is equally serviceable for lateral anastomosis, a portion of the greater curvature being included between the two prongs in a direction approximately parallel with the long axis of the gut.

Of the mechanical devices employed in this operation it is only necessary to refer to the metallic button of Murphy. Other absorbable substitutes have been suggested and employed, but they are all made on the same principle. They are somewhat difficult to use on account of the contraction and eversion which takes place immediately the bowel is divided, and they involve a postoperative risk, because they remain in place for a longer or shorter period, thereby becoming foreign bodies, and because they effect reunion by pressure-necrosis. The Murphy button is made in various sizes, only the smallest of which is applicable to canine surgery. It consists of two interlocking halves, either of which is inserted in each open end of the bowel. The margin of the latter is then gathered around the stem of the button by means of a purse-string suture, the two halves of the button are locked by pressing them together, thus bringing serosa into apposition with serosa, and the union is completed. A few Lembert sutures may be applied additionally if it is desired to reinforce the line of union. The button sloughs when a certain degree of reunion has taken place and is voided at the anus in the course of ten or fifteen days.

The progress of reunion of anastomosed bowel has been studied by Halsted and Mall. Before the completion of the operation a primary union through sticking together of the serous coats by a fibrinous substance took place. On the sixth day the serous walls were firmly united by a semi-fibrous tissue, rich in spindle and round cells. On the fourteenth day the union between the muscular coats and the submucosa was very firm of fibrous tissue, and at the end of two months all the coats were fully regenerated, and the wall straightened out.

Senn found that if he resorted to additional mechanical irritation of the apposed surfaces, by scarifying them with the point of an aseptic needle, a circumscribed plastic peritonitis ensued, which caused adhesions and obliteration of the serous spaces to take place very much sooner than when the latter were left intact.

Senn believes that the employment of omental grafts from one to two inches in width and sufficiently long to completely encircle the bowel favor healing of visceral wounds, and afford an additional protection against perforation. He observed that they retained their vitality and became fairly adherent in from twelve to eighteen hours, and were freely supplied with blood vessels in from eighteen to forty-eight hours.

There is no doubt that it is a good plan to encircle the bowel at the site of operation with omentum, because in any case there is invariably matting together of the intestine with other parts, and it is better that omentum should form the adherent tissue than coils of intestine, which favor the formation of flexures and kinks.

Judicious after-treatment is no less important than the delicate conduct of the operation itself. Extreme caution must be observed in the matter of feeding for some time after apparent recovery, both as regards the amount and nature of the food. Parkes had one case that resulted in failure as late as three weeks from the date of operation through neglect of caution in this matter.

Suppressed appetite and much emaciation are usually present during the first four or five days following the operation, but as recovery becomes certain the craving for food becomes inordinate. A voracious appetite at this period must be sparingly gratified. Liquid diet is best for the first two or three weeks.

It is interesting to note that such a severe operation may be performed on the pregnant animal without necessarily inducing premature birth. In Jordan's experiments two females were preg-

nant at the time of operation, and later brought forth their young at full term. Frank had a similar experience, operating on the thirtieth day of May, and the puppies were born on the thirteenth day of June following.

Jordan observed that the presence of tape-worms in the canal had an unfavorable effect on the healing process.

VENTROFIXATION.

This operation consists in producing the formation of adhesions between the wall of a portion of the intestine and the abdominal wall by means of sutures. It has been undertaken by a few operators as a preventive measure against procidence. It must be remembered, however, that it involves the formation of a flexure at the site of fixation, which at some subsequent period may become the seat of fecal impaction. Liénaux and Gray have reported recoveries from procidence by this operation, but the reports having been made within comparatively short periods after its performance (three months in Liénaux's case) are valueless as to the ultimate effect on the bowel. Hence, it is an operation which is not to be counselled until all other means have failed. The technic is as follows: The abdominal cavity being opened in the lateral position, gently withdraw the everted portion, at the same time having an assistant help by external manipulation. Next insert the stitches which are to close the abdominal wall, but do not tie them. Now pass two or three fine interrupted silk sutures, threaded each to an ordinary milliner's needle, into one side of the wall of the bowel in a direction at right angles to the long axis of the canal, by which they do not interfere with its vascularity, taking care that the stitches do not penetrate beyond the submucosa. Carry the sutures so as to include the peritoneum and part of the muscular coat, a short distance from the margin of the incision. Then tie these stitches, which brings the gut into the desired position, cut the ends off short, and finally secure those in the muscular wall, and close the external wound as in celiotomy.

RECTAL IRRIGATION. ENEMETA.

The injection of fluids into the bowel is a valuable surgical and therapeutic measure. It is employed for three purposes, viz.,

as a means of inducing evacuation of fecal accumulations or foreign bodies retained in the lower bowel; for the purpose of applying disinfectant and astringent medicaments directly to the mucosa in diseased conditions; and for administering nutritive media when food cannot be taken through, or retained in, the natural channels.

As a defecatory aid it acts in two ways, viz., by softening and disintegrating fecal matter and by distending the wall of the bowel whereby the latter is stimulated to contract. For large and medium sized breeds a bulb-syringe should be used to give the injections, the "alpha" or "omega" makes being preferred, as they permit of a continuous stream being thrown with varying degrees of force. Fountain syringes unless elevated to a height lack the requisite force. When it is desired to direct a stream beyond an obstruction, the rectal scoop described under Coprosthesis may be substituted for the ordinary hard-rubber nozzle. For toy dogs and puppies the rectal syringe for infants is to be preferred. Luke-warm soapy water forms the best preparation where economy is necessary. Equal parts of glycerine and water and olive oil are sometimes employed with advantage. The quantity of fluid sufficient to distend the rectum and colon varies between one-quarter of a pint in the smallest animals and one pint in the largest. If a larger quantity is used it will pass the ileo-cecal valve and traverse the small bowel, and if in sufficient amount will reach the stomach.

In most animals the ileo-cecal valve is patent, but where it is not, it effectually prevents the passage of fluids, even if the latter be forcibly injected. I have established by experiment that one-half a gallon of water is sufficient to traverse the whole extent of the intestines and reach the stomach, in a fox terrier, and a little over a gallon to have the same effect in a setter. It must, however, be remembered that where a solid fecal obstruction is being attacked a continuous stream should, of course, be kept up, as it escapes by the anus as fast as it is thrown in.

Medicated injections employed for their local effect on inflammatory conditions of the intestinal mucosa may be advantageously used in quantities somewhat larger than those used to merely unload the bowel. Or, a preferable way is to carry out a veritable irrigation of the bowel by means of an inlet and outlet tube, the latter being attached to a fountain syringe in this case. The irri-

gation should be continued until the returning fluid runs clear. The medicaments mostly employed are protargol, nitrate of silver, or tannic acid (1:100), or bichloride of mercury (1:5000). When the latter is used, a pure water injection should follow it immediately in order to guard against absorption of the drug into the system.

Nutritive enemata are employed to utilize the well-known absorptive power of the mucosa of the lower bowel. There are many useful commercial predigested preparations which can be employed in this manner with advantage. It would seem, however, that predigestion is not altogether essential, for Voit and Bauer found that egg-emulsion with the addition of a pinch of sodium chloride was easily absorbed by the mucous membrane of the rectum and colon. Eichhorst made similar observations. Other experimenters have found that under certain conditions an antiperistalsis of the bowel may take place (Nothnagel, Bernheim, Gruetzner, Swiezynski). Nothnagel observed that salt solutions injected induced a retrograding current.

Nutritive enemata should be heated to body temperature. Three or four a day suffice.

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The Rectum and Anus

EXAMINATION.

The anus is examined by direct inspection and palpation, the rectum by dilating the anus with a speculum and reflecting light rays within by means of a mirror. The rectum may also be palpated in part through the abdominal wall.

CONGENITAL MALFORMATIONS.

Congenital occlusion of this portion of the alimentary tract is of occasional occurrence. Its usual seat is in the region of the anus where the integument remains imperforate or the rectum ends in a blind pouch. It will be remembered that in fetal life the rectum is formed from hypoblast and mesoblast while the anus is developed by invagination of epiblast, which as development proceeds joins the hind-gut by absorption of the intervening septum. If this process should fall short of completion the condition in question is produced. It is a condition which is rarely discovered until symptoms of rectal obstruction have developed. Assimilation of its mother's milk by the suckling is very complete in the alimentary canal so that very little fecal waste takes place. Consequently, the effect of an imperforate excretory office of a young animal may not be pronounced for some days. Moeller saw one puppy which had lived twenty-six days before its condition became manifest.

Symptoms and Diagnosis. The malformation may be suspected by the exhibition of persistent yet ineffectual attempts at defecation, a distended abdomen, and disinclination to nurse. When the anal opening alone is wanting, the skin covering it is observed to be

unnaturally prominent owing to distension by the underlying feces, but where both rectum and anus are imperforate, this prominence does not exist. Imperforate rectum alone is diagnosable only with the aid of a probe.

Treatment. A trocar of proper size may be employed to effect an opening by puncture, but the operator must avoid injuring the sphincter. An improvised bougie should be passed two or three times daily to prevent the formation of cicatricial adhesions, and the parts may be touched with lunar caustic as found necessary.

FOREIGN BODIES.

Foreign bodies which have escaped arrest in their progress along the intestinal canal sometimes find lodgment just within the anus. This is particularly true of fragments of bone. These are apt to partially penetrate the wall and set up inflammatory disturbances. Their presence is usually complicated with coprostasis owing to the animal's disinclination to defecate on account of the pain accompanying that act.

Symptoms and Diagnosis. The symptoms are similar to those of coprostasis. Palpation with the finger in the rectum will reveal the presence of a foreign body.

Treatment. The indications are to effect removal of the body, if necessary with the aid of a rectal speculum and forceps.

PSEUDOCOPROSTASIS.

This is a condition which occasionally occurs in long-haired dogs, the hair around the anus becoming glued with fecal matter, which forms, so to speak, a firm plaster over the anal orifice, and effectually inhibits the function of defecation.

Symptoms and Diagnosis. The symptoms are those of coprostasis. Examination of the anus will reveal the condition.

Treatment. The only treatment required is to clip away the hair from the anal orifice, to disintegrate it by hot applications, and follow this up with a brisk purgative.

SUPPURATION OF THE ANAL POUCHES.

This disease is common, particularly in males. Normally, the glandular wall of the anal pouches secretes a greyish or brownish

viscous matter of nauseating odor and acid reaction which traverses a short conduit to be discharged by a circular orifice on either side of the margin of the anus. In animals of sedentary habits the secreting surface often becomes inflamed and the character of the secretion altered. The latter, more or less purulent, accumulates and gives rise to a swelling or chronic discharge, which in house dogs is particularly objectionable. When an accumulation occurs, the animal by its own efforts sometimes succeeds in relieving itself, but if the matter finds no outlet, it is apt to break through the skin immediately outside the anus and discharge externally, forming a fistula. If thorough discharge takes place, the fistulous tract may close and spontaneous healing follow in the course of a few days. Recurrence is not uncommon.

Symptoms and Diagnosis. The subject of this disease first suffers from pruritis, from which relief is sought by constant licking or biting at the anus or dragging it along the floor. In this manner the matter may be expelled. Defecation, being painful, may be suppressed, and may lead to coprostasis, but there is often straining in the defecatory posture in an attempt to expel the matter which must not be confounded with defecatory efforts. Digital palpation of the parts reveals a tense or fluctuating enlargement, which is hot and very sensitive to pressure. Sometimes the matter finds almost continuous vent at the anus.

Treatment. Expulsion of the contained matter must be brought about by local pressure exerted by the thumb and index finger on either side of the anus. This procedure should be repeated for a week or two as often as the sac fills, and if the disease then shows no sign of abating an injection of strong corrective solution must be made within the pouches in the following manner: Secure the animal firmly in the ventral position and dilate the anus with a speculum, the two blades being inserted superiorly and inferiorly respectively, so that the excretory orifice of the two sacs will be in view on either side immediately within the anus. Armed with an aspirating syringe containing some peroxide of hydrogen, and to which a fine nozzle is attached, direct the latter in turn within each excretory orifice to the depth of the pouches. Inject the peroxide, withdraw the nozzle and squeeze out the frothing matter by extranal pressure. Cleanse the parts with a wad of absorbent cotton in the grasp of hemostatic forceps. Then fill the

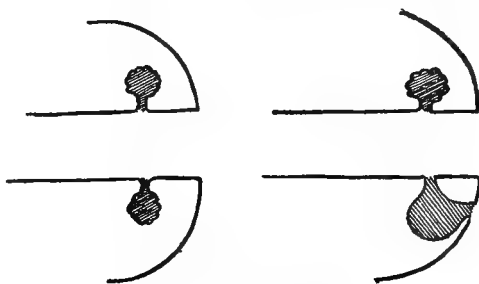
syringe with a solution of nitrate of silver or protargol (3:100-5:100), or a strong tincture of iodine, reinsert the nozzle and inject the solution.

In a day or two a painful but regenerative local suppurative inflammation follows, and the matter can be squeezed out at intervals.

Failing by this procedure, the animal must be anaesthetised, a probe-pointed grooved director inserted, and the pouch opened up and laid bare to the intestinal canal. The pouch is then irrigated and its walls either cauterised or scraped with a sharp curette.

ANAL FISTULA. ANAL SINUS.

True anal fistula is rare. As has been pointed out elsewhere, the term fistula comprehends any abnormal tract having two orifices of discharge, while the term sinus is more properly applied when there is but one orifice of discharge. An anal fistula to be true and complete must have two orifices, one situated in the rectal mucosa, the other in the perianal cuticle. When it has but an external orifice and the other extremely in a cul-de-sac it is incomplete, or more properly a sinus. The majority of abnormal tracts about the anus are tracts of discharge leading from suppurating anal pouches, opening externally just without the anus. At the same time there exists the normal excretory orifice within the anus, but the fact of the existence of the latter does not make the condition one of fistula. It is rather one of sinus.



No. 43. Anal Sinus.

However, true fistula does sometimes occur as a result of wounds caused by lodgment of foreign bodies, particularly sharp fragments of bone, and other tracts arise from malignant neoplasms, tuberculous abscesses, purulent prostatitis, disease or lesions of neighboring bones, and external traumatism.

Symptoms and Diagnosis. As with inflammation of the anal

pouches, pruritis manifested by licking or dragging the anus along the floor, is a constant symptom. The usual form,—the external incomplete fistula or rather sinus,—gives vent to a purulent discharge. A true complete fistula may discharge fecal matter. The probe should next be brought into use, to definitely determine the exact course of the tract, but it must be remembered that should the probe reach the lumen of the rectum, in the majority of cases it is because it has passed through the normal excretory orifice, and that this does not indicate the presence of a complete true fistula. The probe and the speculum will always serve for making a differential diagnosis.

Treatment. In discharging anal pouches treatment must be directed towards promoting a healthy secretory surface within the gland, and for this purpose injections of solutions of nitrate of silver or tincture of iodine as indicated under Suppuration of the Anal Pouches should be employed through the abnormal tract until the latter heals, which it usually does before long. In true fistula the object is to destroy the wall of the tract. A grooved director is passed through the fistula tract till its extremity projects within the lumen of the gut, and it is manipulated so that its extremity is pushed out through the anus. All the tissues intervening between the director and the ano-rectal canal are then divided, and the wall of the tract, including ramifications, curetted. Internal incomplete fistula is treated in a similar manner, but it must first be converted into the complete form, and to accomplish this the anus must be dilated with a speculum.

Where the condition is dependent upon some other disease or lesion, treatment must vary accordingly. Neoplasms must be extirpated.

Following the operation the wound should be irrigated if found necessary. If the sphincter has been necessarily divided, incontinence is thereby created, but this only lasts for a certain length of time until reunion of the fibers has taken place.

HEMORRHOIDS. PILES.

The typical hemorrhoidal condition is a very rare complaint. It is often confounded with the very common condition of enlarged and suppurating anal pouches. Old dogs of sedentary habits occasionally suffer.

Hemorrhoids are composed of varicose or dilated veins of the hemorrhoidal plexus. When they have for their covering the skin about the anus they are termed "external," and when they are limited by the mucosal membrane within the anus they are termed "internal." Both may co-exist, when they are described as "mixed." The external variety is usually seen as a cluster of small cutaneous projections made up chiefly of hypertrophied perirectal connective tissue, which may be secondary to inflammation of the anus or rectum, and not truly hemorrhoidal. When the external veins are involved, phlebitis may lead to thrombus, and they are then apt to rupture, forming a soft tumor, which may suppurate, and eventually become a fistula. The internal variety is composed of numerous enlarged vessels, hypertrophied connective tissue, and mucous membrane. This variety may exist in the form of a tumor composed of a varicose vein, connective tissue, and a few arterial twigs, which tends to protrude, especially during defecation, or as a collection of sessile ulcerating excrescences which are very prone to bleed when irritated by fecal masses.

The cause of hemorrhoids may be sought in anything which may obstruct the portal circulation, such as coprostasis, hepatic congestion and cirrhosis, enlarged prostate, proctitis and other diseases of the rectum, and chronic cardiac disease. These conditions lead to stasis in the hemorrhoidal veins, the more easily on account of the freedom of the latter from the valves.

Symptoms and Diagnosis. The chief symptom in the early stages is pruritis, manifested by the animal constantly dragging the anus along the floor or licking the parts. Later there appear the hemorrhoidal knots, and if the veins burst, considerable local swelling. The pain may cause suspension of defecation. In the internal variety there may be passage of blood. Rectal exploration is painful.

Hemorrhoids may be confounded with polypi, which, however, have a distinct pedicle, with prolapsus, and with suppuration of the anal pouches, to differentiate from which a careful examination is necessary, or with neoplasms, which are usually characterized by induration.

Treatment. Simple pruritis and hemorrhoids of recent origin or free from ulceration are amenable to medication and regulation of diet. Treatment consists of administration of remedies which

overcome constipation, cold enemata, and appropriate injunction. When chronic or ulcerated, protruding internal piles are best removed with clamp and cautery under general anesthesia, as follows: Hopper the animal and dilate the sphincter with a speculum. Seize the tumor with forceps, draw it out, and clamp it at its base in a direction parallel with the longitudinal axis of the gut. Cut it off far enough from the clamp to leave sufficient stump for searing, and apply the cautery. Instead of cauterising, a ligature may be employed. The non-protruding form is best treated by punctate cauterization, the point of the cautery being made to penetrate the substance of the tumor.

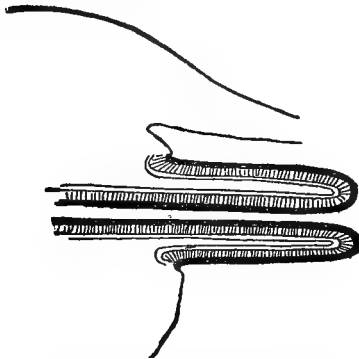
When the external variety requires operative treatment it may be seized with forceps, dissected from neighboring tissues, the pedicle tightly ligated with silk, the tumor cut off on the occluded side, and the wound sutured. Where blood has been extravasated the tumor should be incised, the clot removed, and the skin sutured. An abscess is treated in the usual manner.

PROLAPSE OF THE ANUS. PROCIDENCE OF THE RECTUM.

Distinction must be made between simple prolapse of the rectal mucosa for a short distance, and true eversion or procidence of all the rectal or intestinal tunics. The former condition probably has its origin in a local hyperemia, while the latter is of the nature of intussusception, and is due to any cause which may induce an exaggeration of the normal ejaculatory functions of the rectum. Simple prolapse of the mucosa may, by a constant and increasing

dragging effect cause the muscular tunic to follow. Weakness of the external sphincters and of the supporting action of the levator ani may at times aid in producing the conditions.

Procidence of the rectum is seen quite frequently in puppies suffering from intestinal catarrh and parasites. In older dogs, anything which will cause the animal to unduly strain, such as chronic constipation, diarrhea



No. 44. Procidence of the Rectum.

with tenesmus, rectal polypi, hemorrhoids, urethral stricture, enlarged prostate, labor pains, and the injection of superhot or irritating clysters, may lead to eversion of several inches of the rectum.

In some instances portions of the colon or even the small intestine may form the protrusion. The importance of accurately determining whether such is of local origin or not, is shown by the experience of Walley. A three-months' old St. Bernard was destroyed after all the usual methods of effecting permanent reduction had failed. At the necropsy it was established that some ten inches of ileum had been forced through the ileo-cecal valve into the rectum and the supposed rectal procidence was in reality an instance of ileo-cecal invagination, which could only have been treated by abdominal section.

Symptoms and Diagnosis. Simple prolapsed mucosa is easily recognized as such. A typical protrusion presents the appearance of a curved cylinder with the mucous membrane considerably swollen. At the apex and in the center of the cylinder is the orifice of the canal. In the early stages the protruding tissue is covered with mucus and prone to bleed on coming in contact with any rough surface. In the later stages the mass is more or less indurated with patches of ulceration and gangrene, particularly at the dependent extremity. The passage of semi-solid feces is possible.

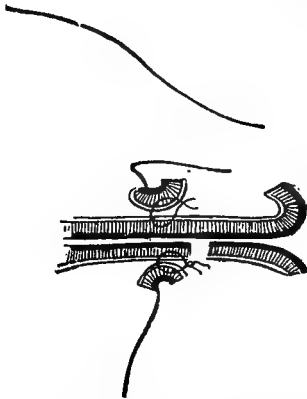
Treatment. Simple prolapsed mucosa is best treated by linear cauterization as follows: Seize it in five or six places with as many pairs of forceps, draw it out and make three or four radiating stripes with the cautery through the mucosa only.

Procidence of the rectum is one of the most intractable mishaps in canine surgery. When the everted rectum has not become congested it is not a very difficult matter to return it to its proper position with the assistance of a little lubricant. By a digital kneading process, commenced at the extremity of the protrusion, the latter is gradually worked into the lumen. Replacement having been effected, the next difficulty is to prevent further eversion. For, recurrence of the trouble is very prone to take place, sometimes shortly afterwards, at other times several hours later. Various contrivances have been used as preventive means. The tobacco-pouch stitch to constrict the anal opening, has been much used, but very often it is efficient only as long as it is allowed to remain. Degive recorded an instance of procidence, in which he made three

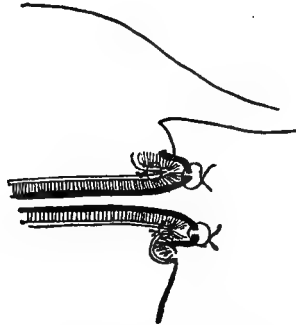
consecutive attempts at anal suturing, but with ultimate failure. Finally, he performed celiotomy, and withdrew the bowel through the pelvis. He did not attempt to stitch the bowel to the abdominal wall, and there followed another eversion, and ultimately the death of the animal. Of late the Gersuny operation has met with some success. This consists in injecting melted paraffin wax (specially prepared for the purpose) into the submucosal tissue at the anal margin to form pillars which act as barriers to further protrusion.

Failing replacement by the above simple measures, two operations only offer any reasonable chance of a successful issue. The first and simpler of the two is amputation of the everted portion; the other, celiotomy, withdrawal of the protruding portion, and suspension of the same to the abdominal wall (ventrofixation) by sutures. Amputation may always be recommended, but the other method is contra-indicated where there is present much gangrene. Unless the trouble is remedied by simple measures shortly after its first occurrence and before congestion has taken place, it is generally useless to temporise with simple reduction and anal suturing. To the animal the return of the inflamed and swollen parts must feel of the nature of a foreign body, and efforts are immediately put forth to again bring about its evacuation. However, straining can be prevented for several days subsequently by inducing chlorotone narcosis.

The best method of amputation is as follows: The animal being hopped in the ventral position and given a general anesthetic, and the tail being held out of the way by an assistant, grasp the protrusion with fixation forceps and extend it as far as possible from the anus, and apply close to the latter a small rubber band or ligature to act as tourniquet. Make a circumscribed incision through the external intestinal tube parallel to the anal margin and a short distance posterior to the ligature. The internal tube must now be held steady, as but slight traction will pull it away from the peritoneal cavity, which is not desired. Seize the anal margin of the severed external tube, which by this time is much retracted, with the hemostatic forceps and roll it outwards on itself, thus exposing its serous membrane. Pass a fine silk suture threaded to a fine milliner's needle into the serosa and deeper layers of this tube (but not past the submucosa) and out again, and then pick up a similar piece of the inner tube. Tie this stitch and cut the ends off close, thus bringing the two serous surfaces into apposition at



No. 45a. Amputation of Rectal Procidence. First stage.



No. 45b. Amputation of Rectal Procidence. Second stage.

this point. Use the same kind of stitch on the opposite side, and repeat it between these two until a complete circle of interrupted sutures has been inserted and tied, from six to eight generally sufficing for the entire circumference of the gut. The only vessels which require particular attention are the median hemorrhoidal, running on the lateral aspect of the internal tube, and these can be included in one of the sutures. While severing the external tube, the venous branches returning on the serous surface of the external tube, and which are more or less prone to bleed owing to the congested condition of the area they supply, may require to be seized with hemostatic forceps, and so held until the hemorrhoidal vessels are secured. As soon as the serosa-serosa suturing is completed the occluded side of the intestinal tube, which is now the only part connected with the procidence, is quickly severed close to the line of sutures with either scalpel or scissors. To complete the operation, approximate the two mucous surfaces with continuous silk sutures, clean the stump and push it back within the anus.

The best anesthetic to use is chloretone, its prolonged narcotic effect being desirable as tending to allay subsequent straining.

Hobday inserts a sound or clinical thermometer case within the lumen of the inner layer. Four or five catgut interrupted sutures are passed through the two layers down on to this and back again, and tied close to the sphincter, in order to prevent retraction of the inner layer, and the procidence is amputated.

Viborg and Stockfleth insert a hollow cone of wood (carrot answers as well) on which there is a groove within the lumen, and then ligate both layers on to this and amputate the occluded por-

tion. This method produces pressure-gangrene and inflammatory adhesion at the line of ligation.

Moeller passes two threaded needles crosswise through the protrusion close to the anus. He then cuts through at a distance of one-half to one inch posterior to the stitches and draws forth both stitches from the lumen of the inner layer. After cutting through the center of these, four sutures remain in position. If necessary (in larger animals) two extra stitches may be passed diagonally between these and treated in the same manner. All the sutures are tied and the stump is pushed back into the cavity.

To all these latter methods one serious objection may be offered,—they do not take into account the possibility of the protrusion being the sac of the hernia and containing a coil of intestine, which would run the risk of being included in the ligatures or sutures.

NEOPLASMS.

The type of tumor met with in the anal region is epithelial or glandular. When it originates in the skin immediately outside the anus it is epithelioma, and when it grows within the rectum just within the anus it is adenocarcinoma, though simple adenomata of the peri-anal glands are sometimes found outside the anus. Sutton regards the majority of anal tumors as innocent sebaceous adenomata.

Symptoms and Diagnosis. The epitheliomatous tumor has a characteristic shape, being wart-like or in the form of a cauliflower-like excrescence, and may be pedunculate. Froehner has pointed out that this pedunculation is sometimes very suggestive of lipoma. Its surface may be ulcerated with raised and hard edges, and give vent to a turbid, evil-smelling secretion, which cauterizes the adjacent skin. The tumor may be unilateral, bilateral, or situated above or below the anal opening or it may be composed of numerous knots completely encircling the same. In size, it may be as large as a hen's egg or an apple, and in consistence, usually soft but sometimes hard. Its surface color is red or bluish-red. It is easily distinguished from suppurating anal glands by absence of fluctuation, but the knotty form needs careful examination to differentiate from external hemorrhoids. A good rule is to regard all rapidly-growing tumors of this region with suspicion.

Treatment. All tumors of the anal region should be totally

ablated as soon as possible, the incisions being made well into the healthy skin. A general anesthetic should be given. There is usually a prominent nutritive vessel which must be securely ligated. The general technic for removal of tumors is described in the chapter on Neoplasms.

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The Liver

EXAMINATION.

Very little of the normal liver can be palpated through the abdominal wall. When, however, the organ is the seat of neoplastic or inflammatory changes, this method of examination is very helpful in enabling the practitioner to arrive at a definite diagnosis. But as with other visceral organs a confirmatory explorative celiotomy is usually necessary.

TRAUMATIC LESIONS.

These consist of wounds resulting from stabs or the passage of missiles, and rupture through sudden application of force to the abdomen such as may occur at a run-over, without the superficial parts exhibiting any trace of injury. Rupture is always very serious because the blood-vessels are held open by the inelastic substance in which they are embedded. I have seen the latter lesion take place from the kick of a horse and be followed by death within ten minutes from hemorrhage, and Goubaux records witnessing an animal die from it within a few minutes after receiving a violent blow in the abdomen.

Symptoms and Diagnosis. Diagnosis of internal hemorrhage is always difficult and seldom in time for surgical interference. It can only be by constitutional symptoms, viz., blanching of mucous membranes, coldness of extremities and failing heart. There is usually great tenderness immediately over the seat of lesion.

In all suspected cases explorative celiotomy should be undertaken.

Treatment. Bleeding from slight lacerations can be controlled by direct pressure or thermo-cauterization after the abdominal cavity has been opened. Severe wounds should be treated by excision of the affected lobe.

NEOPLASMS.

Most neoplasms of the liver are malignant and secondary, the latter consisting of carcinoma and sarcoma. Innocent growths occur in the form of adenoma and cavernous angioma. Trasbot has seen lipoma. Cysticerci have also been occasionally observed.

Symptoms and Diagnosis. A neoplasm that has grown to any considerable dimensions causes a noticeable change in contour of the abdomen, which in females may lead to a supposition of pregnancy. Palpation will reveal the presence of a freely mobile mass within the cavity. Malignant growths are accompanied with cachexia and emaciation. Intraabdominal tumors can only be definitely located by explorative celiotomy.

Treatment. Only non-malignant neoplasms are eradicable, and they are removed by partial hepatectomy or extirpation of the whole of the affected lobe with ligation of all vessels. Hobday attempted the removal of an adenoma, but the operation was unsuccessful owing to hemorrhage.

CHOLELITHIASIS.

The formation of free concretions in the biliary passage is extremely rare. Froehner has observed and described a case in which a calculus of the size of a cherry stone was found in the ductus choledochus in an eight-year old Leonberger. In Paris and in Baltimore gall stones had been experimentally produced in dogs by the inoculation of weak cultures of the colon bacillus into the gall bladder, thus indicating that such stones are indications of previous low inflammatory infection of the mucous membrane of the gall bladder.

Symptoms and Diagnosis. The symptoms vary according to the seat of lodgment of the obstruction. If it lodges in one of the hepatic ducts or in the ductus cysticus, colic is induced without icterus, whereas if it should completely block the exit of the bile by lodging in the ductus choledochus, obstruction or hepatogenous icterus develops. In Froehner's case death took place within a few

days with symptoms of profound icterus. Ante-mortem diagnosis would be almost impossible without explorative celiotomy.

Treatment. The only effective treatment in cases of this nature is to remove the obstruction by incising immediately over it and afterwards suturing, as is performed quite commonly in human surgery.

Surgery of the Liver

It is possible to remove a considerable portion of the liver without endangering life or health. According to Ponfick, three-fourths of the organ may be extirpated in the rabbit, and the lost portion will become replaced within a few weeks by regeneration of specific liver tissue. Gluck endeavored to extirpate the entire organ in several animals. Of these, two were alive the morning of the seventh day and eating well, but the remainder died of peritonitis or thrombophlebitis of the inferior vena cava soon after the operation, though no necrosis of the ligated portion followed when strict asepsis had been observed, nor was there any secondary hemorrhage. It was found impossible to completely excise the organ because of the inferior vena cava being solidly embedded in the Spigelian lobe.

The operation of Cholecysto-enterostomy, the establishment of artificial connection between the gall-bladder and part of the intestine, generally the duodenum, has been successfully performed experimentally. L. R. Mueller records an instance of natural union between a cholecystic gall-bladder and the intestinal tract by development of an intercommunicating fistula. He divided the bile-duct after having doubly ligated it. In spite of this the severed ends reunited, the ligatures became partly encapsulated and the canal regained slight permeability. Murphy has done the operation by means of his anastomosis-button. Previously, Colzi, De Page, Harley, and others had experimented on dogs by suturing the wall of the gall-bladder to that of the duodenum, and establishing a fistula between the two through chemical destruction or incision within the circle formed by the sutures. At the necropsies which Murphy conducted after the animals had recovered and had been destroyed it was found that a valve had invariably formed on the intestinal side of the opening, thus preventing the contents of the duodenum from finding ingress into the bladder.

In practical surgery it is very rare that operative interference of the liver is indicated. A few instances of removal of tumors have been recorded. But most liver tumors are secondary, showing the disease to be generalized and operative measures useless.

Partial Hepatectomy. To reach the organ most directly the incision in the abdominal wall is made on the right side, extending from the ensiform process upwards close to the borders of the ribs. A very large opening is usually necessary, particularly when a very voluminous growth is present. An affected lobe should be removed in its entirety, all vessels entering it being previously secured.

Gluck has counseled the employment of rubber bands in lieu of ligatures. All bile should be promptly wiped away, as it is apt to contain pyogenic microorganisms.

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The Pancreas

There are practically no diseases or lesions of the pancreas which are remediable surgically. It is very rare that the organ suffers injury either by direct or indirect violence, owing to its remote location. Malignant neoplasms occasionally occur, but their presence is seldom discovered until the disease process has extended and hopelessly involved other organs, notably the ductus choledochus. *Cysticercus cellulosae* has occasionally been found in the organ.

Surgery of the Pancreas

Berard and Colin have demonstrated that the pancreas has no connection with the duodenum at one stage of its development. It is originally composed of two distinct portions, the one lying parallel to the duodenum, and the other perpendicular. Later

these two sections effect a junction and become adherent to the duodenum, the outcome of which is the common duct. This fact has some bearing on the surgery of the organ, as will be presently seen.

Vaughan Harley describes the organ in the adult animal as follows: It consists of two portions, the vertical and horizontal or subgastric. One extremity of the vertical portion lies in the mesentery away from the intestine, the other in close connection with the duodenum, where it joins the horizontal portion to form as it were the head of the gland, opposite the junction of the stomach with the duodenum. The blood-supply is from the pancreatico-duodenal vessels. The horizontal portion is longer. It runs from the point of union to the two parts below and somewhat behind the stomach as far as the spleen, then turns downwards and ends in a mesentery of its own on the level of about the middle of the left kidney. In this portion the splenic vessels run, and in extirpating it, it is necessary to separate them from the gland substance.

In the light of considerable experimental surgery that has been performed on the pancreas, physiologists concede that the gland normally not only excretes into the alimentary canal but yields up some substance to the blood, and that there is a constant breaking down of sugar in the blood. If glucose be added to aseptic blood it is used up in twenty-four hours.

As long ago as 1682 Brunner wrote that total ablation of the gland was impracticable. More recently, the researches of von Mering and Minkowski have shown that complete extirpation is always followed by diabetes mellitus in severe form. Sugar was found in the urine in some cases four hours after operation. Bernard, Klebs and Munk, Finkler, Martinotti, Heyden, Vaughan Harley, Senn, Hédon, and Mouret made some observations, finding that complete suppression of the pancreatic function was incompatible with the animal's existence.

Senn showed that complete division of the organ through its middle portion leaving the excretory duct intact was not dangerous, provided hemorrhage, both arterial and venous, was controlled. The detached portion never regained its physiologic importance, and the parenchyma was removed by absorption without any ill-effects being noticed in the animals. Removal of the entire organ

was invariably followed by fatal results. In six animals (cats and dogs) operated upon, death occurred within a few hours to nine days, either from shock, profuse hemorrhage, or gangrene of a portion of the duodenum, owing to that part of the bowel being deprived of its mesenteric vascular supply over an area corresponding to the attachment of the pancreas.

Hédon and Mouret grafted portions of the pancreas subcutaneously in a number of dogs in the following manner: Celiotomy was performed and the vertical portion separated from the rest of the organ at the level of its junction with the head by means of a ligature, without interfering with its vascular supply, it being nourished by a special artery. This portion was then secured to the subcutaneous tissue by sutures, its vascular pedicle passing through the opening in the abdominal wall. In two or three days after fixation a large retention-cyst formed through the persistent secretion accumulating behind the ligature and distending the ducts. A fistula resulted, but finally the secretion stopped and this portion of the gland comported itself like a ductless gland. In three weeks union was established with the subcutaneous tissue, and newly-formed vessels sufficient for its nutrition had penetrated the graft. The vascular pedicle was then suppressed and the graft was complete, but the latter was found to undergo progressive atrophy under the influence of connective tissue growth. In these cases, if the abdominal portion of the gland remaining *in situ* was extirpated, with a few exceptions no glycosuria developed provided the grafted portion had not undergone advanced atrophy. But if much atrophy was present there was considerable glycosuria. The graft being extirpated, severe glycosuria appeared and terminated the life of the animal.

Senn found that if he left the organ intact but occluded the excretory duct, which rendered the animal physiologically in the same condition as after complete extirpation as far as intestinal secretion was concerned, the health remained perfect for three or four weeks, but death resulted from marasmus in two to four months. From this it will be seen that removal of the pancreas must not comprehend resection of more than a portion of the organ, and that the duct should be left intact.

Senn has shown that the operation is not dangerous provided hemorrhage, arterial and venous, be controlled, though Vaughan

Harley regards the mere effects of operation as very fatal, particularly from shock.

The mode of operation is as follows: Incise the abdominal wall from the ensiform cartilage backwards for three to five inches slightly to either side of the linea alba. Draw the duodenum forward and separate the portion of the organ it is intended to remove from its intestinal attachments. Doubly ligate all vessels. The horizontal portion is reached by raising the spleen and great omentum, or to simplify matters the latter can be completely removed. Removal of the isolated portion can then be effected by simple incision between the double ligatures. Senn advises the employment of rubber-bands and prevents the knots made in them from unfastening by transfixing them with a silk ligature. He also advocates the severance of tissues by tearing rather than by cutting, and states that it is not essential or necessary to remove detached vascular portions of the gland as atrophy of the parenchyma ensues, but it is highly important to remove parts deprived of their vascular supply.

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The Spleen

EXAMINATION.

The spleen is easily felt in thin animals by abdominal palpation with the fingers of both hands. In this manner neoplastic changes can be detected without difficulty.

CONGENITAL MALFORMATIONS.

Accessory spleens sometimes occur. Spreull observed an instance in which the organ was separated into two distinct portions by a space of two inches.

TRAUMATIC LESIONS.

This organ suffers similar lesions to the liver. Wounds are always dangerous, as they lead to rapid and profuse hemorrhage. They may occur as a result of perforations of the abdominal wall from stabs and the passage of bullets. Accidental wounds inflicted during the course of surgical operations are also serious. On one occasion when I was performing oophorectomy, the organ extruded itself during suturing of the abdominal wall and sustained an accidental puncture by the needle, from which there was considerable hemorrhage. The operation was not concluded until it was believed the bleeding had been permanently arrested, but secondary hemorrhage took place, with fatal termination.

Symptoms and Diagnosis. The same remarks on diagnosis of wounds of the liver are applicable to wounds of the spleen. If a wound is suspected, an explorative celiotomy should be promptly undertaken.

Treatment. Pronounced wounds should be treated by splenectomy. Parkes says that removal of the organ for acute wounds nearly always results in recovery. Hemorrhage must not be arrested by ligature, but direct pressure or thermo-cauterization suffice where there is no extensive laceration.

NEOPLASMS.

Both innocent and malignant growths of the spleen occur. Of the former the commonest are hematoma, hypertrophy, and cysts. About three per cent of all necropsies disclose the presence of single or multiple innocent splenic growth. A form of growth known as leukemic adenoma occurs usually associated with similar enlargements in the other lymphatic glands, which are of a progressive and lethal nature. Malignant neoplasms are usually secondary.

Symptoms and Diagnosis. Splenic neoplasms can only be definitely demonstrated by explorative celiotomy though they may be felt as a mobile mass on palpation. When they reach a considerable size they cause a change in the contour of the abdomen.

Treatment. Only cysts, hematomata, and non-leukemic hypertrophy are operable and these should only be interfered with when of such dimensions as to interfere with the comfort or health of the

animal. They are removed by partial or complete ablation of the organ.

Surgery of the Spleen

It has long been known that the dog will survive complete removal of this organ. Aristotle wrote: "The spleen is not an organ which is indispensably necessary to the body." Among the earlier writers Pliny and Clarke mention that spleenless dogs not only live after operation but even seem to improve in condition. Bardeleben recorded the recovery of three dogs from which the organ had been removed. Vulpian performed complete extirpation and the subject lived six and one-half years without inconvenience, and Crips saw two dogs alive five months after the operation. In recent years Picard and Malassez, Bizzozero and Salvioli, Zesas, Vitzon, Gibson, and Frouin have performed complete splenectomy experimentally with recovery. Gibson found that total extirpation was followed by a decrease in the number of red corpuscles in the blood and a relative and absolute increase in the number of white corpuscles, and the animals gained weight. In one case, the subject was killed six months later and the mesenteric lymphatic glands were found to be distinctly enlarged. Gibson concluded that the spleen has a blood-forming action which is perhaps a subordinate one. Jordon had less favorable results with complete extirpation. Of six dogs submitted to this operation, all suffered considerable shock and three died. In cases where the organ was partially removed, the animals appeared to suffer no inconvenience when the lower half was excised, but suffered greatly when the upper half was removed. Kuester ligated portions of the splenic omentum and vessels. The corresponding part of the organ became greatly swollen and ultimately atrophied. Jonnesco, and Carrière and Vanverts ligated the whole of the gastro-splenic omentum, including the vessels, and found that abscess formation might result in certain cases. Investigating the matter, the latter observers discovered that in eleven healthy animals, ten showed the presence of microorganisms in the organ. The bacteria were more plentiful immediately after the animals had eaten. They consisted of staphylococci, streptococci, and colon bacilli, but their virulence was impaired. Hédon transplanted the spleen subcutaneously in the same manner that he transplanted the pancreas.

Like other important glands, when the spleen is removed in part, the remaining portion will undergo compensatory enlargement. An instance is recorded by Landenbach in which the organ was almost entirely extirpated and six months later was found to have become completely regenerated.

COMPLETE SPLENECTOMY.

The animal being anaesthetised and hopped in the dorsal position, make the abdominal incision slightly to the left of the linea alba immediately anterior to the umbilicus. Insert the fingers in the left hypochondrium and draw the organ forward through the wound. Secure all vessels and their supporting tissues at the entrance to the hilus in three or four silk ligatures and make the division on the occluded side.

PARTIAL SPLENECTOMY.

Secure the vascular branches supplying the portion of the organ it is intended to remove with very strong double silk ligatures and divide between the knots. Apply an elastic ligature around the organ or ligate it in half-inch sections with continuous silk suture, and remove the occluded mass with scissors.

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CHAPTER VII.

The Abdomen—Continued

THE URINARY ORGANS.

Urolithiasis

The formation of free concretions in the urinary tract is of fairly common occurrence. It is believed to depend upon two factors, viz., a *Systemic* alteration or modification of metabolism, and a *Local* alteration in the urinary tract. It is believed that there must exist a primary organic nucleus around which the calcareous salts become deposited, or in other words, calcification is secondary to, and dependent upon, local degenerative tissue changes. Such lesion occurs in the healthy aseptic gland secondary to primary uric acid diathesis. Uric acid is a chemical poison, and according to Ebstein, its excessive elimination originates an inflammation which results in cellular necrosis. Such necrosed cells or the albuminoid substance to which their destruction gives rise, form the organic nucleus.

Antoine de Heyde, in 1686, was the first observer to note the presence of the necessary nucleus, and more recently various experiments have been carried out to ascertain the manner in which calculous formation takes place. Tuffier conducted certain of these experiments and observed that aseptic smooth foreign bodies were not modified by a sojourn in healthy urinary passages, neither did the organ enclosing them undergo any alteration by their presence. These results impelled him to study the conditions under which extractive matters of the urine are precipitated on the surface of foreign bodies to form calculi. In order to do this he produced varied chemical composition of the urine. Nitrogenous and phosphatic diet and ingestion of urates and oxalates produced no result when sterile glass marbles were introduced in the kidney and bladder. Nicolaier and Ebstein and Thomassen endeavored to produce artificial lithiasis by incorporating derivatives of oxalic acid

with foodstuffs. The administration of oxamethane and oxaminic acid produced no effect, but oxamide did. Oxamide is an odorless white powder, obtained by heating oxalate of ammonium. It was given in doses of four to six grams for six weeks with as little water as possible. Ebstein's explanation of its effect was as follows: the oxamide was dissolved in the digestive tract, absorbed, and eliminated by the kidneys, where it induced organic alterations, notably in the glandular epithelium. The latter underwent necrosis and thus was produced the initial albuminoid nucleus indispensable to the formation of all calculi. Tuffier repeated these experiments and also examined for the presence of microorganisms on the surface, and in the depths of the calculi with negative result. This upset the bacterial theory of formation in favor of the physico-chemical. The artificial calculi were extracted and the animals subsequently restored to health.

It has been known for a long time that foreign bodies in the bladder are very apt to become encrusted with urinary salts. In the seventeenth century Anton Nuck introduced a piece of wood within the bladder, and found it had become covered with incrustations at the end of several weeks. Tuffier in recent years observed that while a foreign body with perfectly smooth surface did not favor the formation of deposits, one with a rough surface did, particularly if it were septic. On a piece of rough aseptic silk he found deposits, but on smooth catgut there were none. Moreover, catgut was absorbed in two weeks' time. This fact would seem to have an important bearing on the selection of sutures for surgical purposes, but it must be mentioned that Maksimow found that catgut used for cystorrhaphy experiments when it penetrated the mucosa, became the seat of deposit of urinary salts. Znamensky found incrustations on carbolized silk sutures which had penetrated the mucosa, sixteen days after performing a resection experiment. On the other hand, Thomson failed to find any seven weeks afterwards, in an instance where two sutures had penetrated. In certain ureteral-suturing experiments conducted by myself there were no signs of incrustation after periods ranging from three to seven weeks.

Calculi of uric acid or urates (ammonium urate) are usually small, hard, smooth, and yellow, brown, or reddish. They are the most common to be met with, and originate as a result of uric

acid diathesis. Calculi of oxalates (calcium and ammonium oxalates) are believed to occur as a result of oxalic diathesis, and oxalic acid being a derivative of uric acid, the oxalic acid diathesis is a secondary manifestation of the uric acid diathesis. They are hard, variably shaped, but often mulberry-like, and brown or yellow. Calculi of cystin are also believed to be derivatives of imperfect metabolism of nitrogenous substances. They are soft, waxy, and brownish yellow. All these varieties are found pure or mixed in aseptic acid urine, the local lesion necessary to their production being inappreciable, but the principal rôle being played by the uric acid diathesis. The calculi of alkaline urine are mostly secondary to them.

When the crystals form and persist as small gritty particles the condition is termed "sand," "gravel," or sediment. If the crystalline particles become agglutinated by renal or vesical mucus, albumen, degenerated epithelium, or blood clots, the nucleus is started, which grows by further accretion, until a "stone" or calculus is formed.

The other varieties, *i. e.*, phosphates and carbonates (ammonio-magnesium-phosphate, calcium phosphate, calcium carbonate) occur in alkaline urine, and probably often secondary to the acid deposits, a primary acid calculus becoming the seat of phosphatic deposit through the development of alkaline urine as a result of disease of the tract. It is probable that alkaline urine and the presence of products of local tissue degeneration may also result in primary precipitation of phosphates and carbonates. Alkaline urine results from fermentative changes incident to catarrhal inflammations. The latter condition is not uncommon in old dogs suffering from hypertrophy of the prostate with consequent local debilitating effect of stagnating urine. These calculi, with the exception of those formed of triple phosphate, are hard, smooth, and white or greyish, and attain considerable size. The triple phosphatic calculi have rough jagged surfaces.

All these substances may assist in the formation of a single calculus. A uric acid nucleus may be surrounded by phosphates in the presence of altered reaction of the urine. A return of acid reaction is followed by another layer of uric or urate deposit, and so on.

The smaller breeds are more subject to urinary deposits than

the larger. The condition having once developed is very liable to recur. Thus, an animal may be said to suffer from a "uro-lithic habit," but this depends, of course, upon the persistence of the lithemia, which plays the principal rôle in calculous formation.

The clinical importance of urinary calculi depends upon the portion of the tract at which they find lodgment. The practitioner is principally concerned with those found in the bladder and urethra. These will be considered under their respective headings.

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The Kidneys

EXAMINATION.

Surgical diseases of the kidney are diagnosed by examination of the urine, by abdominal palpation, and by direct inspection and exploration. Examination of the urine discloses changes in its physical and chemical properties. The excretion may be increased or decreased in quantity or altogether suppressed, or it may contain blood, hemoglobin, albumen, pus cells, and glandular cells. When blood originates in the kidney it generally becomes intimately mixed with the urine by the time it is discharged, the flow of urine exhibiting its presence from the outset, while when it comes from the bladder it is usually seen towards the end of micturition.

Abdominal palpation with the fingers of both hands, the animal being in the standing position, reveals alterations in the dimensions and situation of the glands.

Direct intraabdominal inspection and exploration by acupuncture or aspiration are necessary to discover the presence and character of abnormal secretions.

CALCULI. (See also Urolithiasis).

Urolithic deposits occurring in the kidney are of minor im-

portance from a surgical standpoint because they may, and generally do, exist without inducing symptoms which can be diagnosed. They are often found at necropsies in animals which have suffered from lithiasis exhibited clinically in other parts of the tract. They are usually small, and probably have their origin in the uriniferous tubules whence they pass to the pelvis of the organ. Should septic processes take place and induce an alkaline reaction of the urine, very large phosphatic calculi may be formed. The two largest renal calculi recorded were found by Guillon, each occupying one kidney and weighing ninety-six and ninety-seven grams respectively. Mégnin observed others weighing six and seven grams. Tuffier produced them artificially.

These bodies may cause irritation and abrasion of the walls of the pelvis of the organ, which may lead to more or less hemorrhage, the blood being carried away with the urine and giving rise to the symptom known as hematuria. If the calculi accumulate in large numbers mechanical distension of the organ takes place. But it very often happens that no appreciable symptoms whatever are evident, and it is hardly to be doubted that many urolithic animals go through life without the faintest suspicion of the fact on the part of their owners. It is when the deposits enter the narrower passages and obstruct the flow of urine that they form a serious menace to the animal's existence. If a deposit becomes lodged in any part of the ureteral canal a retention cyst of the kidney or hydronephrosis results.

Symptoms and Diagnosis. This is very difficult when the kidney is the seat of concretions of dangerous size, and is practically impossible without expulsion of sediment or the smaller calculi. There is usually considerable hyperesthesia of the lumbar region, arching of the back, in some cases strangury, pain at defecation, and there may be painful attacks of colic induced by the passage of calculi along the ureteral tract. Lauteur and Guillon have both recorded witnessing attacks of colic. The alkaline or phosphatic calculi are generally preceded by a history of catarrh of the urinary passages. In some cases there is only stiffness in the lumbar region, in others occasional lameness in one or both hind-legs.

Hematuria may or may not be present, the blood appearing with the last few drops of, or mixed with, the urine, but the amount

of blood may be so slight as to be detected only with the aid of the microscope. It is generally increased with exercise.

Micturition becomes frequent and the animal manifests a constant tendency to lick the genitals, particularly at the end of micturition.

Treatment. If there is reasonable suspicion of the existence of deposits an explorative celiotomy is justified. If the latter has a negative result, it is without serious consequences, while if it has a positive one, a cure may be affected by further operative measures. If on exploration the kidney is found to be healthy and showing no signs of dilation or hydronephrosis, nephrolithotomy, or incision of the organ and extraction of the calculus must be undertaken, but if on the other hand it should prove to be atrophied or hydronephrotic, or complete removal of contained calculi is obviously impossible, nephrectomy or complete extirpation is indicated, provided the opposite gland is in functioning order.

The presence of calculi in the kidney may be detected in some cases by palpation of the organ. Tuffier found it possible to detect them by palpation over the hilus. Failing in this, Lequeu recommends acupuncture with a needle, the point of which coming in contact with a deposit conveys sufficient sensation for purpose of diagnosis. Thomassen practised nephrolithotomy for the removal of calculi artificially produced, with perfect results and with rapid recovery of the animal.

In order to correct the lithemia or local conditions which give rise to calculous formation and to prevent their recurrence a course of medication and special dieting should be adopted. If the case is one of acid lithiasis the administration of alkalies and diuretics is indicated as well as withdrawal of meat. A diet of bread, milk, and eggs is suitable. Alkaline or catarrhal lithiasis is also to be treated with a milk diet supplemented with administration of mineral acids and nux vomica. But in spite of medicinal treatment the so-called urolithic habit will often persist and subject the animal to the necessity of undergoing repeated operations, particularly in the case of impacted urethral calculi.

NEOPLASMS.

The kidneys are rarely the seat of neoplastic formation. The cystic conditions known as hydronephrosis and pyonephrosis oc-

asionally occur, while instances of primary and secondary carcinomata and sarcomata have been recorded.

Hydronephrosis. This term is applied to the accumulation of aseptic matter within the kidney. The lesion originates from obstruction of any part of the urinary tract, and may be partial or complete, and according to the position of the obstruction, may be unilateral or bilateral. The condition is described more fully in the chapter on Neoplasms. It will suffice here to point out that when the onflow of the urinary secretion is arrested, glandular secretion continues for a time and the kidney, together with the portion of the ureter above the obstruction becomes enormously distended. The intraglandular pressure thus produced causes atrophy of the secreting elements, and finally, if the condition continues long enough, nothing remains of the erstwhile kidney but a large fibrous sac with cystic contents.

Unilateral hydronephrosis is not necessarily dangerous, the opposite kidney taking on the function of its degenerate fellow (compensatory hypertrophy). Bilateral hydronephrosis is necessarily fatal, the rapidity of the approach of dissolution depending upon the degree of obstruction to the urinary flow. In one instance experimentally produced by myself, but in which complete occlusion of one of the canals had not taken place, the animal lingered three weeks, all the while gradually becoming weaker and narcosed from accumulation in the blood of non-eliminated poisons.

Symptoms and Diagnosis. In unilateral hydronephrosis, symptoms may be wanting and micturition still taking place. Life may continue indefinitely, the healthy kidney taking on the function of its fellow. In the bilateral form, micturition is gradually suppressed, the animal at the same time exhibiting progressive emaciation, anorexia, and pronounced lethargy. Abdominal palpation reveals the presence of an elastic tumor. Explorative celiotomy should then be undertaken. The abdominal cavity being opened, the tumor is seen intimately adherent to the sublumbar wall, and its base traversed by well-developed blood vessels. The cyst fluctuates.

Treatment. If the degenerative process has not involved the entire kidney and the urinary tract can be made patent again, the gland should be left undisturbed. But if the glandular tissue is hopelessly involved, the only practicable alternative is to perform

nephrectomy or complete removal of the organ. Tapping of the cyst can only be palliative, and it soon fills up again. In a case recorded by Almy, where the cyst was believed to be tuberculous, several successive tapplings and iodine injections were employed without avail.

Pyonephrosis. This term is applied to the accumulation of purulent matter within the kidney. It is always the result of infectious processes derived from the blood or by extension along the urinary tract. It may also result from traumatism. White has recorded rupture of a pyonephrotic kidney.

Symptoms and Diagnosis. The symptoms are obscure. Prominent are anorexia and emaciation. Examination of the urine discloses the presence of albumen, pus cells, epithelial debris and cylinders. In other respects the symptoms resemble those of hydronephrosis, and the same means should be adopted to establish the diagnosis.

Treatment. This is the same as for hydronephrosis.

PARASITES.

The giant Eustrongyle occurs in the kidney very commonly in certain European countries. This parasite gradually destroys the substance of the gland, and when nothing but the fibrous sac remains tends to migrate, usually by the urinary tract. Previous expulsion is exceptional.

Symptoms and Diagnosis. Hematuria is the principal symptom. This, together with coincident manifestation of nervous or rabiform symptoms should lead to suspicion of the presence of the parasite. Explorative celiotomy is then in order.

Treatment. This must be by nephrotomy and extraction of the parasite, or nephrectomy, according to the degree of destruction which the renal tissue has sustained.

Surgery of the Kidney

The kidney is reached by extraperitoneal or transperitoneal celiotomy. By the former method the abdominal cavity is opened in the lumbar region, by the latter, through the linea alba.

In the extraperitoneal operation an oblique incision three to five inches in length is made through the skin at the angular space

formed by the posterior border of the last rib and the transverse process of the first lumbar vertebra. The muscular tissue is then divided by blunt dissection down on to the peritoneum. The index finger being introduced within the wound is made to disengage the peritoneum, but without puncturing it. Between it and the psoas muscles lies the kidney. The latter is brought out through the wound and grasped between the thumb and index finger of the left hand, and is ready for the next operative step. This method is not suitable when much enlargement of the gland exists, in which case the transperitoneal method should be followed, the opening in the wall being made anterior to the umbilicus.

For either operation the animal should be securely hopped in either the lateral or dorsal position and given a general anesthetic.

NEPHROTOMY. NEPHROLITHOTOMY.

Section of the kidney is undertaken for the extraction of calculi and the parasitic *Eustrongyle*. The operation has been successfully performed by Tuffier, Legueu, Thomassen, and Rubay for the extraction of concretions. A longitudinal incision is made at the convex border, where vascularity is at a minimum and hemorrhage, as a rule, insignificant. Superficial vessels of large caliber traverse both faces of the gland, but do not anastomose at the border. The incision is carried through to the pelvis. In case of much bleeding (Tuffier experienced this on one occasion) it can be arrested by a stream of water and compression of the renal artery between thumb and finger. Every vestige of concretion is then removed. Large alkaline concretions sometimes have branches extending into the calyces, which increase the difficulty of their removal. These are best freed by passing a blunt instrument around them. In cases of acid concretions the ureter should be sought and a probe passed down into its lumen into the bladder to make sure that no stone is lodged in it.

The pelvis can also be opened by direct incision, but this position is seldom selected, as a wound thus made is usually followed by the formation of a serious fistula.

Tuffier and Thomassen closed the organ with three or four catgut sutures. If sutures are used they must not be tied very tight, so as to destroy any renal tissue and provoke the formation

of cicatrical tissue. Healing under asepsis is *per primam*. Rubay found it unnecessary to use any sutures at all, but merely returned the wounded organ to its proper position. A minute scar forms at the line of incision.

After-treatment consists in dieting exclusively with milk. Increased micturition usually follows for a few days.

NEPHRECTOMY.

This operation is indicated in advanced cases of hydronephrosis, or whenever the renal tissue has hopelessly lost all power of function, or has sustained severe wounding. The operation must not be undertaken unless the opposite kidney is perfectly healthy. It is difficult where the organ is much distended, and in case of cystic formation it may be found advantageous to first open the sac and evacuate the contents. The pedicle is clamped with blunt forceps. The renal artery and vein are then ligated. It must not be forgotten that these vessels often split up into three or four branches soon after leaving the aorta. Ligation is best effected by means of an aneurism needle, artery and vein receiving each a separate ligature. It is always safest to apply double ligatures, as the risk of hemorrhage from the pedicle is very great.

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The Ureters

CALCULI. (See also Urolithiasis).

Urolithic deposits are seldom found in the ureters, but they occasionally become lodged there in passage from the kidney to the bladder, or they may form on the proximal side of the constriction. Sutton described an instance in which a calculus was found lodged in the vesical end of the left ureter, while there were two large and two small ones in the bladder. Tuffier found calculi of

oxalate of lime in the ureters in his experiments for the production of concretions.

Symptoms and Diagnosis. This is as difficult as in the case of renal calculi. A calculus impacted in the ureter obstructs the flow of urine and results in the formation of hydronephrosis. If the presence of the latter condition can be determined it remains to make an explorative celiotomy to discover the cause of the obstruction.

Treatment. If the obstruction proves to be a calculus, ureterolithotomy or incision of the duct and extraction of the body is indicated.

SURGICAL WOUNDS.

In operating on abdominal viscera it is possible to sever the ureter by mistake or by a slip of the knife. The accident has happened in human surgery.

Treatment. Such a lesion can be remedied by the operation of Anastomosis or Uretero-ureterostomy.

Surgery of the Ureters

The necessity for surgical interference with these important ducts may only occur as a remote contingency, nevertheless every veterinarian should know how to carry such an undertaking to a successful conclusion. Hence, a brief review of the experimental surgery that has been accomplished will not be superfluous.

The ureters are reached by exerting gentle traction on the bladder, whereby they are made to stand out prominently beneath the peritoneal fold under which they are loosely embedded. The latter is opened by snipping with scissors, and the ureter can then be drawn forward. It must not be confounded with the vas deferens with which each ureter runs a short parallel course along the sides of the bladder. The two ducts are very similar in size and outward appearance, but the vas deferens is firmer, feeling like a piece of whip cord.

The principal operations consist of Ureterolithotomy, Anastomosis of the severed ureter, and Implantation of the ureter in abnormal positions. The ureters have been experimentally im-

planted in different parts of the bladder, in the vagina, in the skin, and in the intestine. In one instance, Tizzoni and Poggi made an artificial bladder out of a knuckle of small intestine in which they implanted both ureters, the animal completely recovering.

Anastomosis or Uretero-ureterostomy was successfully accomplished in 1887 by Poggi, who invaginated the upper segment into the lower and sutured it in position. Since then, van Hook, Bovée, and Kelly have experimented in the same direction and the technic of their several methods differs only in minor respects.

This operation is only available when the severed ends can be easily approximated. The ureter of the dog runs in a comparatively straight line from the kidney to the bladder, and if more than half to one inch of its continuity is destroyed, the tension to which it is subjected by stretching is too great to permit of reunion being maintained. But Bovée has shown that this difficulty may be overcome by taking advantage of the mobility of the kidney and displacing it posteriorly. The gland may be separated from its surrounding tissues and brought down to the level of the iliac crest and there stitched to the abdominal wall. This procedure gives considerable slack to the ureter.

Implantation in the bladder or Uretero-cystotomy may be undertaken with good results, though there is always considerable risk from cicatricial stenosis with resultant hydronephrosis.

Implantation in the bowel or Uretero-enterostomy is not a practicable operation for the reason that intestinal bacteria invariably ascend the ducts and give rise to pyelonephritis. It was at first believed that if the trigonum vesicae were implanted together with the ureteral orifices the ascending infection might not take place, but the experiments in this direction all terminated fatally through sloughing of the implanted part. The reason of this was made apparent in the discovery that the blood-supply of the trigonum came from the vesical arteries, and not from the ureteral, so that in order to preserve the nutrition of the parts implanted it would be necessary to include a large part of the bladder wall which operation would practically resolve itself into Cysto-enterostomy or Vesico-rectal anastomosis, which is described elsewhere. Peters claims that if the ureters be so implanted that their free ends project into the lumen of the bowel, a natural valve is thereby produced, simulating the bile papilla, and that by this means

the ascent of bacteria is, to some extent, prevented. Of late Barbat has endeavored experimentally, with fair success, to use a portion of small intestine to bridge over the gap left after resection of the ureter. This he did by excising a small tract of ileum, without disturbing its mesenteric attachment, closing the two ends of the same, re-establishing the caliber of the remaining intestine with a Murphy button, and implanting the upper end of the ureter and the bladder in the isolated portion. ●

URETEROLITHOTOMY.

The obstructing calculus being located, the wall of the ureter is incised and the body extracted. The opening is then closed with a few interrupted black silk sutures placed so as not to include the mucosa. The wall of the tube being considerably hypertrophied at this point, is rendered quite prominent.

URETERO-URETERAL ANASTOMOSIS.

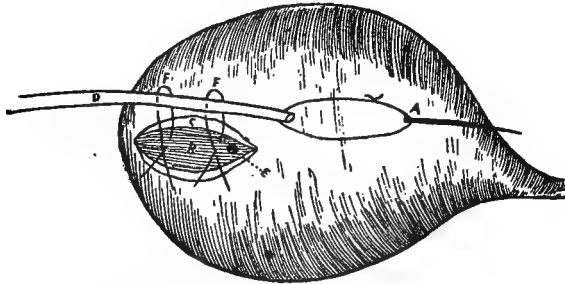
URETERO-URETEROSTOMY.

Kelly's method is as follows: The open end of the lower fragment of the ureter is closed with a fine silk ligature, and just beneath, a slit, about half an inch in length, is made in the ventral wall. Two black silk sutures are passed through each lateral wall of the lower extremity of the upper fragment, through the slit in the lower fragment and out through its lateral wall. These two sutures serve as tractors by which the upper fragment is drawn into the lumen of the lower through the slit. These sutures are then tied and the slit is entirely occluded. Two additional sutures are passed through the lateral walls, avoiding the mucosa, where the ends overlap. The ureter, thus anastomosed, is dropped back into its normal position.

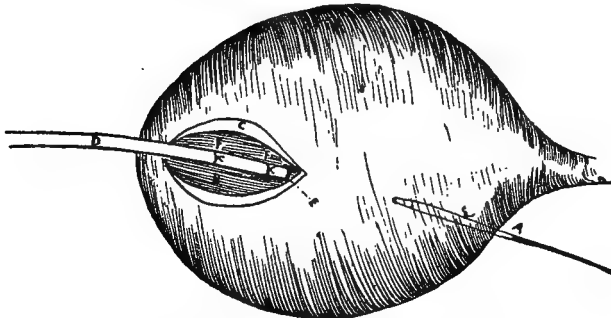
URETERO-VESICAL ANASTOMOSIS.

URETERO-CYSTOSTOMY.

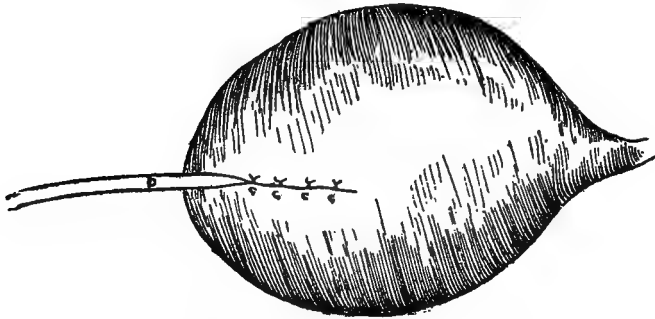
The technic of this operation as experimentally performed by myself, is as follows: The ureter (D) being exposed by raising the bladder, a traction suture (A) is passed through it immediately above the spot at which it is to be divided, and it is stripped of its



No. 46a. Uretero-cystostomy. First stage.



No. 46b. Uretero-cystostomy. Second stage.



No. 46c. Uretero-cystostomy. Third stage.

peritoneal covering for a short distance. It is then ligated near its vesical insertion and severed just above the ligature. A spot on the bladder is next selected as near to the original site of insertion as possible. Here the peritoneum is incised a distance of about half an inch and (C) deflected laterally. A small opening (E) is made

through the muscular wall (B) and mucosa at the distal extremity of the incision. Two sutures (F) of fine black silk threaded to a fine straight cambric needle are passed through the muscular wall of the bladder and continued through the muscular wall of the ureter, avoiding the lumen as far as possible, at a point which will permit the ducts to project into the bladder. By means of the traction sutures the ureter is approximated to the bladder, while the sutures (F) are tied. Guided by a grooved director, the needle holding the traction suture (A) is passed through the opening (E) into the interior of the bladder and made to emerge through its wall a little further on. In this manner the end of the ureter is pulled through the opening. A third suture is then passed through the bladder muscle and ureteral muscle at the edge of the opening. Finally, the deflected peritoneum is united by the interrupted sutures (G) and the traction suture pulled out after cutting one strand. By intersuturing the bladder and ureter in the above-described manner a broad surface of adhesion is obtained through which a maximum amount of tension is resisted.

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The Bladder

EXAMINATION.

Affections of the bladder are diagnosed by functional symptoms supplemented by abdominal, rectal, and vaginal palpation.

The functional symptoms consist of abnormal micturition and changes in the physical and chemical properties of the urine. Blood when it originates in the bladder is usually expelled at the end of micturition.

A sample of the urine for examination may be obtained at the time of its expulsion from the body by catching it in a receptacle or causing the animal to urinate on a concreted surface; otherwise it is drawn off by catheterization. By abdominal palpation the bladder when empty can be distinguished only with difficulty. When it is

distended, however, it may easily be felt as a pyriform body situated immediately anterior to the pubic border. By rectal palpation it can be felt under both conditions. The presence of uroliths and neoplasms can generally be recognized by either method of palpation, while inflammatory disturbances of the wall of the organ are indicated by the evincement of pain on pressure.

TRAUMATIC LESIONS.

Injuries sustained by the bladder consist of traumatic or spontaneous rupture and wounds caused by penetration of foreign bodies. Accidental wounds have also been inflicted during the course of surgical operations.

Rupture. Rupture can occur under the influence of some sudden strain while the organ is distended. Harrison observed an instance which occurred in a Mastiff while the latter was making attempts to copulate.

The lesion can also result from the application of some violent compressing force, as when a wheel passes over the abdomen.

It can also occur from gradual or sudden over-distension owing to mechanical obstruction at the neck or in the urethra, such as is caused by the lodgment of a calculus (Petit and Almy) or through torsion of the organ (Siedamgrotzky).

It is less apt to follow the gradual formation of an obstruction, as occurs from the presence of neoplasms, on account of the compensatory hypertrophy which takes place in the wall. But that it may and does sometimes take place under such conditions is evidenced by the following cases: Wehr described an instance resulting from compression by a carcinoma of the retroperitoneal glands, Demeurisse one from compression by a carcinoma of the neck of the bladder, and Simonds another from compression by an enlarged prostate.

It may also occur as a result of suppression of micturition through an animal's instinct of cleanliness. In December, 1900, the municipal court of New York was called upon to decide a suit at law brought by the owner of a Japanese Spaniel against an express company, which had contracted to deliver the animal at a certain destination but which, through negligence on the part of its employees, it had failed to do. The animal, cooped for several hours,

retained its urine until the wall of the bladder became paralysed, and secretion continuing, rupture followed. The owner won the suit.

Wounds. This class of wounds consists of stabs by pointed weapons generally in the hands of vicious persons, gun-shot wounds, and puncture by sharp extremities of bone in cases of fracture of the pelvis. The researches of Vincent have shown that puncture by instruments of small diameter, such as needles, are perfectly harmless and heal spontaneously.

Surgical Wounds. Accidental incision during intraperitoneal operations has occasionally taken place. Rodloff and Hobday both relate that they have met with this accident, the former during an operation for hernia and the latter while performing oophorectomy. Siedamgrotzky, while operating for perineal hernia, which proved to be of the bladder, incised the latter through the animal moving suddenly. In each of these instances the lesion was sutured and terminated in recovery.

Symptoms and Diagnosis. Systemic collapse with suppression of micturition following a history of application of a compressing force or of extreme distension of the bladder from obstructive causes should lead to a suspicion of rupture. In thin animals abdominal palpation will generally reveal the pyriform outlines of the distended bladder, and if these can be made out rupture can of course be excluded from consideration. Should such lesion have occurred, the introduction of a catheter is followed by escape of both urine and blood. A definite quantity of aseptic liquid should then be injected with moderate force. While this is being done, palpation will reveal gradual distension of the organ, which is almost immediately succeeded by collapse and the return of a diminished quantity of the liquid. The aspirator may be employed to determine the presence and character of any intraperitoneal fluid, but the latter does not, as a rule, remain long in the cavity, being quickly absorbed. In some of Znamensky's experimental resections, where the stitches in the bladder wall gave way, and the animals undoubtedly died of uremic poisoning, there was not a sign of urine in the cavity, it having been entirely absorbed.

Treatment. Rupture of the bladder calls for prompt operative interference. Vincent made very complete experimental research in bladder lesions in a number of dogs. He performed celiotomy,

wounded the bladder in various ways (by instruments and bullets) allowing urine and blood to escape into the peritoneal cavity, closed the abdominal wall, reopened it several hours later, restored the continuity of the parts, cleaned the cavity, and again closed the wall. The following conclusions were reached: Solutions of continuity of the bladder wall are capable of reunion by first intention if properly sutured, and even spontaneously in exceptional cases. Rupture of the organ in half its extent heals very well. The chances of recovery are very good if suturing be practiced from six to twelve hours after perforation with extravasation of blood and urine. They diminish as the time increases and if suturing be undertaken twenty-four hours later it is useless, the animal dying from the lethal effect of the absorbed urine rather than from peritonitis. Nevertheless, if the urinary intoxication is not pronounced the operation should be proceeded with at any stage. A vigorous dog will survive forty-eight hours. If drainage exists, as may take place through an abdominal wound, life will be prolonged over this period, and it is conceivable that spontaneous repair might thereby ensue.

Simple wounds are treated by celiotomy and simple cystorraphy. Severe wounds involving less of the tissue may be remedied by resection.

CYSTITIS.

Inflammation of the bladder is an infective process caused by the activity of bacteria which gain access to the organ by way of the genito-urinary tract, the peritoneal cavity, or the blood stream. Thus, it may be produced by septic catheterization, by extension of inflammatory diseases of continuous or contiguous organs (nephritis, urethritis, vaginitis, pyelitis, peritonitis), and by stagnation of urine resulting from causes of a mechanical nature (prostatic enlargements, urethral calculi). It has also been known to follow prolonged retention of urine in instances where animals have been kept in crates for lengthy periods. Other factors are the ingestion of substances irritating to the mucosa of the urinary tract (cantharides and turpentine preparations) and causes of a traumatic nature, such as wounds and the irritation of calculi. The disease occurs in both acute and chronic forms. In most cases the former develops as a complication of nephritis. The mucosa becomes swollen and highly injected and sometimes hemorrhagic. In severe

cases there may be pseudo-membranous formation and even gangrene, all the coats of the wall participating. In the chronic form the mucosa is thickened and the muscular layers hypertrophied with occasional formation of polypoid myxomatous growths.

Symptoms and Diagnosis. Acute cystitis is characterized by impeded, frequent, and painful micturition with intermittent slight attacks of colic. The urine flows drop by drop and may finally become entirely withheld, the animal dying of uremia. The urine is always greatly modified, becoming neutral or ammoniacal, and containing epithelial debris, leucocytes, mucus, albumen, and crystals of ammonio-magnesium phosphate, and sometimes blood. The head is carried low, the movements of the hindquarters are uncertain, constipation is present, the appetite is diminished or suppressed, thirst is intense, the temperature elevated, the pulse hard and frequent and respiration accelerated, and finally reflex vomiting may occur. Palpation reveals a distended and extremely sensitive bladder. The prognosis should always be guarded. In chronic cystitis catarrhal symptoms form the prominent feature. The urine is purulent and signs of distress follow the act of micturition. The sound should always be passed to ascertain the presence or absence of calculi.

Treatment. Disinfectant irrigation of the bladder is indicated, a warm saturated boric acid solution containing a few drops of liquid extract of belladonna being highly recommended.

On account of the limited capacity of a portion of the urethra in males by which ample irrigation is rendered impossible, Camardi has successfully practiced and recommends that the urethra be opened in the perineal region, a drainage tube inserted, and irrigation carried out thereby morning and evening.

If calculi are present they must be extracted. Internally, such antiseptics as salol, urotropin and benzoate of soda which are eliminated by the kidneys, may be given with beneficial effect. The diet must be non-stimulating, all meats being withdrawn.

CALCULI. (See also Urolithiasis).

The urolithic deposits found in the bladder are of variable conformation, at times existing as small rounded concretions when they are usually present in large numbers. Wesbitt counted one hundred and ninety-four in one case, some of the stones being embedded in

the mucosa. Sometimes they occur as calculi of smaller or larger dimensions. The bladder may be completely filled by them so that the urine must percolate through drop by drop (Kitt). At other times, large single calculi are found, oval in form and closely conforming to the shape of the bladder. Johne saw one which measured 11 cm. in length, 7.5 cm. in width, and 6 cm. in thickness, and which weighed 490 grams.

Symptoms and Diagnosis. Acid calculi in the bladder affect the organ in no greater degree than they do the kidney. It is the larger alkaline concretions with which we have principally to do in this organ. As already stated, they usually occur concurrently with, and probably as a result of, catarrhal cystitis. Hence pus is generally present which makes the urine very turbid. The wall of the bladder is greatly hypertrophied, and ulceration of the mucosa with hemorrhage is common. Johne observed small polypoid growths and it is not uncommon to find the smaller calculi embedded in the mucosa.

The presence of the large cystic calculi can in most cases be detected by abdominal palpation. They are felt on the floor of the bladder. When calculi lodge in the neck of the bladder they induce symptoms similar to those which are seen when the urethra is obstructed.

Treatment. This can only be by operative interference. The removal may be effected by either of three operations, viz., prepubic lithotomy, lithotripsy, or litholapaxy.

The preferable operation in all vesical cases, excepting in the female, is prepubic lithotomy or removal by celio-cystotomy, for the reason that the prostatic portion of the urethra is often not penetrable by instruments owing to enlarged prostate, and the urethral method is not suitable for multiple or very hard calculi or for encysted stones. The prepubic method affords better access to the interior of the viscus and involves no more risk than does perineal section, provided careful technic be observed. Moreover, it obviates the necessity of the practitioner providing himself with a cumbersome array of several sizes of lithotrites and an evacuating bulb. In twelve cases of prepubic extraction reported by Malzew there were only two fatal results.

In the female, the dilatability of the urethra more readily permits of litholapaxy.

The term lithotrity is used to designate the operation of crushing the stone by means of a lithotrite, wielded through an opening made in the urethra, and leaving the fragments to be washed out by the subsequent flow of the urine, and the term litholapaxy the crushing and removal of the fragments at one and the same operation. When the urethral method of removal is followed, litholapaxy should be practiced, as good surgery aims to make certain the removal of every vestige of concretion within the organ, so that none may remain to form a nidus for further accretion or to become an obstruction in its passage through the urethral canal. In fact, it goes without saying, that lithotrity should never be practiced. When the stone is lodged at or near the neck of the bladder in the male the preferable way to effect its delivery is to force it back within the bladder by means of the flexible metal sound or a bougie and then remove it by prepubic lithotomy.

Whenever calculi are extracted from the bladder by direct operation, the ureters should also be explored to make certain that they do not also contain such bodies. Sutton describes an instance where he observed calculi lodged in both the bladder and ureter at the same time.

The medicinal remedies employed in alkaline or catarrhal lithiasis are benzoic preparations and salol, together with the milk diet.

Irrigation of the bladder with antiseptic solutions by means of the catheter should also be resorted to, the object being to allay any tendency to cystitis or to alleviate it if it has developed.

TORSION. RETROFLEXION.

Torsion of the bladder was witnessed twice by Siedamgrotzky. In one instance it was caused by the presence of a subserous hematoma near the neck of the organ, in the other through an omental sarcoma becoming adherent to the neck.

Retroflexion is a condition in which the viscus is bent abruptly back into the cul-de-sac of Douglas under extreme expulsive efforts in subjects suffering from prostatic enlargements of other form of obstruction, and forms a subcutaneous swelling in the peri-anal region (see Perineal Hernia).

Symptoms and Diagnosis. In torsion and in some cases of retroflexion suppression of micturition takes place as a result of

obliteration of the urethral lumen. Contrasted with suppression resulting from prostatic enlargements and calcular obstruction it is complete and sudden in its advent. The animal makes ineffectual attempts to urinate and has colicky pains. Distension of the organ is discoverable by abdominal palpation. To exclude calcular obstruction from consideration the catheter or sound should be passed. Palpation with the index finger in the rectum or vagina permits of differentiation from prostatic enlargements. Uncertainty as to the condition present should be relieved by explorative celiotomy.

Treatment. As soon as the bladder is found to be overtaxed it should be promptly evacuated by puncture. The condition must then be relieved by direct adjustment through the open abdominal cavity, according to the exigencies of the case.

NEOPLASMS.

Both innocent and malignant growths have been observed in the bladder but their occurrence is extremely rare. Myxoma, myoma, and primary and secondary sarcoma and carcinoma have been recorded.

Tumors of the bladder offer but little scope for surgical interference.

Symptoms and Diagnosis. The dominant symptom is progressive, painful, and frequent dysuria coupled in the case of malignant tumors with cachexia and inappetence. The abdomen may or may not show enlargement according to the size of the growth. Palpation of the abdomen or with the index finger in the vagina or rectum discloses the presence of an uneven growth.

In cases of carcinoma, sarcoma, and myoma, seen respectively by Demeurisse, Bournay, and Liénaux, there was no hematuria, but Schulz observed in a case of primary carcinoma straining at micturition for some time before a drop of urine was passed, the latter flowing in a thin stream and being followed by a few drops of blood. This was particularly noticeable after exercise.

Treatment. Celiotomy and extirpation of the growth or partial resection of the viscus are indicated. If the terminal portions of the ureters are involved they can be divided and implanted elsewhere, while if the neck of the organ is diseased the only alternative is extirpation of the growth and anastomosis of the remainder of the organ with the rectum, as practiced experimentally by Frank,

Gluck, and Zeller, and others. But it must be borne in mind that a favorable termination to the latter operation could only be hoped for in a young or middle-aged animal free from cachexia. Liénaux attempted the removal of a myoma by blunt dissection, but experienced excessive hemorrhage from which the animal succumbed two days later.

Surgery of the Bladder

For all operations on the bladder the animal should be secured with hobbles in the dorsal position.

Simple operations, such as catheterization, irrigation and puncture are performed without the aid of anesthetics, but all operations involving celiotomy or perineal litholopaxy require general anesthesia. When the continuity of the wall of the organ is interfered with Znamensky has advised the use of chloroform for the reason that it is the only anesthetic which prevents muscular contractions, the wound remaining its natural size, thus permitting of linear suturing. Chloretone, since invented, produces the desired effect equally as well. The opening in the abdominal wall should be made immediately in front of the pubic border, in the median line, the penis in the male being dislocated for this purpose. (See Celiotomy.)

The bladder is a prominent organ and easily reached. Some authors advise the introduction of a catheter by way of the urethra to facilitate its finding, but this is superfluous. When empty it is easily pulled forward out of the abdominal wound, but when distended this becomes more difficult owing to hindrance offered by the most prominent ligaments—the two lateral and the median umbilical enclosing the obliterated urachus. On raising the organ and examining its superior aspect, two prominent vessels are seen which bifurcate and with others are distributed over the surface of the organ in an arborescent manner. They become still more prominent when the wall of the organ undergoes hypertrophy, as is commonly seen in the presence of calculi, enlarged prostate, etc. Most of the vessels lie just beneath the serosa and are therefore easily ligated. When the organ is distended they are stretched but when it is contracted they become very tortuous. The ureters find insertion immediately to the outside of the two prominent vessels just before

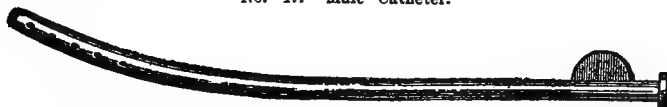
the bifurcation of the latter. They are embedded in more or less connective tissue and fat and must be carefully sought for when any extended operation is undertaken. The ureter crosses the vas deferens on either side, and the latter must not be mistaken for the former, an error which has befallen some experimenters.

PASSAGE OF THE CATHETER AND SOUND.

Catheters made of cotton web or soft rubber, preferably the former material, are best adapted for use on the male. Their length should be from fifteen to eighteen inches, and sizes three to twelve



No. 47. Male Catheter.



No. 48. Female Catheter.

(metric scale) meet all requirements. A wire stylet facilitates passage of the instrument, but it must be used with extreme caution as it is very easily thrust through the wall of the instrument.

Bougies for treatment of stricture are used in somewhat larger sizes. For the female the catheter should be of the same material as for the male, or, better still, of metal in the same sizes.

These instruments should always be rendered sterile and be well lubricated before being used.

PASSAGE OF THE CATHETER IN THE MALE.

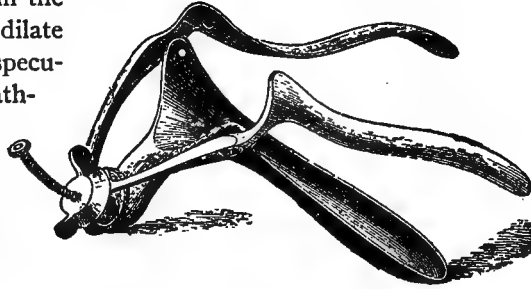
Secure the animal in the dorsal position and stand facing its left side. Expose the penis by retracting the prepuce with the left hand. Holding the catheter in the right hand insert it within the urethral orifice and pass it gently along the canal. Some slight impediment is generally met with at the level of the posterior extremity of the penial bone owing to a decrease in the caliber of the urethra at that point, but it is easily overcome by a little increased pressure. An obstruction at this point indicates a pathologic condition. As soon as the ischial arch is reached, the wire stylet is

gradually withdrawn to permit the instrument to pass the perineal curve.

The bougie and metallic sound are passed in a similar manner.

PASSAGE OF THE CATHETER IN THE FEMALE.

Secure the animal in the ventral position and dilate the vagina with a speculum. Introduce the catheter into the vestibule, direct it within the urethral orifice, and pass it forward till it enters the bladder.



No. 48. Vaginal Speculum.

IRRIGATION.

This operation is productive of highly satisfactory results in inflammatory conditions of the bladder, the object being to bring disinfectant and other medicinal agents in direct contact with the diseased tissue. It is also resorted to as an adjunct to urethrotomy when the latter operation is performed for the removal of calculi, in order to produce immediate evacuation of any calculi which may still remain in the bladder. It is carried out by the siphonage system. The animal being secured in the dorsal position, a catheter is introduced within the bladder in the ordinary manner. The stylet being withdrawn, the urine is permitted to escape. Connection is then made with a small rubber tube and funnel and the latter are elevated. The solution is poured in, and when the organ is well distended is allowed to run out again by depressing the tube to a lower level.

PUNCTURE.

This operation is indicated whenever urine is prevented from escaping in the natural manner and there is risk of rupture of the bladder from its accumulation. The operation is a minor one and entirely devoid of any ill after-effects, owing to the remarkable capacity of the organ to contract under the stimulus of an instru-

ment however fine. Wounds of small size are thus promptly sealed. Vincent punctured the bladder of a dog with twelve needles of different caliber in an experimental way. There was no penetration of urine and no inflammatory reaction on the peritoneal side. Znamensky had similar results. Rouville carried these investigations a point farther and discovered that if the organ is distended by injection, immediately after puncture, the fluid will escape at the orifice of puncture in a jet and thus gain entrance into the peritoneal cavity. On the other hand slow accumulation of urine after the operation was not followed by filtration. Rouville was of the opinion that in cases of unavoidable distension which necessitate repeated puncture, this should be done at intervals sufficiently short to prevent great accumulation. The best spot at which to make the puncture is immediately in front of the pubis in the median line. To reach the median line in the male, the penis can be pulled over to one side. A very fine trocar and canula, or preferably an aspirator should be used for the purpose. Puncture may be repeated as often as is considered necessary.

CYSTORRAPHY.

All surgeons who have extensively practiced suturing of visceral organs advise the use of the ordinary milliner's needle. The surgical needle is very apt to wound vessels and induce local hemorrhage. Znamensky experienced this trouble in his bladder-resection experiments, the blood escaping into the interior of the organ and forming a clot which prevented the free outflow of the urine. Maksimow, Julliard, and Vincent had good results from the experimental use of carbolized catgut, Nos. 0 and 1, as a suturing material, but occasionally the knots became loosened and it was too quickly absorbed. Metallic suturing was always effective but some difficulty was experienced in handling it. Vincent never had any bad results from the employment of silk and considered it the best material to use, an opinion in which I fully concur. It finally becomes encapsulated by an organized exudate. Maksimow tried suturing throughout all the coats of the wall and the animals succumbed. The mucosa tended to interpose itself between the approximated edges of the wound and hindered the reparative process, the gut being absorbed before reunion was established, and there was consequently extravasation of urine. Moreover, suturing mate-

rial which penetrated, as is the rule with all foreign bodies, sooner or later became the seat of deposit of urinary salts. Accordingly, sutures must only be made to take up serous and muscular coats. In other words, the proper method is that of sero-musculosa—sero-musculosa, with inversions of the margin of the wound. This method utilizes the well-known plastic activity of peritoneal surfaces, which exceeds by far that of primary union of wounded muscular tissue. It is important that sutures be applied not too far apart. The extent to which the bladder will contract under the stimulus of section is quite remarkable, being fully one-half the former capacity, and sutures placed apparently at sufficient distance from each other while the viscus is in this condition will be altogether too far apart when it is distended with urine. Sutures placed at a distance of 2 mm. from each other will be at 3 mm. after distension. A single row of sutures suffices in simple cystotomy or after resection of small portions of the wall, although this may be reinforced with a second one at the discretion of the operator. Znamensky found a double row imperative in cases where he resected the greater portion of the organ. Vincent advises that the operation be supplemented by urethral injections of some colored fluid, such as milk, with sufficient force to distend the organ. This affords means for detection of permeability of the sutured surface, in which case a second row of sutures must be inserted.

After suturing, the catheter should be used at least twice daily until normal micturition is established, not on account of the operation interfering with the contractility of the organ, but because blood-clots may clog the urethra. After operations on the bladder the urine discharged for the first day or two is liable to be mixed with more or less blood. In simple operations the animal usually recovers its normal spirits within two days.

PREPUBIC LITHOTOMY. CYSTOTOMY.

The abdominal cavity being opened and the bladder drawn forward and surrounded with packs, an incision is made where vascularity is seen to be least. In the presence of calculi the organ is usually much hypertrophied and its vascularity increased; hence persistent bleeding is prone to occur at the site of incision. All bleeding points should be ligated or twisted though they tend to stop of their own accord through the subsequent contraction of

the organ. The incision is made of sufficient length to effect delivery of the largest body present, and the edges of the wound caught with hemostatic forceps. It is a good plan to apply the sutures without, of course, tying them, before making the incision, as it insures more accurate alignment being made than is afterwards possible, owing to the tendency of the organ to contract under the stimulus of the knife. Encysted calculi, i. e., calculi embedded in the mucosa, are removed by scraping with the scoop. All calculi being removed, the interior of the organ is flushed with a warm antiseptic or saline solution and the wall closed as described under cystorraphy.

LITHOLAPAXY.

The technic of this operation in the male is as follows: Administer a general anesthetic and secure the animal in the dorsal position with the hind legs drawn forward. Pass the catheter to the bladder, draw off the urine and inject a quantity of antiseptic or saline solution sufficient to distend the viscus. Open the urethra as in urethrolithotomy, making the incision in the perineum at the level of the ischial arch. Withdraw the catheter and introduce a lithotrite of suitable size through the wound and cautiously pass it through the prostatic urethra into the interior of the bladder. Turn the shaft of the instrument so that the blades will point towards the roof of the organ which is now undermost, and wait a few moments until currents generated by the passage of the instrument have subsided. Draw back the male blade and manipulate it until the stone is caught. It may be necessary to turn the blades to either side. Then lock the instrument and crush the body by screwing. Sudden cessation of resistance indicates that either the stone has slipped away from the grasp or it has been pulverized. Repeat the crushing process until no stones of any size remain and then proceed to evacuate. The latter part of the operation is accomplished with a bulb instrument, known as the evacuator, by which a suction effect is produced. In the absence of the instrument the next best means to employ is irrigation with the catheter. Leave the urethral wound open to heal by cicatrization as in urethrolithotomy. In the female the operation is more practicable provided the stones are of very moderate size. It is conducted as follows: Anesthetise and secure the animal in either position. Dilate the vagina with a speculum,

and then the urethra, using for the latter purpose a conical blow-pipe such as is provided in dissecting sets, or enlarge by incision as in urethrolithotomy. Then introduce a lithotrite and extract or, if necessary, reduce the stone or stones to fragments and evacuate precisely as in the male.

RESECTION.

Extirpation of the bladder, whether partial or complete, is borne well by the dog. Many experiments of this nature have terminated successfully. Tizzoni and Poggi who removed the greater part of the original organ and connected the ureters with the neck, found that the latter had undergone transformation into an entirely new bladder-like viscus at the end of three years. Gluck and Zeller extirpated the entire organ together with the prostate gland and implanted the ureters in the skin in four dogs without losing an animal. Fisher removed elliptical portions of the organ from eight different dogs. Of these five recovered and one of the deaths was apparently due to purulent accumulation in the abdominal wound. In four of the cases no antiseptic precautions were observed. In another series of experiments, carried out by Vincent, recovery was complete in from three to four weeks, healing taking place by primary intention. Other successful experiments were made by Brenner, Thomson, and Znamensky. The latter authority found that one-third and even two-thirds of the wall could be resected and the animal make a good recovery. When, however, more than two-thirds were removed there was not sufficient of the detrusor muscle remaining to accomplish ejection of the urine. The organ had lost its power of contractility, the urine stagnated, dammed back, and a hydronephrosis resulted. Such a termination could be avoided in the human being by employment of a permanent catheter, an expedient which would hardly be practicable in the dog. It would be better to divert the flow of urine into some other channel, the rectum, for instance.

In partial resection due care must be observed that the ureters be not destroyed. If it be found necessary to remove the part of the bladder at their point of entry, they must be implanted elsewhere. Vincent found scissors best for cutting all the coats at once. He also found that the mucosa tended to protrude through the edges of the muscular wound, owing to contraction of the latter. If this oc-

curs, it must be trimmed, but Znamensky cautions against unnecessary cutting of it, because there is always more or less hemorrhage therefrom, which finding its way into the interior of the viscus retards healing, as pointed out under Cystorrhaphy. All vessels that have been severed during the operation must be securely ligated. The principal vessels are easily secured as they run under the serosa, prominently in view. Two rows of sero-musculosa—sero-musculosa sutures are advisable.

VESICO-RECTAL ANASTOMOSIS. CYSTO-ENTEROSTOMY.

It has been demonstrated by Frank that it is possible to undertake this operation with favorable result. This does not seem very remarkable when it is remembered that in early fetal life the renal secretions empty into the primitive cloaca, that this disposition is normal throughout the life of birds, and that it may occur as a congenital malformation in the dog (Varaldi). For practical purposes, however, the operation has little application, though, as has been pointed out elsewhere, its employment as a remedial measure for prostatic enlargements in stud dogs in which it is desired to conserve the testes, is deserving of trial. Frank found that the bladder remained free from feces, that some cases were not followed by ascending infection, and that the presence of urine with feces in the rectum did not produce pathologic irritation of the latter. The feces were always passed in liquid form, being softened by the urine.

To facilitate the operation Frank used the decalcified bone-coupler devised by himself for anastomosis of all hollow viscera, but the Murphy button would answer the purpose equally as well. The bladder and rectum are emptied of their contents by gentle squeezing and drawn forward into position. Two or three interrupted Lembert sutures are applied about half an inch below the lower ends of the incisions determined on in the bladder and rectum, care being exercised in selecting them that the button or coupler, when it is inserted, will not encroach on the ureteral openings in the bladder. A longitudinal incision is then made in the bladder for the coupler and the latter inserted and fixed in position with the puckering string. The rectum is treated in like manner and the two portions of the coupler united. Finally interrupted Lembert sutures are placed around the borders to make the union more secure.

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The Urethra

EXAMINATION.

The urethra is examined by palpation over its course and by passage of the sound or catheter.

CONGENITAL MALFORMATIONS.

Congenital occlusion of the urethral canal is occasionally met with both in males and females. Usually an orifice exists at some part of the tract higher up and the animal suffers no inconvenience. The term Epispadias is applied to the condition where the urethral orifice is situated at the root of the penis, and the term Hypospadias when it occupies a more distal and ventral position on the organ. Both Kitt and Raynard mention having observed these abnormalities.

Sometimes the primitive cloaca persists. Veraldi recorded a case in which the urethra, one inch from the neck of the bladder, formed a junction with the rectum an inch and a half above the anus. The animal had never urinated by the natural channel.

Symptoms and Diagnosis. An animal born with occluded urethral canal may go several days and even weeks before exhibiting

any peculiar symptoms, urinary secretion simply slackening up in response to the damming up that occurs, or if the obstructing membrane be thin enough the urine may ooze through by pressure. After a while the animal manifests uneasiness and the abdomen is observed to be enlarged. Upon manipulation the distended bladder can be made out.

Treatment. Simple puncture of the membrane suffices, the subsequent flow of urine serving to keep the channel open.

TRAUMATIC LESIONS.

Wounds. Traumatic exposure of the urethral lumen sometimes occurs as a complication of a wound of the neighboring tissues. Mossé treated one inflicted by a knife in the hands of a miscreant.

Symptoms and Diagnosis. A break in the continuity of the canal is recognized by a flow of urine through the wound.

Treatment. In extensive wounds the urethra should be sutured with fine catgut and the neighboring parts cleansed and freely drained. Minor wounds may be allowed to heal by granulation. Healing is usually uncomplicated and quick to follow.

STRICTURE.

Cicatricial contraction may follow wounds of the wall caused by lodgment of calculi or surgical interference to remedy this condition. Siedamgrotzky attributed a case of stricture to extreme torsion during coitus. A rather rare condition is the formation of small exostoses on the penial bone, which, by encroaching on the urethra, produce the effect of stricture.

Symptoms and Diagnosis. Difficult or suspended urination accompanied by pain call for examination by passage of the sound, when a differential diagnosis between this and obstruction by calculi or prostatic enlargement can be arrived at. In using the sound the normal decrease in caliber at the level of the posterior extremity of the penial bone must be taken into account.

Treatment. This condition can be considerably relieved by passing a sound or catheter every two or three days for a period of some weeks and allowing the instrument to remain within the canal for a few minutes.

Exostoses of the penial bone are removed by exposing the bone by cautious dissection without injuring the urethra, and removing them with suitable forceps.

OBSTRUCTION.

This usually takes place from the lodgment of calculi, but may also be occasioned by the parasitic giant *Eustrongyle*.

Calculi. (See also Urolithiasis.) It will be remembered that in the male the Urethra is narrow in its prostatic portion, becomes widest in its membranous portion, and again narrow as it passes into the cavernous portion, while it loses all power of expansibility as it traverses the gutter of the penial bone. Sediment and the smaller stones very frequently pass into the urethra and lodge at one of the narrower points and form an obstruction. This takes place most frequently at the proximal extremity of the penial bone, and also occasionally just anterior to the prostatic portion. These stones may be present as an impacted mass of numerous small calculi, cemented together by mucus, and extending some distance up the lumen of the canal. They often become embedded in the wall. Siedamgrotzky described a case of a three months' old animal which died suddenly suffering from inflammatory edema of the foreskin. He found a cylindrical calculus in the curved portion of the urethra, the latter having been perforated by it, thereby causing infiltration of urine. Tuffier found calculi in the prostatic portion of the urethra.

Exostoses of the penial bone produce the effect of urethral calculi and may be mistaken for the latter.

In the female also calculi sometimes lodge in the urethra, but this seldom takes place owing to the larger caliber, shortness, and dilatibility of the canal.

Lodgment of calculi in the urethra causes damming back of the urine in the bladder, which extends to both kidneys and results in bilateral hydronephrosis and rapid dissolution. It is rare that the bladder ruptures, owing to the compensatory hypertrophy which it undergoes. Petit and Almy have recorded an instance. The extremity of the penis may also become gangrenous.

Symptoms and Diagnosis. The symptoms are very marked. The animal is exceedingly uneasy, lowers its head, looks round at the flanks, arches its back, assumes a straddling gait or posture like

that of a female in the act of micturition, and makes frequent but generally ineffectual attempts to urinate, though it is quite common for a few drops of urine to be passed. Palpation reveals the urethra above the penial bone distended. The bladder is also somewhat distended though not extremely so, but it is hard and painful. On passing a catheter or probe, its passage is arrested at the seat of lodgment of the body, and a sensation of something hard is conveyed to the touch. Unless relief is given the animal shows signs of uremic poisoning in a very few hours. It becomes indifferent and stupid, lies on its side and moans if disturbed. Finally convulsions take place prior to death.

Treatment. An animal received in this condition may be in considerable danger either through rupture from over-distension of the bladder or from hydronephrosis. Should the former lesion be deemed imminent, no time must be lost in giving relief by puncture of the bladder. The obstruction is next removed by the operation of urethrolithotomy.

It must not be forgotten that the "urolithic habit" may subject the animal to the necessity of undergoing supplementary and repeated operations in cases of impaction of the urethra. Siedamgrotzky mentions relieving an animal by operative measures, which, however, died later from the second impaction at the neck of the bladder. Pécus treated a case, where, after operating on the first occasion, a second impaction took place fifteen days later. After that he allowed the urine to permanently find escape by fistulous tract through the surgical wound. The successful outcome of this expedient suggests the advisability of its adoption in all such recurring cases. Furthermore, the "urolithic habit" may be the cause of calculous formation in the higher portions of the tract at no distant date, so that a guarded prognosis is always in order.

Parasitic Obstruction. The giant *Eustrongyle* in its passage from the kidney has been known to enter the urethra. Here its further progress is usually arrested by the penial bone, whereupon it perforates the wall and lodges in the surrounding connective tissue producing rapid formation of a swelling the size of a fist in the perineal region immediately posterior to the testes. Leblanc saw three cases of this nature. In one instance observed by Lacoste the worm was expelled by the urethral tract, the host suffering acute pain.

URETHROTOMY. URETHROLITHOTOMY.

For this operation on the *Male* the animal should be secured in the dorsal position with the hind legs brought forward, after having been previously placed under the influence of a narcotic. Local cocaine anesthesia should also be established. As a guide to the sight of incision, expose the penis and pass the catheter in the usual manner until its further progress is arrested. The point of the catheter is easily distinguished beneath the tissues and it is immediately over this spot that the incision is made in the median line. The median line of the perineum is not crossed by vessels of any size and like the linea alba is comparatively bloodless. Make the incision from one-half to one inch in length, and carry it through the skin, subcutaneous fascia, and urethral muscles to the lumen of the canal. The latter being exposed, remove the impaction with probe, blunt forceps or curette. It is sometimes necessary to crush before its removal can be effected. This being successfully accomplished, it must not be forgotten that a large number of calculi may still remain on the proximal side of the obstruction. For this reason the extraction of the impaction should always be supplemented by irrigation of the bladder with a copious supply of warm sterilized water injected with the aid of a catheter through the wound. It is best to leave the wound open. Though the urine finds vent for a few days at the artificial opening thus established and there is always a slight risk of its infiltration into the neighboring tissues, in other respects it is an advantage, for the reason that additional calculi may be passed from the kidney after the operation and are thus more certain to escape, or may be dislodged should they become fixed at the upper extremity of the wound as is sometimes the case. The wound usually becomes entirely sealed up by granulation in from eight to fifteen days and the urine is again voided by the natural channel. If suturing is employed cicatrization may be complete as early as four days.

In the *Female*. The animal may be secured in either position and anesthetized. Dilate the vagina with a speculum and first attempt to extract the stone with forceps. Sometimes manipulation with the finger in the vagina is sufficient to effect dislodgment. Failing in this, it becomes necessary to enlarge the urethra by incision. The walls of both urethra and vagina are intimately connected, which allows of the former being freely opened up. Intro-

duce a grooved director within the urethra until it comes upon the stone, and then slit up the wall with a probe-pointed bistoury, and employ forceps to complete the removal.

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CHAPTER VIII

The Abdomen—Continued

THE REPRODUCTIVE ORGANS OF THE MALE

The Penis and Prepuce

EXAMINATION.

To expose the penis, hople the animal in the dorsal position, hold the prepuce lightly at its free extremity and retract it with the fingers of one hand, grasp the penis through the prepuce at the level of the posterior extremity of the penial bone with the fingers of the other hand, and push it forward till it is prominently free of the prepuce. Tie a piece of tape round the glans, and therewith draw the organ gradually out till it is fully exposed.

CONGENITAL MALFORMATIONS.

Abnormalities of the penis are rarely met with. Taylor has recorded a case of arrested development in which the organ, instead of protruding in the ordinary manner from the prepuce made its exit through an oval orifice in the skin in the raphe in front of the scrotum. Congenital phimosis is sometimes seen. It is described elsewhere. Hermaphroditism is also occasionally witnessed.

TRAUMATIC LESIONS.

Injuries to the penis most often result from the bites of other dogs, but there is another class of injuries occasioned by the malevolence of human beings which at times comes to the notice of the practitioner. I refer to strangulation resulting from the application of constricting material, and also to mutilation, by individuals of brutal instinct while the animal is in the act of copulation. Vatel witnessed a case of strangulation which resulted from the presence of a ligature which probably had been applied to the parts under these conditions. Bang found a ribbon twisted round the

organ in another case. The following instance of mutilation came to the notice of Moussu: A male being found accoupled with a female, the owner of the latter barbarously severed the connection with a knife. The wounded animal was soon in a state of collapse, but the hemorrhage being successfully arrested its strength was sustained and it lived to an old age. The attendant practitioner being unable to use a sound to prevent occlusion of the urethra by cicatrization had to resort to urethrotomy. Moussu dissected the parts after death and found the penis about an inch in length, regularly rounded and presenting no trace of urethral orifice, though the lumen of the canal was still patent almost to the extremity of what remained of the organ. The opening made to give exit to the urine had persisted as a small fistula, the orifice of which was covered by the hair of the region.

Perforating wounds of the prepuce occasionally result from bites. When they attain sufficient dimensions, the penis is apt to slip through and out.

Symptoms and Diagnosis. Constricting agents produce great tumefaction and symptoms similar to those of paraphimosis.

Treatment. The indications are to divide the constricting body with scissors or scalpel. The operation is rendered difficult by the local swelling. Subsequently the parts should be treated as for paraphimosis. In cases of criminal amputation, the hemorrhage must be arrested as speedily as possible by ligating the divided vessels, if necessary after opening up the prepuce, and the urethra treated as in legitimate amputation. If cicatricial stenosis results, a permanent opening must be established in the urethra beneath the ischial arch to give exit to the urine. Wounds from bites are treated in the ordinary manner.

In one instance of stubborn healing of a preputial wound, Hobday reported success after resorting to the "Cherry" process of making longitudinal incision on either side of, and parallel to, the original wound in order to lessen tension on the same.

BALANO-POSTHITIS. BALANORRHEA.

These terms are applied to the familiar catarrhal inflammation of the mucosa of the prepuce and free portion of the penis. The urethra is rarely involved. In many cases this disease originates as a primary local infection. At other times it develops

secondary to venous stasis, paraphimosis and phimosis, or it may be traced to an initial lesion produced by traumatism or the presence of neoplasms or a foreign body. It is often seen during the course of distemper or eczema.

Siedamgrotzky saw two cases of a fatal infectious disease which had its inception as a virulent preputial catarrh with edema of the scrotum, prepuce, inguinal and other external lymphatic glands, together with leucocytosis.

Symptoms and Diagnosis. The prepuce is slightly injected and swollen, and emits a yellowish, greenish purulent liquid, which is generally licked away by the animal. The hairs surrounding the preputial orifice are often agglutinated. As a rule, the neighboring lymphatics are slightly enlarged, and in rare instances may suppurate.

Treatment. This consists of injection of astringent solutions, such as sulphate of zinc (5:1000), nitrate of silver (1:100), citrate of silver (2:100), two or three times daily. Neoplasms, if present, must be ablated.

PHIMOSIS.

This is a condition of morbid contraction of the free extremity of the prepuce in front of the glans penis. It is not uncommonly of congenital origin, when the orifice is often exceedingly minute. It may also occur as a result of traumatism or of swelling induced by local inflammatory disturbances.

Symptoms and Diagnosis. There is more or less obstruction to the flow of urine, and in extreme cases the latter is passed by drops. The animal is also unable to copulate.

Treatment. Under local anesthesia and with a bistoury and grooved director, make a longitudinal incision in the middle of the inferior aspect of the prepuce of sufficient length to permit of free protrusion of the penis. A single incision is, however, usually insufficient, for the reason that the resultant cicatrization leaves the parts in the same or worse condition than before. Therefore, the preputial ring should be circumcised and the mucosa stitched to the outer skin. The stitches may be removed at the end of a week. Care must be exercised to remove as little of the free extremity of the prepuce as possible or the penis will afterwards protrude. Supplementary treatment consists of antiseptic irrigation of the parts.

PARAPHIMOSIS.

In this condition the prepuce, after becoming retracted behind the glans penis, prevents the latter from returning to its normal position.

It is most commonly observed after coitus. During erection of the penis the hairs surrounding the preputial orifice sometimes adhere to the organ, and as retraction of the latter takes place the free border of the prepuce becomes inverted, thereby forming a constriction. The glans then commences to swell, and if the condition is not soon relieved it may terminate in gangrene.

Symptoms and Diagnosis. The animal walks with a straddling gait, constantly licking the penis, and moves the hind quarters as if in the act of copulation. Examination of the parts establishes the diagnosis.

Treatment. With the animal in the dorsal position, first endeavor to replace the glans by oiling and massaging, and at the same time drawing the prepuce forward. Withdraw and cut off any displaced hairs. Failing in this apply ice or direct a stream of hot water on the organ and scarify it. If this does not succeed, incise the prepuce as directed for phimosis. For a few succeeding days allay any tendency to inflammation of the parts by injections of warm antiseptic or astringent solutions, as directed for balanitis. If gangrene is present amputation must be resorted to. Haubner found it necessary to perform the latter operation.

NEOPLASMS.

Venereal Granulomata. A specific infective variety of neoplasm affects the mucosa of the penis and prepuce. The disease is quite common on the European Continent and in Great Britain where one of the kennel clubs has found it necessary to issue a circular of warning against its perpetuation by breeding infected animals. In this country it does not appear to have gained any foothold. In twelve years I have only seen two cases, and both of these were in male dogs which had recently been imported from England. The area of invasion of the disease is not always limited to the mucosa, for in some cases it infiltrates the adjacent tissues. It may also exhibit metastatic tendencies to the inguinal glands. It is an inoculable disorder, and is probably always communicated



No. 50. Venereal Granulomata.

from an infected animal by the act of copulation. It may develop on any part of the organ, but most commonly occurs at the base and on the corresponding portion of the preputial mucosa. In some cases it is confined to the glans, while in others it covers the entire organ.

Symptoms and Diagnosis. Usually, attention is first drawn to the condition by the emission of sanguineous non-purulent liquid from the prepuce, and by the presence of circumscribed or diffuse tumefaction of the latter. Palpation gives a subpreputial unevenness. On exposure of the penis the growths are easily discernible. In appearance, they vary according to the stage of their development. At the period of discharge they appear as greyish-reddish or pinkish vegetations, which are soft and friable, and bleed easily on being touched, and are generally sessile, but may be pedunculate. In the very early stages, *i. e.*, a few days after the infection has been sustained, they have their inception as minute vesiculate solid pimples. The rate of growth is not rapid, and sometimes several weeks elapse before there is much increase in size. Nevertheless, the disease is progressive and the erstwhile papules gradually assume the vegetative character. A growth of several months' standing exists as a firm lobulated mass of purplish color, and is generally accompanied with cachexia and emaciation.

Treatment. These growths, when of recent origin, may be easily removed and without liability to recurrence, but when long-standing and a considerable area of mucosa is involved they are eradicable only with difficulty. To effect removal of circumscribed, limited growths, expose the penis in the usual manner, anesthetize locally with cocaine and snip them with curved scissors, including with them a portion of the mucosa, to which they are attached. Considerable hemorrhage may occur which may be arrested by drawing the divided mucosa together with a few fine sutures. In some cases it is necessary to slit and afterwards sew up the prepuce in order to more effectually reach the tumors, and repeated operations at intervals of fifteen or twenty days may be required to effect complete ablation. Thermo-cauterization should be tried when recrudescence takes place. Curettage should not be employed, as it involves risk of recurrence of the growth by fresh inoculation of neighboring healthy mucosa.

In extensive invasion of the parts amputation of both penis and prepuce is indicated.

Infected animals should not be allowed to mate.

Papilloma of the Prepuce. Small growths, with or without a pedicle containing melanotic deposits, the so-called pigmented moles, are occasionally seen about the prepuce of black dogs.

Treatment. Simple ablation with scissors serves to eradicate these little blemishes.

Sarcoma and Carcinoma of the Prepuce. Malignant neoplasm is of rare occurrence, and when it does exist is inoperable. Petit and others have recorded instances.

AMPUTATION.

This operation is indicated when the organ is the seat of malignant neoplasm or becomes gangrenous as a result of paraphimosis or strangulation from other cause. The animal should be anesthetised and hopped in the dorsal position. The technic is as follows: Draw the organ well out of the prepuce by means of a tape tied round it, and apply a tourniquet above the proposed line of section, which should be posterior to the os penis. Sever the occluded portion of the organ with a scalpel. If section is made through the bone a saw must be employed. Seize and ligate all vessels with silk, expose the urethra and suture it to the free extremity of the trunk with silk. Establish a prominent meatus by incising the inferior wall of the extremity of the urethra for a short distance in order to lessen the tendency towards subsequent cicatricial stenosis. Remove the tourniquet and allow the stump to slip back within the prepuce. For a few succeeding days irrigate the parts with warm antiseptic solutions, and subsequently see that the urethral orifice is maintained, by passage of the catheter if necessary. Healing is usually complete in from ten to twenty days. Should cicatricial stenosis of the urethra follow the best plan is to establish a fistulous opening beneath the ischial arch by which the animal may discharge its urine.

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The Testes and Scrotum**CONGENITAL MALFORMATIONS.**

The condition known as Cryptorchism is not uncommon. Its recognition by the veterinary practitioner is important from a medico-legal aspect. Sometimes a whole litter of puppies is affected. One or both glands may be involved (monorchism, cryptorchism) and they are most frequently retained within the abdominal cavity, generally at the level of the internal ring. Less frequently they traverse the inguinal canal and reach the position normally occupied by the scrotum (ectopia), the latter being absolutely wanting. Normal descent of the testicle occurs somewhat later, and is more liable to deflection on the right side than on the left. In a true cryptorchid the development of the glands is always arrested, the penis may be rudimentary, and sexual proclivity is lacking, though some subjects exhibit a roving tendency. It is well known that a retained testicle may grow to some extent at puberty, yet neither then nor at any subsequent period does it reach its full size and acquire its spermatozoa-producing powers, the tubules remaining atrophied. While incapable of producing spermatozoa, the retained organ is capable of exerting that influence which the normal testis exerts upon the development and growth of the body. When one organ has fully descended and developed, the animal is capable of procreation, but, on the other hand, when both have failed to reach the scrotum it remains sterile, though it may yet possess enough virility to copulate.

Griffiths experimented on several dogs, both young and full-grown, by replacing the testicle and cord in the abdominal cavity, with the following results: (1) When replaced in young animals it undergoes little change, growing somewhat, but not so much as the undisturbed organ until the approach of puberty. (2) The testicle of a full-grown animal, when replaced, soon dwindles to two-thirds or one-third its natural size, and after a short time presents precisely the same structure as that which is found in the replaced testicle of the young animal. There is no trace of spermatogenesis in the degenerated epithelial cells, and no spermatozoa in the interior of the atrophied tubules.

Retained testes are prone to tumor formation. Leisering and Sutton have seen tumors of retained testicles in monorchids. In

Sutton's case the enlarged gland had undergone axial rotation. Cadiot and Almy regard the condition as predisposing to tumor formation.

Treatment. When it is considered advisable to remove the glands in a true cryptorchid they are most easily reached by opening the abdominal cavity in the vicinity of the inguinal region. They are then sought for with the index finger, and when found drawn outside the cavity, and excised after the cord has been securely ligated with fine sterile silk.

In one instance I ablated the glands in a cryptorchid to cure a mean disposition with successful result.

Ectopic testes are removed by cutting down directly over them, the same technic being observed as for castration.

TRAUMATIC LESIONS.

The testicles occasionally sustain injury from the bites of other dogs, and in countries where the dog is used to hunt the wild boar he is often emasculated by the tusks of the latter animal.

Treatment. Hot antiseptic irrigation or sitz-bath is indicated, and if gangrene is threatened the glands must be removed.

ORCHITIS.

Inflammation of the testicle is of rare occurrence. When it takes place it is usually due to traumatism, such as the bite of another dog or the kick of a miscreant, but it may also arise consequent upon infection.

Symptoms and Diagnosis. The disease is characterized by tumefaction of the gland and its coverings, more or less febrile reaction, and acute pain when pressure is applied. It is to be distinguished from eczematous inflammation of the scrotum.

Treatment. Hot water applications are beneficial. This treatment may conveniently be applied by causing the animal to take a sitz-bath in any suitable receptacle containing a hot antiseptic solution.

NEOPLASMS.

Neoplasms of both the testicle and scrotum have been observed a number of times. Some doubt exists among authorities as to



No. 51. Malignant Neoplasm of the right Testis.

the identity of the malignant type of growth (See Chapter on Neoplasms). It is usually unilateral. Cadiot has seen tuberculosis. Enlargement of the gland may also exist as an indurated fibroid condition, in which there is a great increase of connective tissue with atrophy of the parenchyma, and sometimes presence of retention cysts.

Symptoms and Diagnosis. The gland presents an indurated, insensitive growth, sometimes five or six times greater than normal, with uneven, knotty surface, and with or without fluctuating cystic areas. The corresponding cord is usually tumefied.

Treatment. The only effective treatment is castration, and it should be practiced early, the cord being ligated as far above the thickening as possible. A very stout, double ligature should be used. The operation is contraindicated when metastasis has taken place. When the scrotum is involved, it may also be removed.

PARASITIC EMASCULATION.

Dogs on this continent are subject to attack by the emasculating bot-fly (Cuterebra emasculator). The first recorded instance of this remarkable example of parasitism came to my notice in Montreal in 1893. Since then Glass states that he has seen it on two different occasions. Professor Fletcher, Dominion Entomologist at Ottawa, informs me that squirrels are commonly affected to the extent of becoming emasculated either by the direct action of the parasite or through their own endeavors to relieve themselves of its presence with their teeth. Fitch also made this observation in 1856, in the environs of Lakeville, N. Y. The fly deposits its eggs by piercing the scrotum. In the instance which I observed a small part of one extremity of the larva projected through an orifice in the scrotum, the larger portion of it being buried and encapsulated by a zone of inflammatory fibrous tissue. It was seized with forceps and extracted without much difficulty. It is probable, that if allowed to remain, the parasite would bring about inflammatory changes in, or complete destruction of, the testicle, in the same manner that it does in the squirrel.

ORCHECTOMY. CASTRATION.

This operation is primarily of importance as a remedial measure

for local pathologic conditions, including prostatic enlargements. It is also sometimes resorted to as a means of improving the temper of vicious animals and to correct roving habits and also onanism. The operation being very painful, the animal should be anesthetised and hobbled in the dorsal position. Of the several methods by which the organs may be removed, viz., clamping with cauterization, torsion, emasculation, excision after ligation, the last-named is the best, because there is less risk of subsequent secondary hemorrhage than with the others. Owing to the dog's habit of licking his wounds bleeding may be started from vessels which have not been ligated. In any case the best results are always obtained by operating under strict asepsis and stilling all venous oozing, when the scrotal wound may be immediately closed with a buried suture, and healing is quick to follow. When blood clots are allowed to accumulate or pockets to form, there generally follows a violent inflammatory reaction and liability to peritonitis by extension.

The technic of ligation and excision is as follows: Render instruments and suturing material sterile by boiling and thoroughly cleanse the hands and scrotum. Grasp the testicle between thumb and forefinger of the left hand, thereby stretching the skin over the gland. Expose the latter by one free incision down to the tunica propria. Seize the gland and draw it out of the scrotal sac. The tunica reflexa becomes retracted some distance up the cord anteriorly, but remains adherent to the tail of the epididymis posteriorly. Apply a stout silk ligature to include both cord and tunica reflexa, and remove the gland with scissors, cutting the cord on the occluded side close to the ligature.

The skin wound should be closed with a subcuticular suture. If the parts do not suppurate healing will follow *per primam*, but they should be kept under observation for a few succeeding days. If pus forms it may be evacuated in the usual way and granulation allowed to take its course.

Cagny has proposed a somewhat novel method. He ties a cord temporarily round the scrotum above the testicles to keep these organs in the bottom of the scrotal sacs. He then makes an incision in the median line, draws both glands out and twists the two testicular cords one upon the other after the manner in which two strings are twisted upon each other. A catgut ligature is applied to the twisted cords, they are severed below the point of ligation, the stump is returned to the scrotum, and the integument sutured.

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The Prostate Gland

EXAMINATION.

The prostate gland is examined by digital palpation, the index finger, which may be incased in a rubber glove and well-oiled being passed into the rectum. Enlargements are easily discernible in this manner. Pronounced enlargements may be felt by abdominal palpation in the pelvic region.

PROSTATITIS.

Acute inflammation of the prostate gland is uncommon. A subacute or chronic type is more often seen. The disease is caused by microbic invasion, usually by way of the urinary tract, and tends towards abscess formation. A unilateral or symmetrical swelling is formed which may attain the size of a hen's egg or the human fist. The pus may escape by the urethra, or it may break through into the peritoneal cavity or into the rectum, or even discharge by fistulous tract in the perineal region. The swelling, by compression, occludes the urethral canal.

Symptoms and Diagnosis. The principal symptoms are suspension of normal defecation and micturition, coupled with febrile manifestations. The animal makes frequent and often painful attempts to urinate. Urine may be voided freely or may pass by drops, or there may be complete suppression of the flow. Constipation may be present, the animal refraining from defecating on account of the pain induced by the act. By abdominal palpation the bladder is felt distended. Passage of the catheter calls forth expression of great pain when the instrument reaches the prostatic portion of the urethra. In some cases the compression is so great that the instrument cannot pass. Finally, rectal exploration with the index finger reveals the presence of a painful inflammatory enlargement, which fluctuates when it contains pus. If pressure is applied the matter may be forced out by the urethra. In other cases the

matter does not tend to accumulate, but is constantly discharged by way of the urethra.

Treatment. This should be directed towards relieving pain by administration of morphine or chloretone. Catheterization must be kept up every ten or twelve hours so long as the flow of urine is obstructed. If the catheter cannot penetrate, puncture of the bladder must be resorted to. Brisk purgatives should also be administered. A stream of cold water directed over the perineum is useful to allay the inflammation. When pus is present an attempt should be made to cause its evacuation by pressure over the gland through the abdominal wall or with the finger in the rectum. Haubner cured a case in this manner. Failing in this, the matter must be removed by the aspirating syringe or a fine trocar and canula introduced through the perineum, the finger in the rectum serving to guide the instrument, or the rectum may be dilated with a speculum and either instrument thrust through its wall into the gland.

Prostatic abscesses discharging by way of the perineum are treated by antiseptic irrigation.

NEOPLASMS.

The growths which affect the prostate are the non-malignant hypertrophic enlargements and malignant carcinoma.

Hypertrophy. Hypertrophic enlargement of the prostate is a very common affection among old animals. It may occur also in young animals. The condition is one of abnormal growth of pre-existing gland-tubules but without the power of producing the secretion as in the normal gland. After a variable time atrophy of the tubules and muscle-fibers of the stroma takes place, and in their place fibrous connective tissue develops. Small cysts are formed through small areas of gland-tissue becoming separated by trabeculae of fibrous or fibro-muscular tissue. It will be remembered that the gland is voluminous under normal conditions and surrounds the origin of the urethra and the neck of the bladder. Any increase in volume tends, by compression, to occlude the urethral canal so that micturition becomes a matter of difficulty and at times an impossibility. Prostatic enlargements are very prone to prolapse into the perineal region to constitute the contents of perineal hernia.

Symptoms and Diagnosis. The symptoms of hypertrophy are

very similar to those of prostatitis, but devoid of febrile disturbance. Dysuria is marked, the urine being passed frequently and in small quantities. Each act of urination, particularly if strained, may or may not be immediately followed by hematuria. When hemorrhage takes place it is produced as a consequence of the hypertrophy, the pressure from which, constantly exercised on the prostatic venous plexus causes stasis of the circulation. This plexus being situated superficially is easily ruptured by straining. The bladder becoming distended, the animal exhibits great distress and later acute pain. As an immediate effect the bladder may rupture, but if the distension is not great enough to result in this lesion, and the condition goes unrelieved, more remote effects are apt to follow, the stagnation of urine resulting in cystitis or hydronephrosis. Usually, constipation is also present, and may go on to complete coprostasis. This symptom is also the result of pressure by the enlarged gland. When the latter is very voluminous it is sometimes possible to feel it in thin subjects by abdominal palpation in the pelvic region, but generally speaking, digital exploration by way of the rectum is necessary to verify the diagnosis. Passage of the catheter is met with obstruction in the pelvic region. As already stated, perineal enlargements must always be considered as of possible prostatic origin.

Treatment. The animal must first be relieved of retained urine or feces. This is accomplished in the one case by catheterization, or if necessary by aspiration or puncture of the bladder, and in the other case by rectal injections and the use of the rectal scoop.

Medication has little effect on hypertrophic enlargements. Mueller recommends injection into the gland by way of the rectum of a solution of iodine composed of potassium iodide 2 parts, tincture of iodine 30 parts, water 60 parts. This preparation is injected at intervals of eight to fourteen days by means of a hypodermic syringe with a fine, long needle attached. Castration has permanent remedial effect. This has been proven both experimentally and clinically, first and most fully by White in America, and by Griffiths almost simultaneously in England. Helferich cites Guyon, Legueu, Pravone, Prezwalski, and Sackur to the effect that this operation induces atrophy of the gland. It is probable that changes in the vascularity of the gland play some part in its reduction after castration, as the process of atrophy which takes place

is similar to that which occurs in the uterus subsequent to oophorectomy. The operation should comprehend both testes to ensure atrophy of both lobes, since when unilateral castration is practised, only the lobe on the corresponding side is affected. The benefit derived from the operation is apparent within a few days.

That the growth of the prostate is dependent upon the growth of the testes is evident from the fact that it is not developed until the time of puberty. It is a purely sexual gland, having nothing to do with micturition, its function being to add certain constituents to the seminal fluid at the time of its discharge. Griffiths found that both the prostate and Cowperian glands remained small, lost their glandular character, and became transformed into masses of fibrous connective tissue, when the testes were removed before the age of puberty (about ten or twelve months in the dog), and that when the organs were removed after full development they underwent a retrogressive metamorphosis to the extent of the glandular epithelium becoming converted into the lower and functionless type, and the stroma losing muscular tissue.

Kirby undertook castration experiments on dogs with the object of discovering whether this operation could be of use as a remedy for enlarged prostate in man. He found the average weight of the prostate of thirty-five healthy dogs of certain size to be 17.347 grams. When the gland was removed from eleven similar animals thirty to sixty days after castration, it weighed only one-fourth the original weight.

In valuable stud animals, in which it is desired to leave the testes intact, the alternative operation is Cysto-enterostomy, but it entails considerable risk.

Carcinoma. Malignant adeno-carcinoma has been occasionally observed, but it is not common. It occurs as a tuberous enlargement, with a tendency towards retrogressive metamorphosis and metastasis, particularly to the testicle.

Symptoms and Diagnosis. The symptoms are similar to those of other forms of enlargement as regards the interference with normal micturition and defecation. It may be differentiated by the uneven, tuberous growth and the accompanying cachexia.

Treatment. There is no practicable treatment for malignant neoplasm, excepting its extirpation and anastomosis of the stump of the bladder with the rectum.

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THE REPRODUCTIVE ORGANS OF THE FEMALE

The Ovaries

EXAMINATION.

The ovaries are examined for diagnosis of pathologic conditions by abdominal palpation or direct inspection. By palpation with the fingers of both hands on either side of the abdominal wall, the animal being in the standing position, it is possible, in thin subjects, to recognize the presence of cystic neoplasms. In doubtful cases explorative celiotomy should be resorted to.

CONGENITAL MALFORMATIONS.

The condition known as Dermoid Cyst, in which sequestered portions of the epiblast occur, has been observed by Esser.

OOPHORITIS.

Inflammatory diseases of the ovary are almost unknown, though the not uncommon cystic enlargements of this organ are looked upon by some as having their origin in thickening of the follicular wall caused by chronic inflammation. The organ is also occasionally the seat of congestive changes. A remarkable instance of purulent oophoritis was witnessed by Martin. The disease in this case was attributed to a piece of rye chaff which was found lodged in the ovary, and which had evidently worked its way thither from the vagina, where it was supposed to have been deposited in an injection, as the entire tract it had traversed showed evidence of inflammatory changes.

Symptoms and Diagnosis. Congestion of the ovary is said to be productive of epileptic seizures. Purulent disease produces symptoms of toxemia. In both conditions there is extreme tenderness to pressure over the seat of the organs.

Treatment. This consists in the ablation of the glands by celio-oophorectomy.

NEOPLASMS.

Practically the only growths we have to deal with in the ovary are the cystic formations. Sutton has recorded an instance of adenoma, where the tumor weighed fifteen pounds, and the occurrence of dermoid cysts has also been observed. Cysts sometimes grow to a great size. They represent accumulations of unruptured ripe Graafian follicles, and may be unilocular or multilocular. None of these growths has any pronounced ill-effect on the animal.

Symptoms and Diagnosis. The abdominal cavity is distended in proportion to the development of the growth, and the presence of the latter may be ascertained by careful external palpation. The cysts fluctuate on pressure. Differentiation lies between gestation, hydrometra, and hydronephrosis. It is hardly to be confounded with ascites.

Treatment. All ovarian growths should be extirpated by celio-oophorectomy.

OOPHORECTOMY.

This operation, known in ordinary parlance as "spaying," is principally undertaken for the purpose of suppressing the sexual function. In some cities where a high tax is imposed on the keeping of females, and an altered female is placed in the same category as a male, owners submit their animals to be unsexed from motives of economy. This operation is also occasionally necessary as a remedial measure for certain pathologic conditions, such as neoplasms, hyperemia, and purulent inflammation of the ovary.

In any instance where it is necessary to remove the uterus in whole or part, the ovaries should also be ablated, otherwise their presence gives rise to the formation of retention cysts.

It is claimed by some authorities that ablation of the ovaries is not a certain preventive of the sexual impulse and the concomitant uterine discharges. Leeney, a British practitioner, writing in 1890, asserted that regular periods of "estrus" might follow the operation unless the animals were operated upon when pregnant, and referred to a tradition existing in England that a female should be allowed to copulate some ten days before being spayed, though no explanation was offered. Hobday also believes that the effect of the operation on the sexual impulse is by no means certain, and

states that he has observed signs of "estruation" after the ovaries had been removed, the animals even copulating with the male. Such cases have occurred in my own practice, *even where both ovaries and uterus had been removed*, but only in animals that had estruated normally at least once, or had given birth to offspring. These cases are to be explained on the theory of habit, the organism once having experienced the sexual impulse continuing to exhibit it in spite of the loss of the essential organs. There seems little doubt that the operation performed before the advent of the first estrual period is an absolute preventive. In some cases, at least, manifestations of this nature are due to the leaving behind of small portions of ovarian tissue. Owing to the fact that the enveloping sac of the ovary in adult animals is often the seat of considerable fat, which completely hides the organs within, their recognition *in situ* is a matter of impossibility, and it is then a very easy matter to leave behind a minute portion of the gland. A peculiarity of these cases of recurring "heat" is the appearance of the symptoms at irregular intervals or almost continuously. Another phenomenon which occasionally occurs subsequent to the operation, is the so-called "false heat" or attraction of the male without concurrence on the part of the female, which seems to be dependent upon increased or changed mucosal secretions. There are no physical signs of estruation, but members of the opposite sex are persistent in their attentions. The condition may last some months, but finally ceases. It is due to the remnant of the reproductive tract undergoing certain changes after castration. At first, there occurs a marked hyperemic injection of the mucosa, which becomes soft and swollen. Secondly, the normal secretion is appreciably increased. This condition lasts for a few months, when it is succeeded by shrinkage and atrophy.

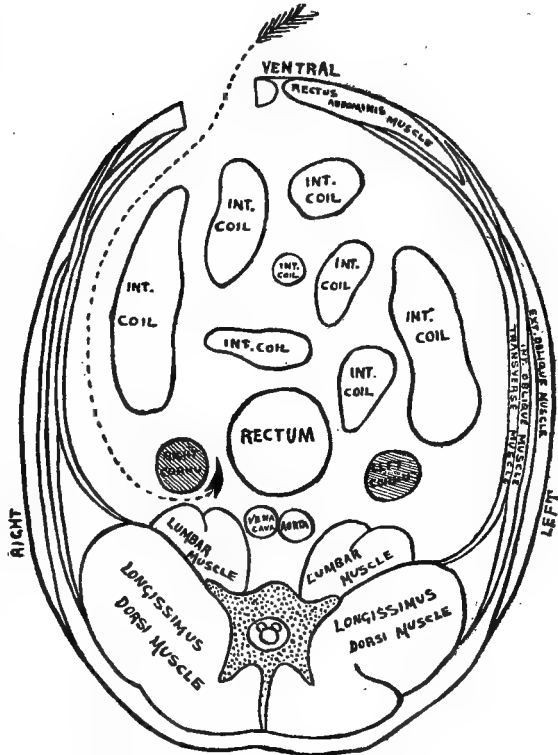
The ultimate effect of the operation upon the organism varies according to individual temperament. Some animals become fat and inactive, while others are in no wise affected. There is little doubt that metabolism is influenced. Curatulo and Tarulli believe that the reproductive glands, besides developing ova, furnish a secretion which modifies tissue change. They found that the phosphates in the urine were greatly and permanently reduced in quantity after removal of the organs, which explained the utility of castration for the relief of osteo-malacia. Poehl believes this se-

cretion to be an active oxidizing agent, which when eliminated from the economy, diminishes oxidation of the organic phosphates contained in the tissues, and these, combining with earthy bases, are deposited in the bones in the form of calcium and magnesium phosphates. On the other hand, Mossé and Oulié claim that the quantity of phosphoric acid is increased and not diminished.

The operation can safely be performed at any period of the animal's life, but the age to be preferred in virgin animals is between five months and the advent of puberty (about ten months), selection of the time depending upon size of breed. It is not advisable to operate while estruation is imminent or in progress owing to risk of inflammation resulting from the congested condition of the parts. Francis recorded an instance of fatal termination from peritonitis after having operated under protest while the animal was passing through the period, and in my own practice I have experienced inflammation and chronic hemorrhage to follow, where the operation was undertaken shortly before the period. The best time to operate on matron females is a few weeks after.

The animal should be placed in the dorsal position and securely hobbled and anesthetised, or a narcotic may be previously administered. Some operators prefer to narcotise and then suspend the animal by the hind legs, this position having some advantage in lessening the tendency to protrusion of other viscera. The abdomen may be opened by median or lateral section. The former is to be preferred, and the incision should be made slightly to either side of the linea alba, and immediately posterior to the umbilicus. If it is made further back than this it is difficult to separate the organs from their anterior attachments. When a flank incision is made, but one is necessary, as both glands can be removed through the same opening. With a little practice it is not a difficult matter to acquire dexterity in finding the ovaries. Their position is beneath the fourth lumbar vertebra immediately posterior to the kidneys. One uterine cornu should first be sought. The peritoneal cavity being exposed, the omentum is drawn forward and stowed away anteriorly. The index finger is then introduced and directed along the internal aspect of the wall on one side till it reaches the sublumbar region. Here it is made to hook round the cornu, which is immediately brought to the surface. By following this procedure the cornu can be almost immediately found, but to dive in

among the coils of intestine and grope about for it is time-consuming and sometimes futile. This cornu being found it is followed up till the ovary is brought to view. With a little gentle traction the latter is brought well without the abdominal wall. The index finger is then thrust through the broad ligament and ligatures are applied above and below the ovary. It is always safest to



No. 52. Diagram to show course pursued by the finger to quickly reach the cornu.

ligate and ligatures of silk are best. As has been pointed out in another part of this work, divided bloodvessels of the abdominal cavity possess a remarkable tendency to bleed when shut off from the clotting influence of the air, and while there are some mechanical devices (spaying scissors, spaying emasculators) on the market by whose action the vessels are crushed, it is infinitely safer to ligate and thereby reduce all risk of secondary hemorrhage to a minimum. It is extremely important to apply ligatures so that all ovarian tissue will be completely occluded. If any portion of the gland is left behind, the object of the operation, when suppression of estruation is aimed at, will be defeated. All tissue within the occluded area is next excised with scissors, the division being made at the upper extremity first. The one ovary being thus removed, the operator follows the cornu back to its junction with its fellow, and follows

of purulent matter which finds vent at the vaginal outlet. Under normal conditions pathogenic bacteria are constantly present throughout the vaginal canal, but the uterine cavity remains free, being protected by the mucus at the cervix. At times, however, especially when vaginitis occurs, microorganisms gain entrance and originate an inflammatory disturbance of the mucosa. It is rather remarkable that it arises most commonly as a chronic process in virgin females of advanced age. This I have found to be almost invariably the case, and Froehner has made similar observations. Should the cervical mucosa swell sufficiently to occlude the lumen, which it very often does, the matter is retained, gradually increases in amount, and forms a septic retention cyst. This condition is known as PYOMETRA. From pyometra secondary septic endocarditis is prone to result.

In chronic cases the wall of the uterus is extremely thickened, the microorganisms present being very numerous and often located deep in the tissues. In one instance the diseased organ when submitted to microscopic examination, exhibited a microorganism, which in shape and size resembled the ordinary diplococcus lanceolatus of human pneumonia, which is found under normal conditions in the mucous passages of the dog.

Symptoms and Diagnosis. When the cervical canal is patent, the vagina presents an injected and swollen appearance, and the discharge, which may be purulent, sanguineous or ichorous, takes place more or less constantly, but more particularly after locomotion or any expulsive effort of the abdominal muscles, such as accompanies defecation. The animal usually licks the vulva a great deal. Abdominal palpation is painful. In the early stages of pyometra there is little change in outward manifestations, and the disease process may continue for some weeks, the abdomen all the while enlarging, until finally the appetite becomes capricious, fails altogether, and thirst and vomiting set in, accompanied by emaciation. The symptom of vomiting is always indicative of grave toxemia. By this time the abdomen is very much enlarged, and by careful palpation the two distended cornua may be made out on either side of the floor of the abdomen. The alteration in the contour of the abdominal wall partakes somewhat of a bilateral uniformly cylindrical tense swelling, as contrasted with the pyriform outline of a cross section of the trunk in dropsical effusion of the peritoneum.

In addition to this, percussion fails to originate the wave characteristic of ascites. It is easily differentiated from coprostasis, where the mass is hard and unyielding and the outlines of the bowel can be distinguished. It is hardly to be confounded with pregnancy or obesity.

Puerperal Septic Metritis. This condition results from the retention of septic matter (fetal membranes, etc.,) in the uterus in connection with abnormal fetations or fetal deliveries. It commonly occurs in those cases where intrauterine death and non-delivery of fetuses takes place. Bacteria gain entrance from the vagina and induce putrefactive changes. The latter are of ichorous character. The inflammatory process extends and involves all the coats of the organ and focal ulcerative degenerations occur and lead to perforation. This results in general purulent peritonitis if the animal has not already succumbed to toxemia.

There are, however, rare instances recorded where retention of fetuses has not led to extension of inflammation beyond the uterus. Welch reported operating on an animal for the purpose of removing the ovaries and finding a bony skeleton within the uterus, the remainder of the fetal tissues having disappeared by decomposition. At the previous whelping period the animal had shown symptoms of toxemia.

Symptoms and Diagnosis. There is a discharge of foul, greenish, or sanguineous, purulent matter. There is rarely any rise in temperature, but the latter frequently falls below normal. The animal ignores the offspring, and is listless, and total collapse rapidly supervenes. The appearance of vomiting is to be regarded as a grave symptom. As in intestinal obstruction, it marks the advent of that phase in the struggle between bacteria and the organism where the latter commences to succumb to septic infection.

Proliferative or Fibroid Endometritis. This condition is characterized by chronic proliferative overgrowth of the submucosal layer. This leads to great thickening of the mucosa, which acquires a mammilliform appearance. Here and there may be seen minute cysts. These represent generalised dilations of the mucosal glands which have resulted from stricture of their mouths by the fibroid growth. The entire organ may be much shrunken. As in pyometra, estruation and the attendant uterine discharges no longer occur. The disease is peculiar to aged animals, and produces little

or no morbid effect on the organism, so that surgical interference is superfluous.

Treatment. Catarrhal endometritis is difficult to treat short of extirpation of the organ. In only the largest animals can any attempt be made at irrigation, and even then it is practically impossible to wash out the whole extent of the two cornua. Very good results are obtainable by a course of administration of official emmenagogue pills, which contain ergotin and other ecbolics. Should the latter treatment fail after a thorough trial, celio-oophoro-hysterectomy is indicated.

When pyometra is established it is always best to remove the uterus as soon as possible before the condition has become so advanced as to render a successful issue doubtful, owing to the great tendency to formation of metastatic abscesses in the liver, spleen, and kidneys. As in catarrhal endometritis proper, discharge of the contained matter can be induced with emmenagogue pills, but the disease is in no wise abated, the infective process having its seat deep in the wall of the organ. These pills are very useful for administering as a diagnostic agent in doubtful cases, as they invariably cause the organ to expel its contents. Burke claimed to have cured an animal suffering from a disease, which from his description was evidently pyometra, by administration of a mixture of ergot, iodide of potash, and digitalis. But as he did not see the animal again after the lapse of three weeks, the claim can hardly be credited, what took place having been in all probability expulsion of the accumulated matter with temporary relief.

The puerperal form of the disease is to be treated by prompt celio-oophoro-hysterectomy. Attempts at extraction of the fetal remains and irrigation are not to be countenanced. The disease is so rapid in its course that hesitancy on the part of the surgeon may result in fatal termination. Moreover, the fact that all the coats of the organ are involved in the inflammatory process renders local disinfection an impossibility. Immediately after an operation of such gravity, powerful stimulants, such as trinitrin, should be hypodermically administered, and the physiologic salt solution injected through the wound into the peritoneal cavity, or hypodermically for several minutes, as fast as absorption takes place. Provision should also be made for drainage as the peritoneum is extremely apt to have become infected.



No. 54. Prociidence of the Vagina, Os Uteri, Uterus, and both Uterine Cornua.

PROCIDENCE.

Eversion of the uterus is rarely seen. It is sometimes confounded with estrual hypertrophy of the vaginal mucosa, polypus and prolapse of the vagina. Its occasional occurrence is associated with the whelping period. Recent writers describe the lesion as being of a partial nature one of the cornua only taking part in the protrusion. But that both cornua may participate I can assert from a case in my own practice which is shown in the accompanying illustration. The double lesion is also attested by the record of Cros, a veterinarian at Milan, in the year 1832. This practitioner was requested to treat a toy bull female, six years of age, which had previously brought forth different litters of five and six puppies without difficulty. On the occasion in question the uterus had become completely everted and by pressure on the urethral orifice interfered with urination. Three days after its first appearance the organ was greatly tumefied and gangrenous. Recognizing the risk involved in replacing tissues in such condition, Cros decided on amputation. This was performed by application of a tight ligature round the neck of the protrusion as far within the vagina as possible. On the following day the ligature was further tightened to complete the isolation and mortification. On the third day the protruding portion was extirpated with bistoury with but slight hemorrhage. The mass on examination was seen to include both right and left cornua. The right horn which had carried the young of the last litter was considerably longer than the left. The anterior extremities of both terminated obtusely from which Cros surmised that they had been torn from their connections with the ovaries, the latter organs remaining within the abdominal cavity. The operation was followed by complete recovery. Ridler and Hobday have also witnessed and treated in like manner, but by immediate extirpation, a prolapse of both cornua.

In one case, recorded by Leech, the everted organ contained the bladder and portion of the intestine.

Symptoms and Diagnosis. At first a tumor appears protruding from the external genitals. It soon becomes swollen and inflamed and later ulcerates. Patches of gangrene develop. The animal strains as if at micturition. The tumor must be carefully differentiated from the not uncommon condition of protrusion of the vaginal mucosa which occurs at the estrual period.

Treatment. If the proci-dence is recent an attempt should be made at reposition, after first cleansing the parts with some disinfectant solution. To effect this it may be necessary to open the abdominal wall and withdraw the cornua. They should then be suspended to the abdominal wall with sutures (Ventrofixation). If the parts are gangrenous or there is objection to celiotomy, the protrusion should be ligated with stout silk as far within the vagina as possible, the occluded portion being excised, not, however, until the operator has satisfied himself that no other viscera are contained within the mass. Following this operation the vagina should be irrigated daily with antiseptic solutions.

In one case treated by Funk the everted cornu prevented the delivery of the fetuses from the other so that Cesarean section became necessary.

TORSION OF THE CORNUA.

This is a very rare condition. It has been described by Eichenberger, Guillebeau and Bonnet, and twice by Kitt. The uterus was always gravid. In Eichenberger's case the animal had previously whelped without mishap, but on this occasion could not deliver. Ergotin was administered and two dead fetuses appeared. Death occurred ten days later from peritonitis. The left uterine cornu and broad ligament were twisted and torn. The former contained two fetuses. The posterior part of the canal was obliterated and its wall atrophied, showing the condition to have been one of long standing, probably a few weeks. In Guillebeau's case the bitch was delivered of one fetus. Labor continued but without any result until death took place a week later from peritonitis. The left cornu containing two dead fetuses and distended to a diameter of six inches was twisted in its long axis at its junction with the body of the organ. The broad ligaments of both cornua were lacerated.

Torsion may also occur independent of pregnancy as I have had occasion to observe. A Yorkshire Terrier, aged seven years, which had previously enjoyed good health, estruated sparsely. Two weeks later it succumbed without any special symptoms other than toxemia and a constant slight discharge of a bloody purulent matter. On making a necropsy, the right cornu was found to be highly inflamed and to contain a purulent hemorrhage matter (evidently

pent-up uterine secretions). A twist existed at its junction with the body of the organ and this had prevented free discharge.

Treatment. The cases cited above emphasize the importance of ascertaining whether any fetuses remain behind or not in all difficult parturition cases. This can be done in almost any case by digital palpation of the abdomen and genital passages. The presence of such being suspected, explorative celiotomy must be undertaken. Relief is afforded either by reduction of the torsion, or if necessary by complete extirpation of the organ.

RUPTURE.

This is a very rare accident and when it takes place it is usually due to rough use of obstetrical instruments. It is said to occur also spontaneously. If the organ contains fetuses the latter may pass through the rent into the peritoneal cavity. The lesion is always serious either from shock or infection of the peritoneum, and the animal usually succumbs.

Symptoms and Diagnosis. When rupture occurs during parturition the contractions of the organ immediately cease and the animal is prostrated. On the finger being introduced within the uterus, the muscular wall is felt interposed between it and the fetus, particularly when the latter is pushed up towards the pelvic region by external abdominal manipulation. Suspicion of the condition calls for prompt explorative celiotomy.

Treatment. The abdominal cavity being opened, fetuses and membranes must be removed, the cavity flushed with moderately hot sterilized water and drainage provided to carry off peritoneal fluids. It is not necessary to suture the rent in the wall of the uterus.

NEOPLASMS.

The growths affecting the uterus are usually innocent in character. The commonest are fibromata, while myomata and lipomata and cystic accumulations occur with less frequency. Malignant carcinomata have also been observed but they are rare.

Fibromata. These tumors spring from the muscular wall and are often in part myomatous, in fact, Sutton believes that many tumors described as fibroids are primarily leiomyomata and later undergo fibrous degradation. They may grow either towards the

lumen of the organ or in the direction of the peritoneal cavity. In the former case, the larger growths may project through the os and even past the vulva.

Symptoms and Diagnosis. Presence of these growths is recognizable by external appearances supplemented by digital palpation. In one instance reported by Romani the tumor seemed to provoke reflex coughing. It prolapsed through the vagina and vulva during a fit of coughing and the coughing recurred when it was pushed back within the vagina, but again ceased on further prolapse.

It is important in diagnosing growths occupying the vaginal passage to carefully ascertain whether they are of vaginal or uterine origin.

Treatment. Extirpation is indicated. If it is not desired to preserve the reproductive capacity it is better to remove the entire uterus together with the ovaries. Tumors which project into the vagina should be removed by way of abdominal section and not by ligation within the vagina.

Hydrometra. This condition is characterized by accumulation and retention of the products of normal glandular secretions within the uterus. It may arise from any of the following causes: Occlusion of any part of the canal (generally the cervical extremity) through cicatrization occurring as a result of endocervicitis originating from injury received during parturition; Occlusion through pressure by the ring in inguinal hernia; Occlusion by surgical means in those instances where the organ is ligated and severed as a simple but bungling method of preventing gestation. In any case, unless pyogenic microorganisms gain entrance, or strangulation takes place, the condition has no ill-effect on the animal.

Symptoms and Diagnosis. An animal affected in this manner is generally regarded as being pregnant owing to the distension of the abdominal cavity, but persistence of the enlargement and absence of lactation serve to correct this impression. Contrasted with the condition known as Pyometra, there is no change in the appearance of the external genitals, no pain on palpation, anorexia, nor emaciation; in fact the physical equilibrium is in no wise disturbed. It may be more easily confounded with obesity. Operative measures are unnecessary except in inguinal hernia where there is danger of strangulation.

Treatment. This consists in total ablation of the organ together with the ovaries.

Surgery of the Uterus

All operations on the uterus should be done under general anesthesia, the animal being secured in the dorsal position for median celiotomy and in the lateral position for lateral celiotomy. The organ is best reached by opening the abdominal cavity in the median line in the center of the distance between the ensiform process and the pubic border.

HYSTEROTOMY.

This operation is resorted to in cases of fetal retention in which decomposition has not occurred nor induced changes in the uterine wall, when the fetus is too large to pass through the natural passages, and in inguinal hernia where the gravid uterus forms the protrusion, and when it is considered dangerous to the dam to allow completion of full term owing to the difference in size between her and the sire. Under the latter conditions the chances of favorable result are greater when the operation is undertaken any time up to seven weeks of gestation. Fractures of the pelvis are apt to reduce the caliber of the passage to such extent as to completely inhibit parturition, when the operation becomes imperative. Brooks and Whitworth and Menveux have recorded instances with successful termination. Funk had to resort to the operation in an animal in which one of the cornua had become inverted, thus preventing the expulsion of the fetuses in the other cornu.

Where the safety of the progeny is desired it is interesting to know that the fetus may survive the death of the dam for some minutes. Kehrer, in experimental observations, found that three minutes after death the fetus began to show symptoms of asphyxia, and in thirty-six minutes it was dead. Sauer extracted some fetuses alive by this operation eight minutes after the death of the dam.

The technic of hysterotomy is as follows: The abdominal cavity being opened with as little wounding of the mammae as possible, draw out the organ in its entirety and protect it with cloths wrung out in hot water. Some difficulty may be experienced in exposing the organ, particularly if it contains several fetuses, but it must be handled with gentleness and the opening in the abdominal wall should be large enough to permit of free passage of the distended organ. Make a single incision cautiously through the uterine wall

opposite the insertion of the broad ligament, over one of the fetuses nearest to the fundus of the organ, avoiding wounding the fetal membranes. Extract the fetus and membranes intact and push along the others to the same opening. The fetuses being removed, a few Lembert or Halsted sutures should be applied to close the incision. Some authorities regard this as not being absolutely necessary as the organ very quickly diminishes in volume, the wound closing by its contraction and quickly cicatrizing.

In inguinal hernia of the gravid uterus, the operation is performed in a similar manner after the hernial sac has been opened. Pregnancy with normal delivery of fetuses may subsequently take place.

HYSTERECTOMY.

This operation is indicated in hydrometra, pyometra, purulent metritis, in cases of fetal retention and decomposition where the wall of the uterus is involved, in torsion, and in inguinal hernia where the gravid uterus forms the protrusion and it is not considered advisable to replace it in its proper position. It is also sometimes undertaken in preference to hysterotomy and removal of the fetuses in those cases where dystokia is feared as a result of the animal having mated with a male of superior size.

The ovaries should always be removed at the same time.

The operation is performed in the following manner: Open the abdominal cavity and draw out the organ as in hysterotomy. Apply stout silk ligatures immediately anterior to the cervix and on the further side of the ovaries, and to sections of the broad ligament, excise the intervening parts with scissors, and return the stumps to the cavity. In the case of the gravid uterus and in the larger animals ligate the arteries separately as one ligature at the cervix is not sufficient for safety. There is liability of such ligatures slipping from the stump with secondary hemorrhage as a result. It is well-known that there is a remarkable persistency in the flow of blood from severed vessels of the abdominal cavity even when only small arteries are divided. Larkes had two such unfavorable results attending the removal of the gravid uterus. In cases of puerperal septic metritis drainage should always be provided for by inserting a fold of sterile gauze within the cavity and carrying it

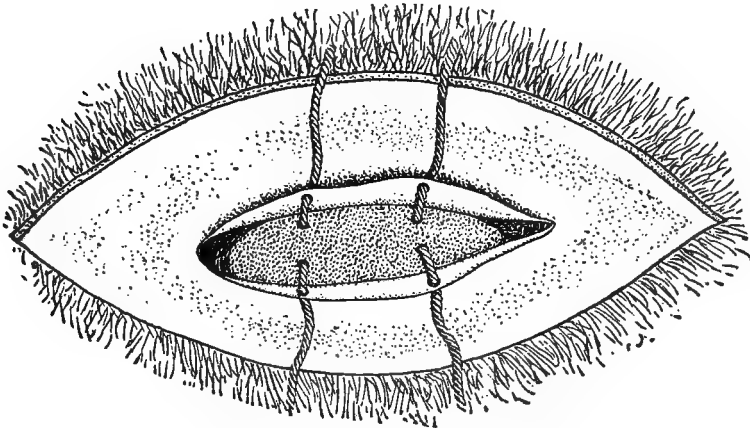
through the wound to the outside. This is removed in the course of five or six days.

Whenever the continuity of the uterus is destroyed, either in one or both cornua, all portions of the organ lying above, as well as the ovaries, should invariably be removed, otherwise there is every probability of a retention-cyst developing from accumulation of glandular secretions, and this may possibly be converted into a pyometra.

The practice of severing the continuity of the organ as a substitute operation for oophorectomy in order to prevent gestation is bad surgery and should never be undertaken. In like manner when the operation becomes necessary in cases of inguinal hernia, and only the middle portion of a cornu forms the protrusion, the upper extremity should be pulled through the ring until the ovary is exposed and the whole of the parts then be removed.

VENTROFIXATION OF THE CORNUA.

This operation consists in producing the formation of adhesions to hold the uterus in position against the abdominal wall. This object is attained by suturing the organ to the inner aspect of the wall. The operation is performed as a remedial measure against eversion of the uterine cornua. The technic is as follows: The abdominal cavity being opened in the median line, the cornua are



No. 55. Ventrofixation of Abdominal Viscera.

sought, straightened out, and brought forward. The same sutures which are made to close the opening in the muscular wall are passed through the muscular tissue of the cornua in the manner figured in the accompanying illustration, while separate sutures are used in the skin wound.

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The Vagina

EXAMINATION.

The vagina is examined by direct inspection, the animal being secured in the dorsal position with the hind legs brought forward. By separating the labia of the vulva with the fingers it is possible to see a short distance within, but to properly inspect the whole extent of the canal an expansible speculum should be employed and light reflected with the aid of a mirror.

CONGENITAL MALFORMATIONS.

According to Kitt, many typical instances of the condition known as Anus-vulva-vaginalis have been recorded. This is a congenital malformation or imperfect development. It will be remembered that during fetal life a depression forms at the site of the anus, which joins the rectum and genito-urinary organs. It later becomes separated from the latter, but if this process should not continue to completion the above-named condition results. Stenosis of the vagina I have seen in a Collie, where copulation was impossible.

VAGINITIS. VULVITIS.

Inflammation of the vagina and vulva occurs in both acute and

chronic forms. It most commonly arises as a result of dystokia particularly in primiparous subjects. It may also be caused by the presence of foreign bodies and neoplasms.

Symptoms and Diagnosis. Acute vaginitis is characterized by the discharge of a mucous, purulent, or sanguineous matter. The labia of the vulva are injected, swollen, and painful, as is also the vagina. In the chronic form a whitish or greyish muco-purulent matter is discharged which agglutinates the hairs at the inferior commissure.

Treatment. In either form irrigate the vagina two or three times daily with moderately hot antiseptic solutions and follow with injections of astringent solutions such as nitrate of silver and sulphate of zinc (1:100). Citrate of silver solutions (2:100) are highly recommended by Italian authorities.

PROLAPSE.

This lesion is of rare occurrence. Estrual hypertrophy of the mucosa is commonly mistaken for it. It may occur as a contingency of the act of copulation when the male exceeds the female much in size and drags the latter about. -

Symptoms and Diagnosis. A reddish congested mass appears at the vulva. If not soon replaced it may ulcerate through contact with the ground when the animal sits on its haunches.

Treatment. The everted part should be irrigated with warm water and then replaced. If the protrusion shows a tendency to recur, the vulva should be stitched, the stitches being withdrawn in the course of three or four days.

RUPTURE.

This lesion has been observed by Raynard, Pflug, and Kitt. It is apt to be complicated by incarceration of the bladder through the rent. It is usually occasioned by the careless use of instruments in difficult parturition. Raynard regarded it as always a very serious accident from which the animal never recovered, owing to development of peritonitis.

Symptoms and Diagnosis. When the bladder is incarcerated it projects from the vulva and is recognized as a fluctuating tumor

appearing at the entrance of the vagina or between the lips of the vulva. Micturition is suppressed or but a small quantity of urine escapes at a time. An exact diagnosis can be made by puncture with an aspirator.

Treatment. The abdominal cavity should be promptly opened and displaced organs returned to their normal position. In view of the great risk of peritonitis supervening it is advisable to secure ample drainage with strands of gauze or tubes inserted in the wound.

NEOPLASMS.

The growths most commonly met with in the vagina are innocent in character. They occur as fibromata either pure or mixed with myxomatous, myomatous, or lipomatous elements, and as hypertrophy of the mucosa. Adenomata have also been observed. Malignant growths occur with comparative rarity. They have been observed as transformed sarcomata and as contagious venereal granulomata which have been variously described as carcinoma, sarcoma, etc. (See Chapter on Neoplasms).

Fibromata. These occur in the form of polypi or as an enlargement of the Cervix and in their gross appearance closely resemble the hypertrophic enlargement peculiar to the estrual period and for which they are often mistaken. It is said of the myxomatous growths that they may remain quiescent for a long period, but may finally assume a true sarcomatous character and at the same time invade the deeper layers of the vaginal wall. The purer fibromata are firm in consistence and insensitive, and have an intact surface, though the latter may become ulcerated by contact with the ground when the tumor is so large that it protrudes through the vulva. These tumors are apt to interfere with free coition and fetal delivery.

Treatment. Extirpation is indicated. Operative technic is the same as for removal of the hypertrophic enlargement peculiar to the estrual period. In the case figured in the accompanying illustration which was operated on at the Johns Hopkins Laboratory the tumor was enucleated through a median external incision, which was made to extend from near the tip of the vulva to the mid-hypogastric region. Mueller treated a fibro-myoma by daily hypodermic injections of ergotin. In one month the growth was con-



No. 56. (After Ortschild) Fibro-lipoma of the Vaginal wall.



No. 57. Estrual Hypertrophy of the Vaginal mucosa.

siderably reduced and the animal subsequently made a good recovery.

Estrual Hypertrophy of the Mucosa. This condition is not at all uncommon in young females. In my experience, members of the St. Bernard breed are most apt to suffer. Pathologically, it consists of an hypertrophied area of mucosa, a sort of elephantiasis, the seat of which is usually the floor of the vagina anterior to the urethral orifice, but the whole circumference may be involved. It is very generally mistaken for and described as prolapse of the vagina, but while the turgid mass of tissue protrudes more or less through the vulva, with the exception of this feature it has nothing in common with true eversion of the vagina. In its morphologic and microscopic features the neoplasm resembles a myxoma and is sometimes mistaken for such, but it is purely a temporary congestive condition associated with the advent of sexual excitement. It generally makes its appearance towards the end of the estrual epoch and subsides as the latter declines. It tends to recur periodically and is then described as being habitual.

Symptoms and Diagnosis. A globular or pyriform tumor is observed protruding through the vulva during the estrual period. It is most prominent when the animal is in the sitting posture, becoming considerably retracted within the vagina when the standing posture is assumed and if small may disappear altogether. Through contact with the ground it may ulcerate in places and become gangrenous. There may or may not be a history of previous appearance of the enlargements.

Treatment. The only effective way of dealing with this form of enlargement and at the same time prevent recrudescence is to extirpate it. Authorities in general advise that the protrusion be reduced, a pessary or packing inserted within the vagina and the vulva stitched, the stitches being left in position for several days. All such measures are superfluous for the reason that the swelling will usually subside of its own accord at expiration of the estrual period. If treatment is undertaken it should be radical.

The most satisfactory method of removing the growth is as follows: Draw the mass well out of the vagina by means of a stout silk suture passed through its substance. Seek the urethral orifice and insert a probe or catheter in the same, to serve as a guide, as particular care must be exercised to avoid wounding it. If the mass

has sufficient pedicle, remove it by means of the small-sized emasculator; if it possesses a broad base, use a scalpel, making a fusiform incision. The mucosa must be sutured to prevent hemorrhage which is otherwise copious owing to the turgescence of the parts. Previous application of adrenalin chloride solution minimizes hemorrhage. The Thomas stitch should be employed (see Sutures). Suturing the vagina is always difficult but this part of the operation may be simplified by applying the sutures immediately beneath the clamped emasculator before the latter is removed and while the area of operation is within easy reach. Or if the mass is to be removed by dissection apply the first stitch just beyond the upper angle of incision, before using the knife. By means of this presection stitch the field of operation can be kept in view while the suturing is being completed. No after-treatment is necessary, but the urinary apparatus must be closely watched for the first few succeeding days for occlusion of the lumen of the urethra from swelling incident to the wounded mucosa.

Other methods of removal are by clamp and cautery, by ecraseur or by ligature and subsequently allowing the mass to slough off, but they are none of them so satisfactory as the method advocated.

Venereal Granulomata. These tumor-like formations which have already been described as occurring in the male similarly affect the vaginal mucosa of the female. It is an inoculable disease and is probably always conveyed by the act of copulation, hence sexual intercourse should be prohibited. The growth appears as a soft or firm, single or multiple, not particularly sensitive, wart-like nodular protuberance. It is commonly situated on the floor of the vagina between the vulva and the urethral orifice, though when long-standing it may extend throughout the length of the vagina and protrude from the vulva. It is a progressive neoplasm, grows slowly at first but quite rapidly later and may reach its maximum growth within a year. It then infiltrates the perivaginal tissues. Occasionally metastasis takes place to the inguinal glands. In the advanced stages it is accompanied by cachexia and emaciation.

Symptoms and Diagnosis. As in the male, it usually escapes notice until it has advanced to the ulcerative stage when a non-purulent evil-smelling, bloody discharge escapes from the vagina. Palpation and examination with the aid of a speculum reveals the

condition. Some males manifest an aversion to, and refuse to mate with, a female affected with this disease.

Treatment. Surgical treatment is, as a rule, ineffectual, unless the growth is limited, in which case a fusiform piece of mucosa, to include the affected area, may be removed, and the edges of the wound drawn together and sutured with catgut. If necessary to reach the growths the perineum must be divided and afterwards sewn up. Complete anesthesia should first be established.

Recurrence of the growths often takes place, when operative measures should be repeated. Hobday says the growth may be retarded by performing oophorectomy in addition to ablation. This is comprehensible in view of the fact that uterine myomata in women shrink and ultimately disappear after the menopause, and surgeons take advantage of this by removing the ovaries and producing artificial amenorrhoea.

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CHAPTER IX

The Abdomen—Continued

Hernia

ABDOMINAL HERNIA IN GENERAL.

The term Hernia is applied to any protrusion consisting of an organ or part which has escaped from the abdominal cavity where it normally belongs and protrudes through some natural or accidental opening in the walls of the latter.

The contents of an abdominal hernia may consist of portions of the bowel alone (enterocele), of the omentum alone (omentocele, epiplocele), or of both these together (entero-epiplocele), of the round ligament with more or less of the broad ligament (mesometrocele), and of one or both uterine cornua in addition to the latter (metro-mesometrocele). The bladder, enlarged prostate gland, spleen, and pancreas have been found present in a limited number of cases. A peculiar instance of protrusion through the abdominal wall has been recorded by Edgar, two fatty (?) tumors being found attached to the uterus, one of which had grown through the abdominal muscular wall.

The protruding organs are contained in a sac which consists of an extension of the peritoneum. In some forms, such as the scrotal and perineal, no true sac of neoformation exists, the protruding organs passing into dilated cavities which are already lined with prolongations of the peritoneum. The sac is covered by the integument and subjacent connective tissue.

Hernia may be congenital or acquired. A familiar example of the former is often seen in puppies soon after birth when the umbilicus remains patulous and a portion of the omentum passes through to form a subcutaneous swelling. The inguinal ring is also occasionally the seat of congenital hernia in females, in whom the round ligament and part of the broad form the protrusion. Acquired hernia is the result of either increased intraabdominal pressure,

weakness of the abdominal parietes, traumatism, or the presence of a predisposing factor in the form of a dilated inguinal canal and congenital herniated broad ligament. It occasionally occurs subsequent to abdominal section, especially when the incision is made in the aponeurotic tissue of the linea alba, through yielding of the cicatricial tissue of the wound. Hobday places the general percentage of hernias resulting from celiotomy at four or five. In an extensive experience, both clinical and experimental, I never have had the misfortune to meet with it, which I attribute to the fact that I have always avoided incising directly in the linea alba. La Torre experimented on twenty-five dogs and determined that hernia after celiotomy was chiefly due to defective union of the muscular layer or relaxation of the cicatrix, following incision through the linea alba. This was not likely to occur when the incision was made through the muscle. If made directly in the linea alba, before closing it, the aponeurotic tissue should be removed as far as the muscular substance of the recti muscles.

There is always risk to be encountered from the presence of a hernia, through incarceration or strangulation taking place or through parturition being rendered impossible. In one fatal case of inguinal hernia which I attended, the lesion had existed four years, the portion of protruding bowel finally becoming strangulated. A hernia is said to be incarcerated when the peristalsis of the retained gut is arrested, generally through adhesions having formed, and the lumen is obstructed by impacted feces. A hernia is said to be strangulated when the return of the venous blood is impeded. This is followed by stasis of the arterial flow, edema, and serous exudation, which increases the distension of the sac. Finally, these changes lead to migration of intestinal bacteria and gangrene. Both these conditions are treated of fully under Intestinal Obstruction.

Symptoms and Diagnosis. Hernia is recognized as an elastic fulness or swelling, by more or less disappearance of the same when the animal is placed in the dorsal position, and by its reappearance when placed in the erect, excepting in the case of the gravid uterus and irreducible and strangulated forms. It may also be replaced by taxis. It is often tympanitic, disappears with a gurgling sound, and becomes tense if the subject is made to cough. It is never painful unless inflamed. In a recent hernia the contents are, as a rule, easily reducible and the sac retains its natural thin, translucent condition,

but in a hernia of long standing it may become thickened and sometimes adherent to the contained organs or neighboring tissues. Differential diagnosis lies between it and neoplasms and abscesses.

Treatment. It has already been remarked that a hernia constitutes an ever-present menace to life. It naturally follows that such a lesion should always be remedied at the earliest possible opportunity. The owner must be informed of the possible terminations and of the advisability of submitting the animal to treatment. Treatment of hernia should be operative in all cases, there being no more danger to the animal from opening the peritoneal cavity in this manner than there is in any other abdominal section, provided due care be exercised to avoid wounding blood-vessels and puncturing viscera. The operation is termed Herniotomy. It is advisable to deprive the animal of all food for two or three days prior to operation and to administer an active purgative.

The fundamental principles governing operative measures for either form are: reduction of the contents, dissection and complete extirpation of the sac, and closure of the opening in the abdominal wall, whether accidental or natural, by suture. The technic is as follows: The animal being hobbled in the most convenient position and anesthetised, an incision is made in the skin directly over the protrusion. The subjacent fascia is next cautiously dissected until the sac is reached, and the dissection continued until the latter is completely enucleated. To distinguish the sac, when it is not adherent to the surrounding connective tissue, it may be picked up between the index finger and thumb when the intestine will slip away, leaving the sac alone in the grasp. In a hernia of some duration it is recognized by its whitish appearance, but if strangulated it may be of dark-reddish color and not easily discernible. Some writers, evidently borrowing from the principles of human surgery where the possibility of infecting the peritoneal cavity always has to be considered, advise that the contents be reduced without or before opening the sac. I am a firm believer in opening the sac at the outset, being no more fearful of any probability of inducing peritonitis than I am when performing simple celiotomy. With an open sac the operator can see what he has to handle, can see whether adhesions have formed at the neck to interfere with reduction, and can see whether any organs need to be extirpated. I have in mind a few instances where the operation was needlessly prolonged for

several minutes by vain attempts to return the organs without opening the sac. When the latter alternative had finally to be adopted it was found that adhesions had effectually prevented the efforts from being crowned with success, and in one case the presence of a diseased uterus was laid bare.

But it sometimes happens that the size of the ring prevents reduction of the contents. In this case it must be enlarged by means of an instrument specially designed for the purpose, or if the latter



No. 58. Herniotome.

be not at hand a probe-pointed bistoury guided by a grooved director will answer the purpose almost as well. The enlargement must be made with due regard to the proximity of vessels.

The contents being returned, the sac is next removed. This should be pulled well out, twisted, and excised after first applying either a simple, multiple, or purse-string ligature to its neck as high up as possible. The stump is then pushed within the abdominal wall. The next step comprises closing the opening in the wall. This is accomplished, as in celiotomy, by suturing the margins. The skin wound is closed as in celiotomy. The subcutaneous application of tampons with the object of giving additional support is unnecessary, if not useless for the purpose for which it is intended. Neither need supporting bandages be employed. The best suturing material to use during the various stages is silk.

In strangulated hernia, treatment, to be effectual, must be undertaken in the early stages, as the lesion is quickly fatal, usually within twenty-four to twenty-eight hours. The sac is opened, the ring enlarged by cutting, and the bowel slightly drawn out and the entire mass carefully examined. Congested bowel, even if dark-red in color, usually possesses sufficient viability for complete recovery and may be safely returned, and the operation completed as already described, but if any part is found to be gangrenous recourse must be had to resection.

ABDOMINAL HERNIA IN PARTICULAR.

Umbilical Hernia. Umbilical hernia occurs either congenitally

or develops during the first few days after birth. The ring in this case is formed by a patulous condition of the omphalo-mesenteric duct and the sac by the sheath of the umbilical cord covered by the integument. Under normal conditions the umbilical orifice becomes obliterated by fibrous organization during the first few days succeeding birth. When this development proceeds tardily the embryonic tissue in the neighborhood of the orifice gradually recedes before the pressure of the viscera and a hernia is formed. The contents consist usually of omentum alone, though sometimes large intestine accompanies it. In acquired umbilical hernia of later life, parietal peritoneum forms the sac.

Symptoms and Diagnosis. This form of hernia is easily recognized as a soft or firm tumor at the umbilicus.

Treatment. The majority of cases of umbilical hernia among newly-born puppies result in spontaneous cure, so that treatment of this form is rarely necessary. Sometimes a small swelling persists during life through adhesions forming between the ring, sac, and omentum without complete return of the protrusion. It is a good plan to apply adhesive bandages over the swelling to assist the tardy closing process. Some practitioners claim to have good results from the injection of a few drops of a ten per cent solution of chloride of zinc. When it is necessary to treat by herniotomy the best results are obtained by completely excising an elliptic portion of the wall surrounding the umbilicus (omphalectomy).

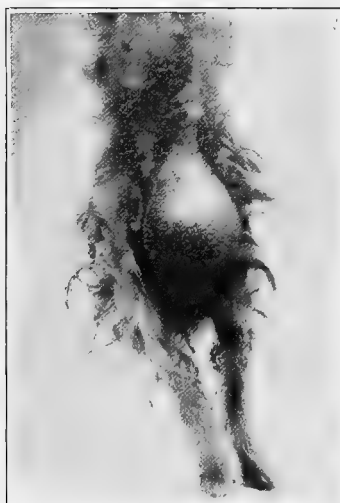
Ventral Hernia. This term comprises all hernias which arise through subcutaneous disruption of the abdominal muscles. It originates either traumatically or by spontaneous rupture under extreme intraabdominal pressure or it may result from surgical wounds. The lesion is not very common. The symptoms and treatment have already been outlined.

Inguinal Hernia in the Female. This form of hernia is most common of all. It is characterized by passage of a fold of peritoneum and visceral organs through either or both inguinal canals. The inguinal canal in the female is very short, and its diameter varies according to the sex and conformation of the animal, being more pronounced in the female than in the male. The internal ring in the female is normally covered by parietal peritoneum, and consequently sealed.

For some unknown reason the lesion occurs more frequently



No. 59. Inguinal Hernia in the Female.



No. 60. Inguinal Hernia in the Female.

on the left side than on the right. In this connection it is worth remembering that normal descent of the testes in the male is said to be naturally later and more liable to deflection on the right side than on the left, suggesting that the mechanism of descent is more ample on the left. It is sometimes congenital in origin, and it may not be detected until, the uterine cornua forming the contents and becoming gravid, it commences to enlarge with the growth of the contained fetuses. It may often be observed to occur in animals after giving birth to litters sired by males very much their superiors in size. In these cases the ring seems to dilate in sympathy with the enormous distension of the abdominal cavity, its caliber being increased with the stretching of the wall. As soon as delivery is accomplished, a part of the collapsed uterus falls through, carrying the peritoneum before it.

It is most common to find the round ligament together with the peritoneal fold by which it is connected with the broad ligament, and this is often the seat of deposit of a mass of fat. Some writers in describing inguinal hernia refer to this ligamentous tissue as omentum, evidently owing to the similarity between the two structures, but my investigations have shown me that it is a rare experience to discover omentum forming part of an inguinal hernia.

A condition of hypertrophy of the round ligament has been designated pseudo-hernia. It is easily differentiated from the true form.

Next in frequency we find one or both uterine cornua, in part or whole, together with the broad and round ligaments, forming the contents of the sac. As already remarked, should pregnancy occur, a rapidly growing enlargement soon becomes apparent. The increase in size may be first detected about one week after impregnation has taken place. Delivery of the fetus *per vias naturales* is, as a rule, impossible, the inguinal ring forming an impassable constriction. Unless removed by operation of hysterotomy it dies and either macerates or decomposes and induces infective inflammation and gangrene of the maternal parts. Instances have been recorded, however, in which the young have been brought forth in a natural manner. Prangé described a case of hernia of a portion of the uterus which contained three fetuses, all of which were delivered naturally a few hours after birth of six others. Roell had a similar experience. In one instance which I relieved by operative measures

the entire uterus and one ovary together with the greater portion of the small intestine formed the protrusion. In this case the uterus was the seat of an enormous hydrometra formed from accumulated uterine secretions through occlusion of the cervical lumen by compression at the ring.

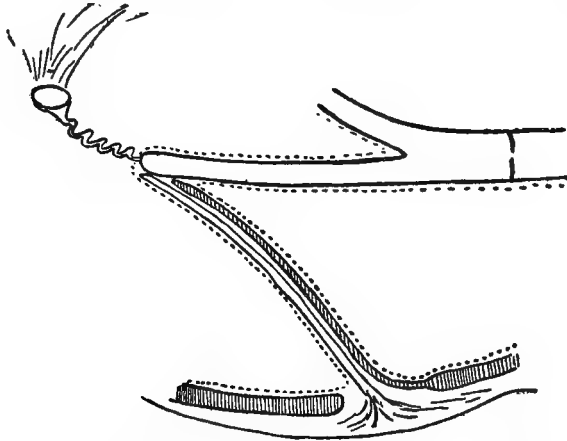
Descent of other visceral organs may also occur. In cases recorded by Hobday, Friedberger, Cadéac, Cadiot and Almy, the sac has been found to contain portions of the small intestine, spleen, pancreas, omentum, bladder, uterine cornua, cecum, and part of the colon.

Adhesion of the pedicle of the protruding viscera to the borders of the ring is quite common, but it is rare that strangulation takes place when the uterus alone is concerned. Prudhomme wrote of seeing such a case, which terminated fatally. But when a knuckle of bowel slips into the sac the risk of strangulation is greatly increased.

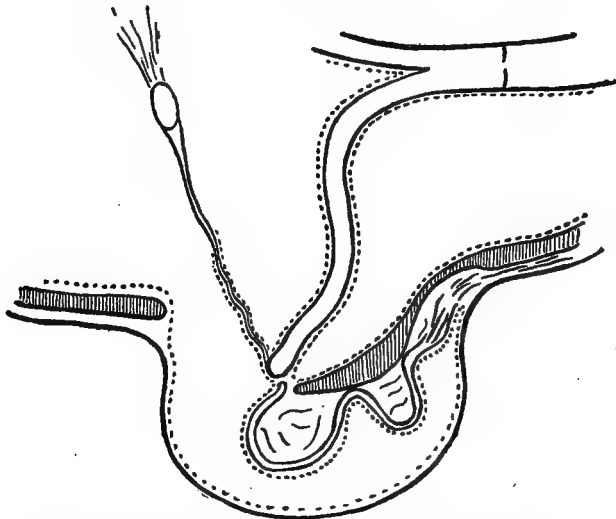
In order to acquire a clear conception of the manner in which congenital hernia of the round and broad ligaments and the uterine cornua takes place, it will be necessary to review the prenatal development of the sexual organs. In early fetal life there exists an intra-abdominal glandular structure on either side of the lumbar region—the Wolffian body—the structure which gives rise to the reproductive gland of either sex. Connected with the Wolffian body are two tubular structures leading to the uro-genital sinus, the Wolffian and Muellerian ducts respectively, the former becoming the vas deferens and epididymis in the male, and the latter the oviduct, uterus, and vagina in the female. The Wolffian body is suspended from the abdominal roof by a duplicature of peritoneum from which a fold (the plica gubernatrix) is projected to and through the inguinal region. This fold subsequently becomes the gubernaculum testis in the male and the ligamentum teres in the female. It is invested throughout with peritoneum which forms a tubular sheath about it. Beneath this sheath are certain muscular fibers having their origin in the abdominal muscles, and which are known as the cremaster muscle in the male but are not specially named in the female for the reason that in the latter sex they are normally rudimentary.

We see that in the female there is an arrangement of structures almost identical with that which serves to bring about migra-

tion of the testes in the male, and it would appear as if Nature had almost intended the same phenomenon should occur in the female. As a matter of fact, we often find evidence of an attempt on the part of Nature to bring about migration of the female organs. When the muscular fibers of the ligamentum teres are sufficiently developed, the natural result is contraction, and there follows the



No. 61. Diagram illustrating normal position of the parts.



No. 62. Diagram illustrating mechanism of Inguinal Hernia.

formation of a pouch communicating directly with the peritoneal cavity, and constituting a sort of diverticulum as in males. This pouch forms the hernial sac in female inguinal hernia, and in proportion to its development and the potential contractility of the muscular fibers, predisposes the animal to this lesion.

Symptoms and Diagnosis. The swelling is situated behind or beneath the inguinal mammae. It may be of such dimensions as to reach the ground, when it is usually rendered sore by friction. Contrasted with neoplastic formations, it lies deeply, is more or less reducible, and decreases in size when the animal is placed in the dorsal position, when there is absence of adhesions. Its consistence varies according to the contents and the condition of the latter. A slight hernia is moderately firm and resistant. The presence of fluid, whether serous, mucous, or fetal, may cause fluctuation. The forms as well as the movements of one or more fetuses may sometimes be distinguished. By palpation a sort of pedicle can be recognized leading to the inguinal canal, and the circumference of the latter can often be plainly made out. If the bowel be involved, intestinal murmurs may be heard with the aid of a phonendoscope. The fact is worth remarking that nursing puppies, as a rule, refuse the teat or teats under which the hernia lies.

A word of caution as to exploration of enlargements in the inguinal region with instruments. Robb recorded having observed an enlargement of the posterior mammary gland of the left side which fluctuated, showing the presence of liquid. An unsuccessful attempt was made to draw off the fluid with the aid of a canula. Finally the tumor was opened and hysterotomy performed and a fetus removed. The mother died of peritonitis, which evidently had its origin at the site of the puncture. Raynard described a case in which the pregnant uterus protruded until it had lodged in the connective tissue immediately beneath the vulva. The owner supposing the enlargement to be an abscess opened it with a penknife, and thereby established a fistula. Raynard explored the tumor and found it to be the uterus containing a three-to-four-months'-old fetus. The hernia was irreducible owing to adhesions having formed between the uterus and connective tissue, and the animal died the following day.

Treatment. Herniotomy in the following manner is indicated: Incise the skin along the axis of the enlargement and enucleate the

sac up to the inguinal ring by blunt dissection of the cellular tissue connecting it with the skin. Some practitioners make a V-shaped incision with its apex towards the anterior extremity of the symphysis pubis, and the flap of skin supporting the inguinal mamma is then turned over. There is no advantage to be gained by this procedure as the canal can always be reached when the incision is made beside the median line. In any event, there is usually a certain amount of redundant skin to be removed. Next open the sac and endeavor to reduce the contents. Sometimes this is easily accomplished, but at other times it is impossible. In the latter case the ring must be enlarged by incision. The incision should be at the extremity of the ring furthest from the median line, in order to avoid wounding the external pudic vessels which make their exit from the cavity towards the inner extremity. It should also be made to avoid the peritoneum. If the bladder forms the contents and is irreducible, it may be punctured to facilitate matters. When the gravid uterus forms the protrusion, and is irreducible, removal of the fetuses must be effected by Cesarean section or the entire protruding portion may be excised, the stump being returned to the cavity. In case the latter alternative is adopted the corresponding ovary should be drawn out and also removed. Fetuses contained in the opposite cornua are not necessarily disturbed by such extreme measures, but may continue to develop till full term. Hobday has recorded an instance, and Nauraux has experienced equally favorable results where the remainder of the uterus has been conserved.

The next step is ablation of the sac. The latter should be twisted and ligated as near to the ring as possible, cut off on the occluded side, and the stump returned to the cavity. The ring should then be sutured, three or four sutures usually answering the purpose. By using mattress sutures and at the same time slightly inverting the edges, the ring can be permanently obliterated. Particular care must be exercised against wounding the pudic veins which stand out very prominently. It may sometimes be found advantageous to ligate them. Redundant skin should be removed. Healing generally takes place by second intention, chiefly owing to the large subcutaneous cavity which must of necessity be left in the groin, and post-operative infection which it is difficult to prevent.

Inguinal and Scrotal Hernia in the Male. In the male the inguinal form of hernia is relatively uncommon. It may occur, as

in the female, owing to dilation of the inguinal canal. The intestine then protrudes into the subcutaneous tissue carrying a fold of peritoneum before it. In scrotal hernia the sac is formed by the processus vaginalis, and the contents, consisting usually of intestine, rarely of omentum, protrude as far as, and rest in contact with, the testicle. Under normal conditions the caliber of the processus vaginalis formed by the descent of the testis becomes much reduced at its upper extremity after passage of the gland, but never becomes entirely obliterated. If this contraction fails to take place the neck of the pouch in the vicinity of the internal ring presents an abnormal opening continuous with the peritoneal cavity thus forming a ready avenue for escape of visceral organs.

Symptoms and Diagnosis. In the inguinal form the swelling is formed between the penis and abdominal wall, while in the scrotal form it exists as a very thick sausage-shaped tumor along the course of the spermatic cord.

Treatment. Inguinal hernia is treated as in the female. Scrotal hernia necessitates some slight modification of technic. Operative measures consist in cutting down on the swelling in the groin over the inguinal canal, opening the processus vaginalis, returning the protruding organs, and suturing the dilated inguinal ring, as in the female, at the same time allowing sufficient room for the spermatic cord and vessels, which are left intact. Some writers seem to regard it essential to remove the testes at the same time, but there is no reason why they should not be retained, their preservation being a matter of paramount importance in valuable stud animals. Griffiths has demonstrated by experiments and observations on artificial and natural mono- and crypt-orchids that testis may be manipulated without injury to itself or the structures of the cord. In one instance he resected the cremasteric muscle and the parts healed entirely. Barnard suggested an alternative method by which the testis and cord are separated from the surrounding structures and placed within the abdominal cavity outside the peritoneum. The tunica vaginalis is removed and the inguinal canal completely closed by suture. Of course the object in preserving the gland in this manner was the maintenance of the procreative faculty. But Griffiths has proved that the full-grown testicle, when so replaced, undergoes a degenerate change and loses its power of spermatogenesis, so that no object would be obtained by this procedure.



No. 63. Inguinal Hernia in the Male.



No. 64. Scrotal Hernia.



No. 65. Perineal Hernia.

It has been suggested that in the scrotal and perineal forms celiotomy should be performed, the herniated portion withdrawn through the ring and then stitched to the abdominal wall to prevent its return to the sac. This would surely be an error for the very simple reason that the ring and sac would still persist, and there would be no provision to prevent the escape of some other portion of the bowel or other organ.

Perineal Hernia. The fold of peritoneum which in males is reflected from the bladder to the rectum on either side, gives rise in the center to a prolongation of the peritoneal cavity—the fossa or cul-de-sac of Douglas, or *excavatio recto-vesicalis*. In females two such prolongations are formed, one between the uterus and rectum—the *excavatio vesico-uterina*. Perineal hernia constitutes the passage into one of these cul-de-sacs of a portion of the bowel, the omentum, the uterus, the bladder, or enlarged prostate. The lesion is observed quite frequently in old males, and it is said, particularly in performing animals which are taught to walk on their hind legs. It is otherwise usually produced as a result of expulsive efforts necessitated by the presence of hypertrophied prostate. It can exist for a long time without interfering with the animal's health. It seldom becomes strangulated, though torsion of the bladder is apt to take place, when that organ forms the contents, or even a fistula may form. Liénaux has recorded witnessing a displaced rectum caused by an enlarged prostate.

Symptoms and Diagnosis. This form of hernia appears in the male as a subcutaneous swelling between the root of the tail and the ischial tuberosity. In the female the swelling occurs in the region of the vulva. Lucet saw a double perineal hernia, the swelling on the right side being formed by the bladder, that on the left by a portion of the omentum. In Liénaux's case, above referred to, the swelling appeared beneath the anus.

When the contents consist of the bladder the tumor has a soft elastic consistence, resembling a cyst. In this case there is usually dysuria. To determine the condition with accuracy the aspirator should be employed. A large perineal hernia may interfere with defecation and force the anus out of its natural position to one side. It may be mistaken for enlarged anal pouches, from which it must be carefully differentiated.

Treatment. If dysuria is present the bladder must be replaced

in its natural position by the following method: Empty the rectum with an enema, elevate the animal's hind-quarters, insert the thumb in the rectum and exert pressure with it through the rectal wall, and at the same time manipulate the tumor from the outside. Usually this maneuver is sufficient to cause the bladder to glide back into place. When it fails herniotomy must be undertaken as already described. It is best to insert a temporary tampon of aseptic gauze in the wound to stimulate the formation of adhesions, the skin being sutured over it. If the prostate is enlarged castration is also indicated. In one instance, where the prostate, much enlarged, formed the protrusion, I removed the latter by a process of dissection and tearing away. In doing this the urethra was accidentally ruptured. No attempt was made to suture it, and for a week succeeding the operation urine flowed through the outer wound, just as it is allowed to do after an operation for removal of stone from the urethra. But the wound soon closed and urination by the natural channel was reestablished and the animal made an uneventful recovery. In a female in which the uterus formed the contents, Benkert performed celiotomy in the inguinal region, introduced his hand and replaced the organ in its natural position. The animal produced young regularly thereafter. Liénaux treated his case by opening the abdomen, straightening the bowel and suturing the latter to the abdominal wall.

Crural Hernia. This form is very rare. Kitt cites Lafosse and Bruckmueller as authority for its occurrence, Hertwig refers to it, and Girard has also seen it. Cadix recorded a case of bilateral crural hernia in a female. It is characterized by protrusion of portions of the viscera, usually the intestine enveloped by parietal peritoneum, through the crural ring in the course of the crural or femoral vessels. Crural hernia emerges beneath Poupart's ligament, inguinal above it. The condition tends towards strangulation.

Symptoms and Diagnosis. The usual form of swelling is observed but in addition there is lameness on the affected side.

Treatment. This is the same as already outlined, only the technic involves particular caution in the avoidance of the vessels which traverse this region.

Diaphragmatic Hernia. This lesion may be congenital or acquired. It is characterized by protrusion of abdominal viscera into the thoracic cavity with or without the peritoneal coat remaining

intact. The acquired form may occur as a result of dilation of the foramen sinistrum through relaxation of the cardiac, gastro-hepatic, and gastro-colic ligaments when the empty stomach is primarily the herniated portion. Fuenfstueck saw a case of this kind, the stomach having become wedged in between the lungs and appeared at the necropsy as a large distended bladder. It was supposed to have resulted through a habit possessed by the animal of bounding down a winding stairway. Caparini and Bernard have seen it result from violent expiratory and defecatory efforts. In these cases there is rupture of either the tendinous or muscular portion of the diaphragm. In Bernard's case portions of the liver and intestine formed the protrusion. In Caparini's case there were two superimposed perforations, each giving passage to portions of the bowel. The portion passing through the inferior aperture was strangulated, while that passing through the upper rent had penetrated the interior of the pericardium, distending it and displacing the heart laterally.

Symptoms and Diagnosis. In the acquired form there is sudden restlessness, crying, anxious facial expression, dyspnea, and meteorism, which are followed by death within a few hours. The congenital form may exist for years without giving rise to any symptoms.

Pancreatic Hernia. Under this name the earlier writers described passage of the small intestine through the hiatus of Winslow, the foramen formed by the great omentum between the posterior vena cava and portal vein, and bordered by the anterior extremity of the pancreas and the lesser curvature of the stomach. No particular mention is made of its occurrence in the dog, the only reference I have been able to find being a suggestion of such a possibility in an article by Pécus.

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The Mammary Glands

TRAUMATIC LESIONS.

The mammae sometimes suffer contusion, which according to the degree of violence, may result in rupture of a few subcutaneous vessels or intraglandular hemorrhage (hematoma) with destruction of glandular tissue. Such injury may terminate in suppuration.

Treatment. Slight contusions require no treatment but are best left to natural processes of repair. If suppuration takes place vent must be given to the pus. In severe contusion ablation of the gland may be advisable.

CONGESTION.

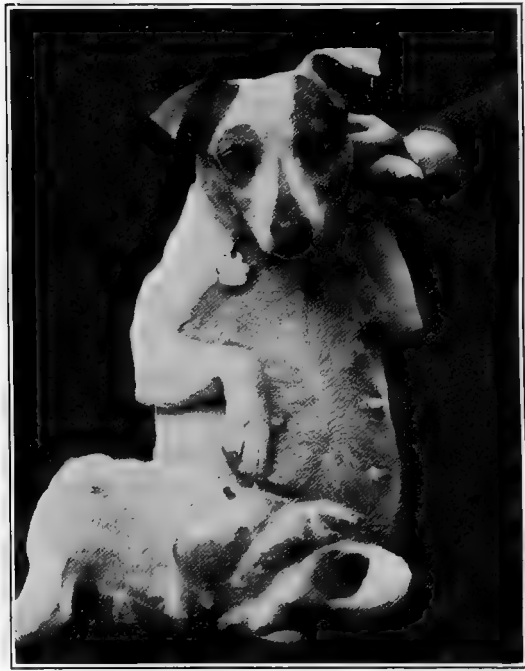
Towards the end of gestation and during lactation there develops a normal turgescence of the parts. This turgescence and also lactation is common in virgin and non-pregnant animals about eight weeks after estruation—a sort of mistaken anticipation on the part of Nature.

Symptoms and Diagnosis. The mammae are hot, tumefied and slightly sensitive to pressure.

Treatment. Restricted diet, free purgation, and massage of the parts are indicated.

MAMMITIS. MASTITIS.

This is an uncommon disease. It generally occurs during the period of lactation shortly after parturition. It is caused by pyogenic bacteria which probably migrate through the galactophorus ducts to the acini and thence spread through the perilobular lymphatics. Lucet and Leblanc have found a white staphylococcus present, and Gaucher and Surmont have experimentally injected a pure culture of a white coccus obtained from a case of chronic mammitis in a human being and produced subacute inflammation of the gland. One or more glands may be affected and usually the ante-



No. 66. Mammary Tumor simulating Hernia.

rior ones. As a rule, the inflammation terminates in multiple abscess formation. Pyemia sometimes follows.

A rather remarkable case should be mentioned here in which a swelling of the mammary region was observed by Mégnin, which upon lancing was found to be due to the presence of a giant strongyle emerging from the body.

Chronic mammitis may succeed the acute form but it commonly originates independently of the latter. It occurs as a sclerotic interstitial fibrosis with gradual destruction of the glandular tissue. This form will be referred to as Fibroma and it also is believed to be due to irritative action of the white staphylococcus.

Neither form is to be confounded with simple congestion incident to sudden cessation of nursing by the offspring.

Symptoms and Diagnosis. In acute mammitis the glands are hot, sensitive, greatly swollen, and edematous, and the milk is replaced by a greyish or purulent matter. There is usually some fever present and also suppression of appetite. The animal lies down frequently and is indifferent to its surroundings. In a few days multiple abscesses form and come to a head externally as dark-red angry-looking foci. These, if not treated may persist as ulcers and fistulae for some time after discharging, healing but slowly.

Treatment. The offspring must be removed and the remaining healthy glands milked by hand. Hot fomentations must be applied to the part and kept up as long as possible. The best way to carry out this treatment is to stand the animal over a tub and apply the hot liquid by means of a sponge. Purulent accumulations must, of course, be opened up with a knife. The bowels should also be freely evacuated with purgative doses of epsom salts.

NEOPLASMS.

The mammary gland is frequently the seat of neoplasia of both innocent and malignant types. It is believed that in some cases the innocent growths may undergo transition into malignancy. This is particularly true of the adenomatous type of growth, and certain it is that pure chondroma, which is ordinarily non-malignant, may occur (Petit), while on the other hand chondromata are usually associated with sarcomatous, myxomatous, and fibrous tissues, and often osseous elements. The strictly innocent growths consist of fibroma, myxoma, lipoma, adenoma, or very often mixtures of these, and cysts. They are characterized by slow development, freedom from

pain, and after attainment of a certain size, quiescence. The malignant growths comprise sarcoma, carcinoma, and, as already stated, mixed chondromata. They are distinguishable from the former type by their more rapid growth, though they sometimes have periods of quiescence, by extension to neighboring lymphatics, by the pain and emaciation they induce, and by their tendency to ulcerate and undergo generalization. Either type must always be carefully differentiated from inflammatory swellings and hernia, particularly the inguinal variety (see Hernia). Hematoma resulting from injury has been recorded by Rodet.

Fibroma. This is a common form of mammary tumor. Formerly much confusion existed as to its proper classification and it was not infrequently confounded with adeno-fibroma. But, inasmuch as the essential element in a fibroma is fibrous tissue and this type of growth develops as a pericanalicular fibrosis or proliferation and projection of connective tissue round the glandular acini, it is now recognized as pure fibroma. By this process of fibrosis groups of acini become isolated, and these undergoing compression, lose their glandular structure and appear as "islands" of cells. It was these "islands" of cells which were once mistaken for true neoplastic or adenomatous formations.

Fibroma sometimes undergoes transformation into a myxomatous condition.

Symptoms and Diagnosis. This growth develops as a hard, knotty, mobile, and sharply-demarcated swelling, varying in size from a pigeon's egg to the human fist, but may attain very large dimensions. The myxo-fibroma is considerably softer.

Lipoma. The fat tumor occurs not uncommonly in plethoric females.

Symptoms and Diagnosis. In consistence it is soft and lardaceous. It grows slowly and is sharply demarcated from the neighboring tissue.

Adenoma. True adenoma occasionally occurs in the gland and is usually associated with more or less increased development of fibrous tissue. Adeno-fibroma is the commonest type of growth met with in this region. It may undergo progressive transition into malignant carcinoma. Isolated or generalized cystic degeneration is not at all uncommon.

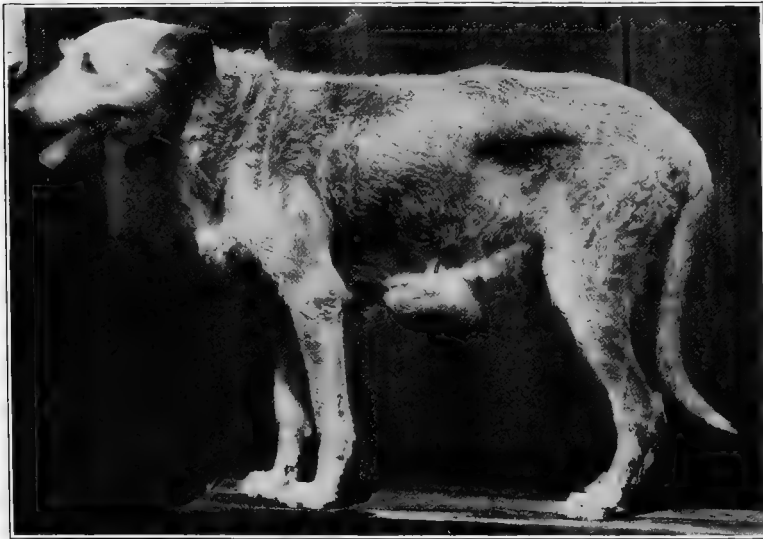
Symptoms and Diagnosis. In macroscopic appearance adenoma is very similar to fibroma, and is hard to differentiate, but is some-



No. 67. Lipoma of Mammary region.



No. 68. (After Ortschild) Showing situation of primary Mammary Growth and the palpable Metastases. Site of nipples indicated by solid black dots.



No. 69. True Carcinoma of the Mammary gland.

what softer, particularly when the cellular elements predominate over the fibrous.

Sarcoma. Sarcoma occurs in pure form but more commonly associated with osseous and cartilaginous structures. Pure sarcoma is seen as a tuberculate growth, which may attain an enormous size. The neighboring lymphatics and subcutis are usually infiltrated, and the growth sometimes breaks through the skin. It is not common.

Symptoms and Diagnosis. The growth is reddish in color with somewhat puckered surface and exceedingly soft and succulent and contains a jelly-like substance. The skin covering it may be mobile. It develops with great rapidity and is extremely metastatic.

Carcinoma. Carcinoma may arise from the glandular cells proper or the epithelium of the ducts. The skin covering the glands may also be primarily the seat of carcinoma which is not to be confounded with that of the glands, though in the latter case the skin usually participates eventually. Myxoid transformation is not uncommon, and such tumors may also become cystic through retrogressive metamorphosis of the secretion of isolated normal acini. Metastasis to internal and vital parts is the rule.

Carcinoma may originate as such *per se*, or as has already been pointed out, may become progressively such by metamorphosis from pre-existing adenoma. Primary carcinoma is infrequent.

Symptoms and Diagnosis. Carcinoma occurs most commonly as a lobulated tumor, varying in size from a pea to a goose-egg, which may remain quiescent for longer or shorter period, and finally coalesce with the skin and degenerate. It usually occurs singly, but secondary smaller growths are sometimes observed in the immediate neighborhood of the main one. More than one gland, however, may be involved at the same time. Sudden increase in size may take place, due to interstitial hemorrhage.

Symptoms and Diagnosis. Carcinoma is moderately hard and usually knotty. When cystic degeneration has taken place, fluctuating centers are perceived. Coalescence with the skin is recognized by the bluish or reddish appearance of the latter, and usually by eventual ulceration.

Chondroma. Cartilaginous growths are common but they invariably occur associated with other tissue elements, assisting in the formation of a complex structure into the constitution of which osseous, fibrous, and myxoid tissues enter. In some cases complete ossification takes place. These tumors are to some extent metas-

tatic and therefore possessed of malignant character. The manner in which this process takes place is described in the chapter on Neoplasms.

Symptoms and Diagnosis. These tumors are easily recognized by their hardness. They are usually encapsulated, often lobulated, sharply demarked, free from the skin, and when removed surgically can be shelled out. In size, they vary from a corn-kernel to the human fist. More than one gland may be involved at one time.

Treatment. Treatment of mammary tumors should always be operative, and no better rule can be observed than to practice early and free removal. When tumors are encapsulated or limited to definite areas the results are good, but when a primary growth is surrounded by a zone of infiltration, or when metastasis has taken place, or cachexia is present, the prognosis is unfavorable and recurrence may be looked for.

The technic is very similar to that prescribed for neoplasms in general, the principal difference being that mammary tumors are usually very vascular and require greater precaution to guard against hemorrhage.

Chronic Interstitial Fibrosis of the Teat. This condition can occur without the mammary gland proper being involved, but it is identical with chronic interstitial fibrosis or fibroma of the latter. The accompanying picture illustrates the extent to which it may develop. The cause is undetermined, but is probably microbic in origin. Irritation incident to sucking by the offspring is certainly not necessary for its production, for it occurs in virgin females. Hereditary tendencies would seem to play a part, for I have seen it develop in identical teats in members of certain families.

Symptoms and Diagnosis. One or more teats are observed to be considerably thickened and elongated. Taken in the hand the teat does not impart a hard feeling, but one of decided augmentation in volume. The gland to which the affected teat belongs is still capable of functioning, and the milk can readily be drawn off, but the teat itself is usually declined by the offspring.

Treatment. The condition being an unsightly blemish calls for removal by surgical means, the technic of which differs in no wise from that prescribed for ablation of dermal tumors.

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No. 70. Chronic interstitial Fibrosis of the Teat.

CHAPTER X

The Extremities

The Legs and Feet

CONGENITAL MALFORMATIONS.

A congenital malformation of the anterior legs is not infrequently met with. The deformity is ordinarily confined to one member but may exist in both, and consists of a contracted condition of the flexor tendons, of variable degree, resulting in an unnatural flexion of the metacarpals or even a true club-foot (carpipes). The head of the radius may be dislocated.

Symptoms and Diagnosis. Where the deformity is of minor degree, the foot can still be brought to the ground, but never in straight line, and lameness is evident. In extreme cases where the metacarpals are completely flexed on to the forearm, the carpus forms the point of contact with the ground.

Treatment. In cases of minor deformity good results are obtainable by sub-carpal tenotomy, but the reverse is the case in true club-foot. Tenotomy is performed as follows: The animal being narcotized with morphine and securely hobbled, the hair shaved and skin cleansed, and cocaine injected locally, the skin is incised longitudinally on one side of the tendon. The leg is next flexed and the blade of a blunt-pointed tenotome inserted and directed flatwise to the anterior border of the tendon. The cutting edge of the blade is then turned towards the tendon, the leg is extended, and the tendon severed from before backwards. Any resultant hemorrhage must be controlled by compression. Finally, a light splint is applied to maintain the leg in extension while reunion of the tendon is taking place. Nothing is done to the wound, which heals in the course of a week, but provision should be made for drainage in applying splints.

TRAUMATIC LESIONS.

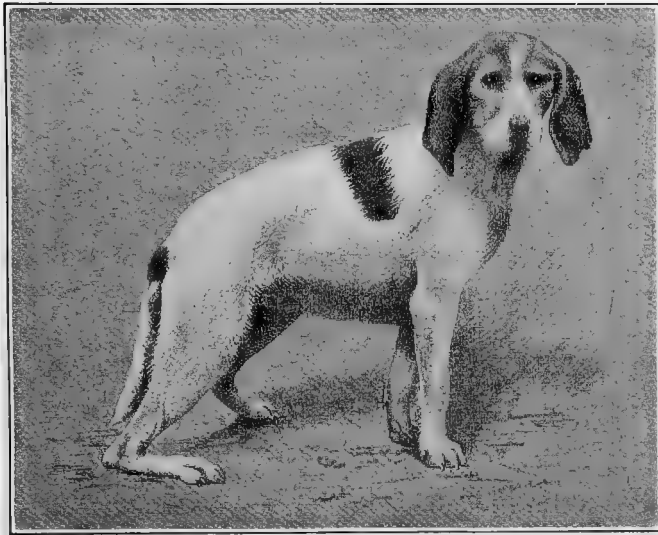
Fractures. See The Osseous System.

Rupture of the Tendo-Achilles. This contingency arises ordinarily through traumatism. A severe gash accidentally or malevolently sustained, a violent contusion, or crushing are the most common causes. In one instance, witnessed by Simonds, the animal, a Greyhound, had become impaled on an iron palisade, the point of the latter penetrating between the tibia and tendon and lacerating the tendon. Extreme muscular effort may also be responsible. Bayer and Bruckmueller have both recorded instances of tearing away of the tendon from its point of origin in the body of the muscle. Thus, it will be seen that the skin may or may not be involved. When complete division of the tendon has taken place the divided ends immediately separate, but if the lesion be only partial, separation may not occur for some days though it usually does so eventually through muscular contraction.

Symptoms and Diagnosis. The behavior of the affected leg is characteristic. Functional impotency of the metatarsus is complete, the whole of the leg from the point of the hock to the toes coming in contact with the ground, after the manner of the rabbit. The animal is forced to walk on three legs. Examination of the postero-inferior aspect of the leg reveals either a wound or a depression corresponding to the separation of the divided ends.

Treatment. This lesion, if left to Nature, usually terminates in spontaneous recovery, the continuity of the tendon becoming reestablished in the course of a few months by fibrous cicatrization. Collin recorded the history of four dogs whose master divided the tendon of one leg each in order to prevent them going off to hunt. In four months' time the animals were at their old habits, the lesion having completely recovered. The tendons in both legs were then severed, but six months later the dogs again returned to the hunt.

In the larger breeds, where the distance separating the divided ends is more considerable, there is more risk of permanent impotency through failure of reunion. Therefore, treatment should always be directed towards maintaining the leg immobilized in extreme extension by means of splints and bandages applied so as to extend from the patella to slightly beyond the digits, a drainage window being provided where the skin is involved. It is not necessary to suture the divided ends, and the strain usually causes the sutures to tear out.



No. 71. (After Cadot and Breton.) Position assumed by the leg after division of the Tendo-Achilles.

Traumatic Division of Tendons. This accident sometimes takes place through the legs coming in contact with a mowing machine in the hayfield.

Treatment. The same treatment is indicated as is described above.

Wounds. Various wounds are received in the feet, among which may be mentioned cuts, pricks, crushing, burns, frost-bites, etc. Sometimes the pads become worn to excess by traveling over rough roads. The gravity of wounds depends upon their nature, extent, and presence or absence of foreign bodies.

Symptoms and Diagnosis. In most lesions of the feet the prevailing symptom is lameness with a tendency to rest the injured foot by raising it, or, if both feet are affected, an assumption of the recumbent position. This being observed, it only remains to make a careful differential diagnosis. The practitioner must particularly distinguish between traumatism and interdigital eczema, a trouble which is very common and which is usually mistaken for an injury by the laity. Worn pads are recognized by the animal constantly licking them. Fractured digital bones are often productive of fistula.

Treatment. The first step is to examine carefully for the presence of foreign bodies, including fragments of digital bone, and if such are found to promptly remove them. The foot should then be thoroughly cleansed by irrigation with, or soaking well in, moderately hot water. If the injury is confined to one foot, the rest may be left to Nature, the healing process being closely watched, but the animal should be confined on a clean wooden or concrete floor. But if there should have been any considerable loss of tissue on the plantar surface of both feet, thereby causing the animal great pain during locomotion, protection should be afforded to the parts in the following manner: Some antiseptic powder is freely sprinkled over the plantar surface, a strip of gauze is placed over this, a pad of absorbent cotton over the latter, and over all a boot constructed of stout linen or thin leather. The dressing should be changed twice daily. In all cases of this nature absolute rest is to be enforced. It requires about two weeks for the epithelium of worn pads to become regenerated.

Fracture of the Nail. This is a quite common accident and may be partial with the nail only slightly disturbed in its matrix, or complete, when it is either suspended from its matrix or entirely

torn away. It is accompanied with considerable pain and lameness.

Treatment. Slight fractures are capable of recovery if left to Nature, but where there is much displacement of the nail it must be extirpated by grasping it with forceps and jerking it quickly away. When the phalanx is involved in the injury, it must also be removed by disarticulation. After-treatment is usually unnecessary, but the animal should be kept out of dirt as much as possible.

INFLAMMATION.

Inflammation of the Pads. This condition is observed principally in animals which have traveled over hard, rough ground, stubble, or asphalt during hot weather when the sun is strong.

Symptoms and Diagnosis. The plantar surface of the feet is hot, swollen, and extremely sensitive to pressure. The animal seeks the recumbent position, shows great disinclination to rise, and walks with evident pain, but trots with comparative freedom.

Treatment. The inflammation, when mild, responds quickly to complete rest supplemented with hot fomentations. When intense, the parts should be constantly fomented or covered with compresses soaked in astringent solutions (alum 3:100—5:100), to which some laudanum may be added with advantage.

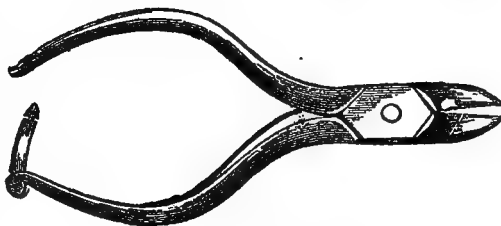
Inflammation of the Matrix of the Nail. Onychia. This is an ailment affecting the bed of the nail and occurs usually as a complication of traumatism or interdigital eczema. It may be acute or chronic and may lead to ulceration and destruction of the nail.

Symptoms and Diagnosis. The animal walks with short, painful step, and prefers the recumbent position or holds up the affected member. The matrix is hot, red, swollen and sensitive to pressure. If suppuration takes place purulent matter oozes from the matrix.

Treatment. Acute cases are treated with fomentations. If the presence of pus is detected vent must be given to it by lancing. Ulcers are treated by touching them with the solid nitrate of silver stick, or by application of tincture of iodine. Old-standing cases, where the nail has suffered destruction, sometimes require complete extirpation of the affected phalanx.

In-Growing Nail. This is a common trouble and affects the supplementary digit or dew-claw, the nail of which, not coming to the ground, escapes friction, and curves and grows to an abnormal

length. Its point may penetrate the pad and provoke suppuration and lameness. For this reason dew-claws are frequently removed as a preventive measure, otherwise it is necessary to cut the nails periodically (about every six months). Cutting is best done with bone-forceps or specially constructed clippers, but care must be observed to avoid cutting to the quick.



No. 72. Nail Clippers.

Interdigital Eczema. This is a disorder of rather frequent occurrence and while it lasts is productive of considerable lameness. Among the laity the pathologic lesions and lameness are usually ascribed to traumatic influences. As the name indicates, the inflammatory disturbance is confined to the skin of the interdigital region, but it is very apt to extend to and involve the matrix of the nail.

Symptoms and Diagnosis. The animal is observed to be constantly licking or gnawing the parts and lameness is often very pronounced. On examining the foot, the skin of one or more interdigital spaces is found to exhibit the characteristic appearance of eczema of other regions, viz., redness, edema, suppuration and ulceration.

Treatment. The foot should be daily soaked for a good while in hot water or antiseptic solution. This is followed with a liberal application of absorbent antiseptic powder to the inflamed area. The foot should be protected with a bandage or boot, both to maintain it free of dirt and to prevent the animal licking. Ulcers should be touched with the nitrate of silver stick.

FOREIGN BODIES.

Various substances may find lodgment in the foot, either accidentally or through human malevolence or carelessness. Among the recorded articles may be mentioned: shot, spikelets of grain, and sharp bodies such as splinters, thorns, and short lengths of wire. Elastic bands rolled on to the leg by children, ligatures applied by malevolent persons, snares in which the animal may get caught

while hunting, have each and all been known to result in serious injury to the parts. Foreign bodies may produce immediate or remote effects or they may be perfectly harmless. Aseptic bodies, and particularly shot, often become encapsulated and exert no ill-effect. Infected bodies provoke inflammatory reaction and fistula. Any kind of sharp body may work its way up through the tissues to a distant area, leaving a fistulous tract behind it. A remarkable instance is recorded by Ducourneau who, on exploring an abscess in the digital region with a probe, found a fistulous tract extending as far as the knee. On opening at the latter point he found a spikelet of grass. The wound healed, but a new abscess developed higher up some days later, which on being opened was found to contain a second spikelet. Elastic bands impede the return circulation and may induce gangrene of the extremity when their tension is strong. When it is weak, they cut slowly into the tissues, causing a circular section of the skin and subcutaneous tissues with edema of the extremities. Non-elastic bands, such as thread, cause analogous results but their constricting action is quick.

Treatment. The indications are to promptly extract foreign bodies of any nature, if necessary by incising the skin, with the exception of aseptic ones which should be left alone unless they render the animal lame. The wounds are then treated as already outlined. If gangrene has set in the mortifying portion of the leg must be amputated.

NEOPLASMS.

All varieties of tumor occur in the legs, but only the more common growths affecting this part of the body will receive special consideration. These are the innocent adenoma, fibroma, lipoma, verruca, tyloma and hygroma of the elbow, hypertrophy of the stratum corneum of the pads (corns), interdigital serous cysts, and malignant carcinoma and sarcoma. Other forms, such as hemangioma and chondroma, observed by Gurlt on the digits, are so extremely rare that they are to be regarded as pathologic curiosities and merit but a passing reference.

Adenoma. These may be of sebaceous or sudoriparous origin. They usually occur mixed with fibrous tissue and are liable to undergo cystic degeneration. Common seats are the region of the knee and hock. There is good reason to believe that they may



No. 73. (After Cadot and Breton.)
Elastic band on the Leg.



No. 74. Fibro-adenoma of the Skin of the leg exhibiting impending malignancy.

undergo transformation into malignancy. The accompanying picture illustrates a fibro-adenomatous growth which had arisen as a result of chronic irritation, that part of the leg having suffered constant friction from a chain. When removed and examined microscopically it showed evidence of impending malignancy. This case is referred to more fully in the chapter on Neoplasms.

Symptoms and Diagnosis. As adenoma arises from the glands of the skin, it is intimately connected with the latter. It grows very slowly. Sudden rapid increase in size is to be regarded with suspicion as evidence of malignancy. It is usually rather firm but may be soft in places owing to cystic degeneration. When of long standing its weight may cause it to become pedunculate. Constant licking on the part of the animal may render it sore.

Treatment. Early and free removal should be practiced, particularly on account of the possible malignant termination.

Fibroma. This is a fairly common form of neoplasm about the extremities, particularly in young animals. It usually springs from the skin proper, but sometimes from the subcutis.

Symptoms and Diagnosis. A tumor of this nature is recognized without much difficulty. It is sharply defined from the surrounding parts, has a regularly firm or hard consistence, smooth intact surface, is often pedunculate, and has a slow growth. Its average size is that of a walnut.

Treatment. Ablation by the ordinary methods is indicated.

Lipoma. Fat tumors are usually seen in plethoric animals advanced in years. Common seats are the shoulder and inner surface of the thigh.

Symptoms and Diagnosis. Lipomata have a soft consistence, with a dermal covering, and may be round or cylindrical in shape. They are frequently pendulous, one observed by Huidekoper hanging from the thigh, having very nearly touched the ground.

Treatment. These growths are removed in the ordinary way.

Verruca. This occurs in the form of the familiar wart, which is fairly common in old animals, occurring at almost any part and often multiple.

Symptoms and Diagnosis. Warts are recognized as smooth hemispherical elevations, sharply defined from the neighboring parts and sometimes pedunculate. Beyond forming a blemish they have little significance.

Treatment. Where it is desirable to remove them they are best excised by a snip of the scissors and the base touched with lunar caustic.

Tyloma. Capped Elbow. This term is applied to the unsightly callosities which develop in the skin principally in the region of the elbow but also elsewhere about the legs, and which are frequently complicated with hygroma, to be next described. They are particularly common in members of the larger breeds, viz., Great Danes, Mastiffs and Greyhounds, and develop as a result of constant intermittent friction and pressure, through the habit these animals have of lying in the sternal position and resting the elbow on the ground. Pathologically, they are an epidermal hypertrophy and hyperplasia, consisting of laminae of horny cells with but slight fibrous development. They sometimes ulcerate.

Symptoms and Diagnosis. The condition exists as a callous thickening with bare, greyish surface. When ulceration takes place collateral edema may occur.

Treatment. No treatment is advisable for the reason that the condition is merely a blemish and does not incommode the animal and would soon recur because of the persistence of the causative factor. Ulcers should be treated with nitrate of silver.

Hygroma. As distinguished from tyloma, the term hygroma is applied to the fluctuating adventitious bursae which are frequently associated with it. They are cysts of contusion or true neoformation, intermediate connective tissue becoming bruised and torn, and spaces forming in which serous fluid and sometimes blood collect, which may (rarely) suppurate and discharge by fistulous opening. Organization by condensation of the adjacent connective tissue may take place when the condition again resolves itself into uncomplicated tyloma.

Symptoms and Diagnosis. Hygroma exists as an indolent, round or oval, uniformly fluctuating tumor, without peripheral induration and ordinarily without inflammatory reaction. It does not incommode the animal in any manner.

Treatment. A cure is difficult of attainment, for the same reason as in tyloma. Simple puncture is valueless, for the cyst recurs as soon as the outer wound has healed. An attempt should first be made to excite an inflammation within the sac. By means of an aspirating syringe with large needle, the fluid is withdrawn from the



No. 75. Multiple Verruca.



No. 76. Interdigital Serous Cyst.

sac and some weak tincture of iodine injected in its place. The surface of the enlargement should also be painted daily with a strong tincture. Suppuration may or may not result; if it does, free exit should be given to the pus by lancing. Considerable collateral edema may develop. This treatment should be repeated a few times before being abandoned.

The only other alternative is ablation in the following manner: The animal being narcotised and secured with hobbles, the region cleansed, and hypodermic injections of cocaine administered locally, expose the sac by an incision in the skin in the direction of the long axis of the leg and carefully enucleate it. It is usually adherent to the olecranon. Finally, suture the skin with subcuticular silk sutures and provide the animal with a soft bed.

Epithelial Hypertrophy of the Pads. **Corns.** This is an infrequent form of growth, but troublesome when it exists. Pathologically, it is a circumscribed callosity which projects outwardly and inwardly, and forms a depression in the corium.

Symptoms and Diagnosis. Corns are observed on the plantar surface of the digits as circumscribed projecting callosities, with regular or festooned contour, and possessed of a deep root. They give rise to much lameness.

Treatment. Radical treatment is the shortest road to a cure. The callosity should be extirpated or eradicated by means of the actual cautery, and the foot subsequently protected with antiseptic powder, gauze, raw cotton, and a boot, until the parts are regenerated.

Interdigital Serous Cysts. These little enlargements are only occasionally met with. They are rather troublesome to deal with.

Symptoms and Diagnosis. Attention is usually first drawn to their presence by constant gnawing and licking on the part of the animal at the interdigital region. There may be pronounced lameness. The little bladder-like sacs are easily discerned.

Treatment. Radical measures are indicated. Complete removal of the cyst-wall, either by dissection or cauterization with the thermo-cautery or silver nitrate pencil is the only alternative to effectually eradicate the trouble.

Carcinoma. As has already been stated, carcinoma may develop from a pre-existing non-malignant growth, but it also occurs as such *per se*. It is comparatively rare.

Symptoms and Diagnosis. Carcinoma is recognized by its rapid growth, its hard consistence with occasional fluctuating or ulcerating foci, its puckered surface of reddish blue color denuded of hair, its intimate cohesion with the skin and its mobility from underlying structures.

Treatment. Growths of this nature may be removed as soon as possible, together with a considerable area of the surrounding skin. When early and free removal is practiced, recidivation need not be feared.

Sarcoma. Sarcoma arising either from the soft tissues or the bones occurs about the legs. In the former case it may spring from the skin proper or subcuticular tissues, and in the latter either from the periosteum or the interior of the bone cavities (myelogenic sarcoma). Myelogenic sarcoma usually develops in the cancellous tissue near the joints and the usual seat is the forearm or shoulder and lower extremity of the femur. The growth gradually causes expansion and distortion of the osseous shell, which, however, is continually being reformed from the greatly thickened periosteum, so that there ultimately results a local deformity of enormous dimensions. Finally, it breaks down and discharges by fistulous tract.

It may be remarked here that owing to the fact that myeloid sarcoma (of the center of the bone) is of distinctly low malignancy and very rarely forms secondary growths at a distance, the tendency now is to speak of this as "Myeloma" and separate it from the sarcomas proper.

Symptoms and Diagnosis. Sarcoma arising from the soft tissues is characterized by very rapid growth, soft consistence and tendency to ulcerate. It is either intimately blended with the skin, when it is usually mobile from the subcutaneous structures, or lies subcutaneously when it is sessile. Periosteal and Myelogenic sarcoma is recognized by the local deformity and rapid increase in size of the enlargement. All the deeper forms are generally accompanied with lameness.

Treatment. Only the more superficial forms are eradicable by operative measures, though there are a few instances on record of treatment of bone sarcomata of the lower extremities by amputation of the member above the seat of disease.

AMPUTATION.

Amputation of the leg is not very often practiced on the dog, for the reason that few people care to see their animals going about in a crippled condition, nevertheless occasions sometimes arise, when, either on account of value for breeding purposes or because of sentimental considerations, the practitioner is called upon to undertake the operation. The dog seems to be but little incommoded by the loss of one leg, for he soon learns to run about fairly well with the remaining three, and particularly is this true when the lesion has occurred in the hind parts. Even when both fore-legs are missing he manages to progress by hopping on the hind-legs after the manner of the kangaroo. Furthermore, the wearing of an artificial support is perfectly feasible, and several cases of successful substitution have been recorded. A simple prop can be fashioned out of some light wood, around the upper end of which a strip of leather is attached to form a socket to snugly fit the stump of the member. The contrivance is held in place by means of a light leather harness reaching to the joint immediately above. Or if something more elaborate is desired the skill and experience of the artificial limb manufacturer may be sought.

The lesions for which amputation is indicated are severe fractures, and malignant growths and gangrene of the extremities.

The best way to perform the operation is as follows: The animal being hobbled and under general anesthesia and the parts freed of hair and thoroughly cleansed, a tourniquet is first applied above the area of the operation. A circular or wedge-shaped incision is made through the skin around the leg, a little distance below where the bone is to be divided. In order to provide for a flap to cover the extremity of the bone, the skin must then be retracted by gently drawing it towards the root of the member. Some slight dissection of the subcutaneous connective tissue may be necessary to properly free the skin. At the level of the retracted skin the muscles, tendons, and vessels are next severed to the bone. The latter is then divided with a saw. The amputated portion being removed, the vessels are sought for, clamped with artery forceps, and ligated with silk. All hemorrhage being stilled, the parts are irrigated with hot sterilized water, and the skin is gathered together with a subcuticular suture, the ends of the latter being

allowed to protrude from the wound, to be removed later on when healing is complete. A dressing of antiseptic powder and gauze should be applied and held in place with bandages and renewed daily. A close watch must be kept for suppuration for a few succeeding days, and if such takes place an opening be made to give exit to the pus. As a rule, healing is quick to follow.

AMPUTATION OF THE DEW-CLAW DIGIT.

Dew-claws are unsightly, and it is frequently desirable to remove them for this if for no other reason. But they may also become the seat of painful in-growing nail and of injury from extraneous causes.

When the digit exhibits no union with the main bone it is a simple matter to snip it off with scissors, and if necessary, ligate the nutrient vessel. In this case, no sutures are necessary, the animal being allowed to attend to the wound itself. Where there is true bony connection, the operation partakes of the nature of true amputation, as described above. Suturing is generally advisable, but the lower extremity of the wound should be left open to afford drainage. As in the preceding instance, the animal should be allowed to lick the wound, though by so doing it may rid itself of the stitches.

DISARTICULATION OF THE PHALANGES.

The various steps of this operation differ but little from those proper to Amputation, except that the section is made at the joint by division of the ligaments.

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The Tail

CONGENITAL MALFORMATIONS.

Anomalous formations are occasionally seen in newly-born animals. Heredity would seem to play a part. In one instance which came under my notice, in a family of Skye Terriers, some

of the puppies of three consecutive generations were born with the two terminal coccygeal vertebrae bent at right angles. Fox Terriers and Poodles and other breeds which are ordinarily docked soon after birth sometimes come into the world with bobtails. Whether this variation can be regarded as a result of long-continued disuse through the practice of docking from remote times, it is difficult to say, though Darwin has pointed out, mutilations occasionally produce an inherited effect. A good example of artificial selection is seen in the Bob-tailed Sheep dog.

TRAUMATIC LESIONS.

The most common lesion to befall the tail is brushing or crushing from its being caught in a closing door. Usually, in these cases the wound is a compound one, but in some instances, as when the organ is trodden upon, a simple fracture may result. A very troublesome lesion is frequently seen in Great Danes. These animals are possessed of very long tails, which they wag with great force. When confined in narrow quarters, constant pounding of the organ against a hard surface soon renders the extremity bruised and sore. Ulceration develops and the wound bleeds at the slightest irritation, the blood being swished about in all directions, to the disgust of everyone with whom the animal comes in contact. Finally, the bone becomes necrosed. Prevention in these cases is infinitely better than cure. If it is absolutely necessary that an animal be confined in narrow quarters the conditions which are productive of the trouble can be rendered nugatory by the adoption of a simple device. Strips of wood three or four inches in width are nailed to the wall lengthwise above the level of the animal's head on both sides and the back. From these some heavy draping made of stout material is suspended and allowed to reach almost to the floor. This acts as a buffer to the pounding tail, and the latter escapes injury.

Treatment. When the parts are badly crushed, amputation is necessitated, but as long as the bone is intact and only the soft parts injured, efforts should be directed towards saving the organ by the usual soothing antiseptic measures employed in wounds of this nature. Fractures, when simple, are treated as outlined in the chapter on Fractures, but the bandages must be of the very lightest character possible. Compound fractures generally necessitate am-

putation. Bruises of the extremity as observed in Great Danes, when there exists chronic tumefaction and ulceration are usually accompanied with necrosis of the terminal vertebra, when the latter must be disarticulated, by the flap method. Provision must then be made to prevent a recurrence of the trouble until the wound is healed. Besides the protective curtain advocated above, a sort of flange should be applied to the tip of the tail just above the wound. This is best fashioned out of a long strip of felt about three quarters of an inch in width, which is smeared on one side with ordinary carpenter's glue. The hair being clipped short, this is then wound round the tail and on itself till a projection an inch or more in width is thereby formed. Glue is the best adhesive material for the skin, and when sufficiently thick, will hold any bandage in place, till the hair in growing out forces it away from the skin, when it can be peeled off with ease. When the tail is pounded against any surface, the flange forms the point of contact and saves the tissues, and if desired, bandages can be kept in place by tying above the flange. The flange is left in place until complete healing has occurred, and if it becomes displaced sooner must be reapplied.

INFLAMMATORY AFFECTIONS.

Circumscribed dermal inflammation may occur as a local manifestation of eczema. Further irritation on the part of the animal itself by incessant scratching and biting soon sets up an ulcerating sore.

Treatment. Treatment is difficult, and at the best, tedious, for most animals rebel at the application of bandage or muzzle. Nevertheless, persistence in this as in every difficult undertaking is usually crowned with success. The treatment most productive of good results consists of cauterization of the ulcer with the solid nitrate of silver, until a cicatricial inflammation is established, and subsequent liberal sprinkling of the inflamed area with some desiccant analgesic powder, preferably xeroform, to which a little orthoform may be added with advantage. The parts should be protected from further irritation by antiseptic gauze and cotton bandages whenever possible, every known device to keep the same in position being tried in rebellious animals. At the same time, the general health must be attended to, intestinal parasites eradicated, the bowels freely opened, and a course of tonic treatment instituted.

Bad cases sometimes require weeks of persistent treatment. Some authors advise amputation as a last resort, the site of operation being selected well away from the inflammatory area, but such radical treatment is rarely called for.

NEOPLASMS.

Besides fibroma, which is of occasional occurrence on the tail, malignant carcinoma is not uncommonly met with about the root of the appendage. It exhibits all the characteristics of the typical cancerous growth, developing rapidly, and having a hard consistence with uneven, ulcerating surface, and tending to infiltrate neighboring lymphatics. The method of treatment differs in no wise from that applied to tumors of the skin in other regions, the sole object being to cause total ablation.

AMPUTATION.

“Docking” of the tail is universally practiced as a fashionable measure on certain breeds, among which may be mentioned: Fox, Irish, Airedale, Welsh and Yorkshire Terriers; Field, Cocker, Sussex and English Water Spaniels; Griffons, Schipperkes; and French Poodles. The puppies of the Bob-tailed Sheep dog sometimes require a slight reduction of their appendages to make them conform to the standard. The length of stump allowed to remain in the different breeds varies. The Yorkshire Terrier is allowed a stump of medium length, about three inches (adult measurement), French Poodles one of three to five inches, Airedale Terriers of four to six inches, Sussex Spaniels of five to seven inches, and English Water Spaniels of seven to ten inches. The Bob-tailed Sheep dog is allowed only a maximum of two inches, and the removal is effected three or four days after birth. In the other animals, the operation is best performed a few days after birth, when the undesired extremity of the appendage may be snipped off with a pair of scissors, or removed with the tail gullotine, the skin being pulled towards the root of the tail while the action is being made. The bleeding rarely amounts to anything, and it can be easily controlled by temporary application of an elastic ligature or strip of tape.

In adult animals, when the operation is necessitated as a gen-

une surgical measure, more minute technic is required. It is practically identical with that of amputation of the leg, but the section is generally made at a joint so that it is in reality a disarticulation. The animal should be narcotized with morphine and receive local injection of cocaine. The technic is as follows: The hair being clipped or shaved off at the site of operation the latter thoroughly cleansed, and the tourniquet applied above, the skin and subjacent tissues are divided by circular incision at a line from a half to one inch below the joint, and two opposite longitudinal incisions extended up to the level of the joint. The soft tissues of this area are next dissected from around the bone and the caudal vessels ligated. The joint is then severed by division of the ligaments. The resulting flap should be secured with a single suture only, in order that drainage may be unhindered. The tourniquet is finally removed, and if any post-operative hemorrhage takes place it can be controlled by an elastic ligature slipped over the stump immediately above the wound. It is best to dispense with protective bandages and not restrain the animal from licking the wound.

It may be noted here that Dell attributed a case of pyemia which he experienced, to an amputation undertaken to relieve a crushed tail, the animal having been run over by a street car, but it is not unlikely that the disease had its origin in the lesion which necessitated the operation.

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CHAPTER XI

The Osseous System

TRAUMATIC LESIONS.

Fractures

FRACTURES IN GENERAL.

Some interesting statistics of fractures have been tabulated by Froehner based on seventy-four thousand eight hundred and seventy-two cases of sickness and accidents treated by the staff of the Berlin Institution between the years 1886 and 1894. In this number one thousand six hundred and ninety-three were fractures, making a percentage of 2.3, or in other words, in every forty dogs treated, one had sustained a fracture.

Fractures of the extremities were most common, amounting to ninety per cent of the whole, and one-half of all the fractures were observed to have occurred in the larger of the long bones.

The prognosis of fractures in general must be regarded as very good, eighty-five per cent of Froehner's cases having completely recovered, the remaining fifteen per cent having comprised the complicated, comminuted and pelvic fractures. In one-hundred and fifteen cases recorded by Stockfleth ninety-two completely recovered. Froehner regards the prognosis of fractures in the dog as four times more favorable than in the horse.

The causes of fractures are manifold, but result mostly from traumatism, such as run-overs, blows from clubs or balls, kicks from horses, falls from heights on to hard surfaces, bites of other dogs, gun-shots, and even extreme muscular action on the part of the animal itself, as occasionally occurs to the olecranon.

Various local or general conditions such as necrosis and old age may exert a predisposing influence on the resisting power of the bones.

Fractures may be partial or complete, compound or comminuted.

Partial fractures commonly occur as fissures, splinters, per-

forations, or depressions, usually in flat bones, such as those of the skull. To these must be added subperiosteal or the so-called greenstick fractures in which the periosteum remains intact.

Complete fractures are observed in long bones and form the majority of all fractures.

A fracture is said to be compound when a wound exposes it to the atmosphere.

A fracture is said to be comminuted when it is shattered into a number of fragments.

The immediate result of a fracture is hemorrhage from the local vessels or those of adjacent parts which may be involved in the injury. Inflammation is precipitated, giving rise to hyperemia and swelling of the contiguous tissue. In a few days these subside, and finally there arise reparative processes associated with callous formation. The process of solidification of the callus is complete within fifteen to thirty days. Stockfleth observed commencing ossification of the callus in a fracture of one of the lower extremities, twelve days after receipt of the injury. It is more rapid in the young and slower in the old. The ensheathing portion becomes absorbed within thirty to sixty days, while the central callus remains for a while, completely occluding the medullary canal, but it also undergoes absorption at a later period.

Muscular action, particularly in cases of oblique fracture, may cause considerable overriding of the broken extremities, the latter being sometimes separated from one another such distance as to make it no easy matter to replace them in correct apposition.

Separation of the epiphyses frequently occurs in very young animals through slight traumatic influences or excessive motion.

Symptoms and Diagnosis. The chief symptoms are: Local pain and swelling, more or less distortion of natural outlines, loss of function, preternatural mobility in all directions, and crepitus. Crepitus, however, is not invariably present, as when muscular fibers or tendons become interposed between the fractured extremities or when the hemorrhage is considerable.

Separated epiphyses are distinguished from luxations with difficulty. Crepitus is less noticeable than in true fracture, being "softer," and it may be entirely absent.

Treatment. The object to be attained in treating a fracture is reduction of any existing displacement of the broken ends and

their retention in normal alignment. This is accomplished by rendering the parts immobile by means of suitable splints and bandages. As a rule, immobilization is indispensable, but exceptional cases occur, as when a broken rib, which is in constant motion, becomes reunited in a short while. The authorities in general teach that a broken bone should be set and immobilized as soon after receipt of the injury as possible. I have long ago discarded this method of procedure, close observation of a great many cases having taught me that it is far better surgery in the dog to await the disappearance of all swelling incident to the injury before attempting surgical interference.

Following almost every fracture there occurs more or less inflammation of the adjacent soft parts which is attended with considerable tumefaction and pain. The application of non-resistant bandages before the swelling is in evidence cannot be made to diminish the interstitial effusion and tension to any extent with safety, but rather serves to increase the latter, menacing free circulation, involving risk of constriction and consequent gangrene, and augmenting the discomfort of the animal. Moreover, it necessitates frequent inspection at short intervals. If such bandages are applied after the parts have become swollen they are soon rendered so loose by subsidence of the swelling as to need renewal. Hence, it is my practice to wait some three or four days for a reaction. It may be argued that postponement involves risk of converting a simple into a compound fracture. This is a matter which may be left with absolute safety to the injured animal itself, provided the latter is allowed to rest. I have never known such an accident to happen.

The advocates of immediate bandaging find it necessary to advise that the foot be included in the bandage in order to prevent dropsical swelling and stasis of circulation. By covering up the foot we deprive ourselves of our best means of ascertaining whether the bandage is too tightly applied or not, but on the other hand, if we do not apply the bandage until the primary swelling has subsided, the foot may be left free with perfect safety, as all danger of pressure-necrosis from inflammatory swelling is past. Too firm application must, however, still be guarded against.

Reduction and setting with dressings is effected in the following manner: Correct overriding by grasping the lower segment and submitting it to firm and steady traction. When the ends arrive

in contact, correct the lateral displacement by direct pressure. Reduction may usually be effected by steady traction and manipulation, but in some cases where overlapping is great and muscular rigidity marked, general anesthesia should first be induced. Instead of chloroform or ether, chloretone or chloral hydrate may be administered. The help of an assistant may also be required. The degree of overriding present may be approximately ascertained by measurement of both legs with a tape measure, the injured member being found shorter than its fellow. The actual condition or position of the fractured ends may be ascertained with the aid of a skiagraph.

In some cases even if the overriding is successfully reduced, the ends of the bones cannot be maintained in apposition owing to the conformation of the parts preventing accurate bandaging. This is particularly true of oblique fractures of the scapula, upper extremity of the humerus, and the femur. The only alternative is to undertake suturing of the broken ends.

Normal apposition being secured, smear the leg freely with oil or vaseline. A protective layer of any material is bulky and unnecessary, the oil being sufficient to prevent friction, except at prominences, which should be protected by padding about, but not on them. If supporting splints are to be used, have them previously moulded or shaped to conform to the contour of the leg, lay them in place, and secure them with strips of adhesive plaster. For large and medium sized animals splints are best made with strips of poroplastic felt, which can be moulded to the desired shape after moistening in hot water. A very light and inexpensive splint for the smaller animals may be made out of the thin wooden platters on which pastry-cooks serve pies, and dairymen butter, to their customers. Rectangular splints may be made out of stout cardboard, cut, bent, and glued together as desired. Supports should always be longer than the broken bone.

Wind the bandage round the leg, commencing from the inferior extremity and giving it a turn as found convenient, and taking care to include the joints at either end of the broken bone. See that the dressing is perfectly dry before the animal is allowed to move.

The permanent dressings which find most favor are made of strips of gauze or cheesecloth thoroughly impregnated with dry plaster of paris, sodium silicate, or starch, and rolled. A bandage

so prepared is soaked in warm water until air-bubbles no longer rise from it to the surface, which indicates that all parts of the roll have become saturated. It is then immediately applied. To afford additional rigidity the ingredients may be smeared over the bandage while it is being applied. Plaster of paris sets quickly, but makes a very heavy dressing. A little salt added to the water makes it harden still quicker, but so rapidly as to be of disadvantage. Pure silicate of soda bandages, while having the advantage of lightness, are impracticable, as a rule, as they take several hours to become perfectly hardened. Mueller overcomes this drawback by interposing small splints of wire gauze, or smearing plaster of paris thinly in between the layers. Starch is also slow to harden. Stockfleth advises the addition of a little mucilage to assist the process. Another very useful immobile bandage, particularly for small animals, may be made by the addition of thick mucilage or glue to strips of cotton.

I consider the best preparation to consist of a mixture of resin and beeswax, two parts of the former to one part of the latter. This is heated together until the ingredients are dissolved. It is smeared over strips of bandaging material, and the latter applied while it is still warm. This makes a very light, strong dressing, and it is also quick to harden.

Where there are no pronounced prominences or angularities to be included, shoemakers' leather makes an excellent support without any need of bandages. It is cut in one piece slightly smaller than the circumference of the parts and moulded to the normal shape of the leg in the same manner as felt, and allowed to dry. Holes are punctured at short intervals near both margins, and it is applied and kept in place by lacing.

Bandages can be removed by cutting with scissors, bone-forceps, or any of the various makes of bandage shears. Plaster of paris may be removed by pouring dilute acetic acid or vinegar along the line to be cut, and then cutting the cloth with a knife, layer after layer. Mucilaginous bandages may be immersed in hot water, leg and all.

In general, fractured large bones need support by immobilization for a period of at least four weeks, and the small bones some two weeks.

It is sometimes found necessary to muzzle dogs under treat-

ment for fracture to prevent them from tearing off the bandages I have never found smearing the latter with bitter or noxious substances to answer the purpose, for an antagonistic dog will go to almost any extreme to rid itself of what it regards as an imposition.

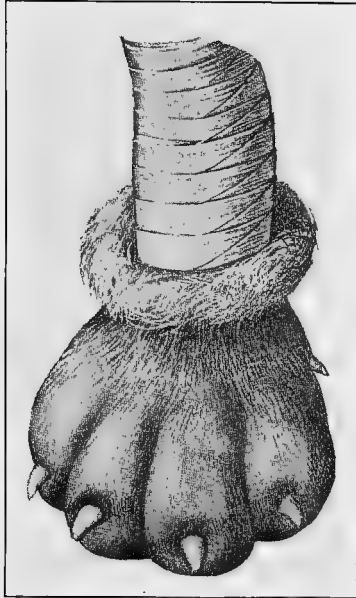
Too firm application of bandages becomes manifest by exhibition on the part of the animal of pain, uneasiness, anorexia, fever, and local swelling. Sometimes the edges of a bandage will abrade the skin and originate local ulceration. In either case the bandage must be removed in whole or part. Persistence of functional impotency after a reasonable course of treatment indicates pseudarthrotic formation or ankylosis following intraarticular fracture.

In compound fractures it must first be decided whether amputation is indicated or not. If it is believed that the leg can be restored to usefulness, thorough antisepsis must first be employed. The interior as well as the exterior of the wound is cleaned and disinfected, detached portions of bone removed and counter-openings made for drainage if necessary. The application of fixed bandages may be postponed until healing of the superficial wound has taken place, though if it is considered advisable some support may be given by the use of temporary splints. Or, the fracture may be treated as a simple one, but a "window" must be arranged over the wound to permit of free drainage.

FRACTURES IN PARTICULAR.

The Cranial Bones. Fractures of the cranial bones are uncommon. In five hundred and forty-eight of Froehner's cases there were only four. The chances of recovery depend upon the presence or absence of intracranial complications, septic infection, and the degree of injury sustained by the brain. Froehner says these cases usually terminate fatally. Moeller states that he has witnessed and successfully treated several cases in which both skull and brain were injured.

There may be many degrees of injury from simple fissure in the external lamellae to penetrating, depressed, or compound fractures and those accompanied by intracranial hemorrhage. Martin instanced a case of simple external fracture, in which he removed two pieces of bone consisting of almost the entire covering of the frontal sinus, from the depths of a fistula, which had been discharging just above the left eye for more than a month. Whitlamsmith suc-



No. 77. (After Cadlot and Breton.)
The effect of too tight or too
early bandaging.

cessfully treated a penetrating fracture of the frontal bone, half an inch in length and one eighth of an inch in width caused by a butcher's knife which had been thrown at the animal. Part of the brain substance, the size of a horse-bean, protruded through the wound. The symptoms to which these injuries gave rise were: partial paralysis of the right side but without loss of consciousness, knuckling over of the knee whenever weight was put on that limb, and aimless movements to the right in an irregular sort of circle. The protruding portion of brain was removed, the skin shaved and dressed antiseptically and the edges of the wound drawn tightly together by silk sutures. Complete recovery ensued in a week.

The great danger of penetrating fractures which are not of sufficient extent to immediately cause death is the liability to intracranial suppuration. Depressed fractures are always dangerous through their causing compression of the brain. The cranial cavity is completely filled by the brain, its meninges, blood vessels and fluids. Any decrease in its capacity necessarily results in compression of the contained organs. While it is known that the cerebrospinal fluid under the influence of pressure is forced into the spinal canal, thus permitting of a certain degree of accommodation to new conditions, experiments have established the fact that compression of the brain by one-sixth of its volume of any material is fatal, and attended by very serious results under much less. Pagenstecher studied the effects of brain-compression produced by injecting wax between the dura mater and cranial vault. His researches showed that the capacity of the skull could be diminished about one-thirtieth without inducing cerebral phenomena.

Depressed fractures become evident through change of contour and by examination with finger and eye. The symptoms appear concurrently with the receipt of the injury. Owing to the increase of intracranial pressure the blood flow is retarded and together with the direct influence of the compressing body there ensue either restlessness, stupor, or coma, with slow respiration and hemiplegia or limited paralysis of certain groups of muscles. In one of Moeller's cases the animal remained deaf during the rest of its life, and subsequently it was demonstrated at the necropsy that the temporal bone had sustained marked injury.

Uebelen treated a Pointer which was in a comatose condition. The kick of a horse had shattered the whole of the left side of the

cranial vault. Part of the muscular tissue covering the skull was dissected and the splinters (sixteen in number) were removed, some of them having to be loosened from the dura. Sharp projections remaining were smoothed, the wound treated with carbolized oil and the skin sewed up. Immediately after the operation the dog recovered consciousness and evinced a desire to run about. In three weeks the wound had healed but the parts remained soft underneath. There was no permanent disturbance of mental function.

Fractures of the basal bones are invariably fatal either from severe concussion or laceration of brain tissue, or rupture of intracranial vessels with formation of blood-clots in consequence of which compression of the vital centers takes place resulting in their paralysis. In these cases the onset of the symptoms may be gradual though the animal may be at first rendered temporarily unconscious from concussion.

In addition to well-defined examples of fracture the practitioner may be confronted with obscure cases of injury in which there is good reason to believe that the main lesion consists solely of concussion and which completely recover in a very short while. Among the symptoms are: total loss of consciousness, inability to coordinate movements, weakened pulse, and occasional vomiting.

Treatment. This is varied according to the presence or absence of intracranial complications. Simple fractures require but local treatment of any parenchymatous contusion and removal of bone splinters, the rest being left to natural processes of repair. In penetrating wounds the chief danger consists in the liability to septic inflammation. Accordingly, antisepsis must be maintained until recovery. It may be found advisable to trephine for purposes of ample disinfection, removing the portion of bone which has sustained the perforation. Unless there be absence of any brain disturbance depressed fractures should always be remedied by surgical interference. If this cannot be accomplished in a simple manner the skull must be trephined close to the depression, and in the hole thus made a suitable instrument introduced to elevate the depressed portion of bone.

Compound cases are treated by antisepsis.

Comminuted cases with loss of substance may be treated on the plan outlined by Uebelen, but unless the periosteum is preserved no true ossific regeneration can take place, the open space becoming

filled with dense connective tissue. Ossification can, however, be promoted by the practice of Osteoplasty.

The Inferior Maxilla. Of all the head bones the inferior maxilla is most commonly fractured. The lesion usually occurs either at about the level of insertion of the second premolar immediately posterior to the root of the canine tooth, or at the symphysis. In the former position the fracture may exist simultaneously in both halves or be confined to one side. This fracture is frequently compound through laceration of the mucosa. It generally results from direct violence, but in rare instances may be attributable to indirect force exerted at a distant point. Such a case came under my notice. A bullet shattered the bone posterior to the last molar and it was concluded that the force of the missile exerted at this point had tended to bend it downward or inward to the extent that it snapped at its weakest spot, as a separate and distinct fracture also existed just posterior to the root of the canine tooth and involved the second premolar which was split into two distinct portions. This specimen is in the Museum of the Army Medical Department.

Chronic mercurial poisoning has a peculiar effect on the lower jaw bones. There is an interesting specimen in the Pathologic Museum at the Copenhagen School. It consists of the skull of an aged hunting dog which had suffered from chronic mercurial poisoning through excessive dosing of the drug for a cancerous growth of the mammae. The lower jaw is carious, some molars are missing and the left ramus is broken across the middle (Stockfleth).

Symptoms and Diagnosis. Characteristic are displacement of the jaw so that the level of the teeth on one side is lower than on the other, associated sometimes with lateral displacement, local tumefaction and crepitation, salivation, difficult or suspended prehension of food, and at times bleeding at the mouth.

Treatment. This is beset with difficulty. For fractured symphysis interdental splinting should first be tried. This is accomplished by passing and securely binding a piece of silver wire round the canine and incisor teeth as near to their necks as possible but free from the gums. It is sometimes necessary to file a slight groove in the postero-lateral aspect of the canines to retain the wire in position. Should this method prove unsuccessful the two separated rami must be wired together with silver wire, the latter operation being performed externally with the animal under general anesthesia

as follows: Make a transverse incision through the skin over the symphysis until the bone is exposed. Approximate the fragments and drill a hole with a fine drill or bradawl transversely through both halves midway between either extremity and near to the margin of the symphysis, so as to avoid the roots of the canines. Then introduce the wire, twist it, cut the ends off short and let them protrude through the skin wound. With favorable progress, withdraw the wire at the expiration of three or four weeks and promote healing of the superficial wound.

Fractures through the body are best treated by application of a permanent well-padded leather or wire muzzle, to remain on the animal some three or four weeks. This muzzle must be firmly applied so that no mandibular motion is possible. The animal can be fed on liquids administered by means of a funnel and tube, and allowed to trickle through the teeth. Thirst must also be assuaged in like manner. The mouth should be cleaned and disinfected daily.

Stockfleth successfully treated a case of unilateral fracture by application of a splint of gutta percha. This was moulded to the normal shape of the jaws and held in place with bandages to include the muzzle and neck. In another instance he observed a comminuted fracture heal by ligamentous union, but the animal experienced considerable difficulty in gnawing bones, etc.

When reunion fails to take place by this method, the fractured parts must be wired together as described above. Froehner completely removes the broken fragment, but this should not be done until every other method has been tried and found unavailing.

The Hyoid Bone. Fracture of this bone generally occurs in one of the greater cornua. It may follow violent seizure of an animal by the throat, a method of apprehension in vogue among members of the pound corps in some cities.

Symptoms and Diagnosis. The symptoms are local swelling, dysphagia, and bleeding from the mouth when the mucosa is perforated by fragments.

Treatment. No treatment is possible.

The Vertebral Column. Fractures in this region are mostly observed in the cervical, lumbar, and coccygeal portions. The prognosis depends on the presence or absence of dislocation and the amount of damage sustained by the cord. Unless the spinous processes alone are concerned, when the cord is seldom injured, dislocation is the rule.

The coccygeal vertebrae become broken mostly through the tail being run over or caught in doors.

Symptoms and Diagnosis. The principal symptoms are tenderness, crepitus, and motor and sensory paralysis. Crepitus and tenderness alone must not be regarded as serious symptoms since they may arise merely from fracture of a spinous process.

When the lesion is in the *cervical* region, death is usually immediate, owing to paralysis of the phrenic nerve, that nerve having its origin in the fifth, sixth, and seventh cervical pairs. If the fracture occurs at or posterior to the seventh cervical vertebra, the phrenic nerve still functions and supports respiration which becomes then wholly diaphragmatic, the function of the intercostals being destroyed. The neck is held stiffly and crepitus may be noticed if the head is submitted to a twisting motion.

In the *lumbar* and *sacral* regions the symptoms are: paraplegia, and paralysis of the rectum and bladder. The intestines become tympanitic from reduced innervation.

It is sometimes a matter of difficulty to make an early differential diagnosis between true dislocation, fracture of the vertebral column and simple injury sustained by the cord from violent concussion resulting from falls from great heights, which are far from common. The cord may become ruptured or hemorrhage take place into the canal. In these cases the symptoms usually disappear within one or two weeks and recovery is often complete but will of course depend upon the presence and extent of hemorrhage or degeneration.

Treatment. No treatment of fracture is possible. Concussion cases must have rest, administration of water and liquid nourishment and assistance in evacuation of the bowels with the aid of enemata if necessary. The animal must be frequently turned to prevent the formation of bedsores.

Simple fracture of coccygeal vertebrae is treated in the same manner as a broken leg, but the bandage must be of the lightest character possible, and made to include three or four vertebrae on either side. When compound the prognosis is unfavorable and the tail has eventually to be amputated above the seat of injury.

The Sternum. Fracture of this bone is a lesion of great rarity. Koenig and Zundel have seen instances in which a run-over was the productive factor.

Symptoms and Diagnosis. Where no displacement exists there are no significant symptoms. There may be crepitation during respiratory movements.

Treatment. If the fragments are in apposition the animal should be maintained at rest until consolidation is effected. If displacement is evident it may usually be reduced by simple manipulation.

The Ribs. These bones are more often fractured than those of the vertebral column. One or more may be broken, but unless this takes place simultaneously there is not necessarily much, if any, displacement. The prognosis is favorable provided pleuritis or pneumonia do not supervene. Laceration of lung tissue may occur when the violence is great.

Symptoms and Diagnosis. Displacement is recognized by elevation or depression at the seat of fracture and local pain. Cellular emphysema will be present, and may extend over a large area, when the lung tissue is wounded. Crepitus is not always distinguished, but its presence is best determined by auscultation immediately over the area. The affected side of the thorax may be held rigid.

Treatment. This fracture is treated by securing immobilization of the chest by means of broad bandages tightly applied. Recovery is the rule.

The Scapula. The scapula sustains fractures mostly in the vicinity of the head and neck. As a rule, there is very little displacement. Separation of epiphyses is not uncommon in puppies.

Symptoms and Diagnosis. The entire leg hangs loosely with the phalanges dragging on the ground, leading to considerable abrasion of the latter.

Treatment. In my own practice I have often left these fractures to Nature, in nearly every case with favorable result. Where there is much overriding or tendency to pseudarthrodic formation it is advisable to undertake internal splinting or wiring of the fractured extremities. German practitioners apply a saddle-bandage which is well-padded and made to pass over the shoulder. English veterinarians apply a plaster consisting of a mixture of resin one part, venice turpentine three parts, and burgundy pitch five parts, put on with a spatula while hot. The exterior is covered with some material to prevent it sticking to other objects.

The Humerus. According to Froehner, this bone sustains

fracture mostly in the lower extremity just above the trochleas where the shaft is weakest. In fifty-four of Froehner's cases eighty-three per cent were in the lower third. Fracture may also take place in one or both condyles in one or both legs. Moeller quotes Stockfleth to the effect that in twenty-six cases observed by him nineteen were of fractured condyles and the remainder of fractured shaft. The external condyle is more frequently fractured than the internal, and usually the displacement is not great, the fractured portion of bone being retained near its normal position by the external lateral ligament.

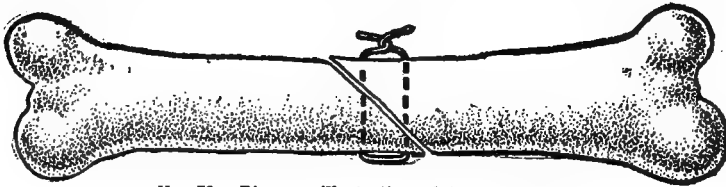
Symptoms and Diagnosis. In fracture of the shaft or condyle of one leg the animal moves about on three legs or sits on its haunches without placing the injured member to the ground. When the condyles of both legs are broken locomotion is peculiarly characteristic, the animal either creeping or depending wholly on its hind legs for propulsive power, kangaroo fashion. At rest, the weight of the body is supported mainly by the haunches, the fore-legs propped out in front. In severe bilateral fractures of leg-bones a prone position is assumed.

Treatment. Fracture of the shaft, being high up, is rather difficult to treat, and if little displacement is evident is perhaps best left to natural processes. In cases of much overriding, the wiring operation should be performed. The lower extremity of the shaft is more amenable to bandaging, and there is a belief that the joint should be flexed to avoid imperfect reunion. Fractured condyle should be bandaged with the joint in full extension. Healing of the latter class of cases is apt to be imperfect through ligamentous union. Hertwig states that perfect reunion is the rule in young dogs. In one of Stockfleth's cases the animal regained complete use of the leg, though the fractured portion became almost entirely absorbed and the union was ligamentous. When ossific reunion has taken place and the splints have been removed, there is usually considerable stiffness, which, however, soon disappears with use of the parts.

The Radius and Ulna. These bones form the seat of about one-half of all the fractures of the fore-legs, and from one-half to two-thirds of these occur in the lower third of these bones. Usually both bones are broken together. When one bone alone is concerned it is generally the ulna and in the olecranon, owing to the prominence

of the latter. The olecranon has been known to become fractured through great and sudden exertion of the triceps muscle. Fracture of the radius alone may escape notice, through its consort sufficing to support the weight of the body. The prognosis is most favorable of all fractures, only three in one hundred and twenty-two of Froehner's cases having failed to become reunited. In the early part of the last century Sir Astley Cooper made some experimental observations on fracture of the olecranon. He found that in a transverse fracture the action of the triceps muscle drew up the fractured portion from one-half to two inches, the extent of separation depending on the degree of laceration of the ligamentous fibers proceeding from the coronoid process to the olecranon. If the olecranon was broken off within the insertion of the coronoid ligament, and the fibers of the latter remained intact, the detached portion moved laterally but separated little from the ulna, and bony reunion easily took place. If, however, the break took place beyond the ligamentary insertion, and the detached portion was separated by the action of the triceps muscle ligamentous union ensued from lack of adaptation. A longitudinal fracture produced with but slight obliquity, so that the broken portions still remained in contact, readily gave place to osseous reunion.

Treatment. Treatment of transverse fracture of the olecranon with separation must therefore include adaptation to the detached portion, which is best secured by suturing with silver wire, as follows: Under strict asepsis, expose the ulna by a longitudinal incision, and clean away all blood-clots, etc. Drill corresponding holes by means of a bradawl or small drill from the posterior surface of



No. 78. Diagram illustrative of Bone-suturing.

each portion of the bone through its thickness to the fractured surface. Introduce the wire, approximate the parts, twist the wire and leave the ends long to hang out of the wound to permit of their

subsequent removal. The leg should be further secured with splints, the joint being kept fully extended.

Treatment of other fractures of these bones is on the general principles already described. In young dogs imperfect reunion of separated epiphyses is occasionally seen. Such cases are treated by refracture, which is usually easily accomplished manually.

The Carpus. The carpal bones are rarely fractured.

The Metacarpal Bones. These bones are quite commonly the seat of fracture, especially in their upper or middle third, and one or all the bones may be involved. Fracture of a single bone, not being sufficient to cause a deviation of the parts from normal position, the local swelling may at first sight suggest nothing worse than simple contusion, consequently injuries in this region should always be carefully examined before a diagnosis is given.

Treatment. The necessity of treatment will depend on the extent of the fracture.

The Digital Bones. These usually sustain compound fractures from the foot being caught in doors, run over, or trodden on by horses. The broken extremities can be seen and felt through the external wound.

Treatment. In the treatment of these cases all splinters must be removed, and it is sometimes necessary to resort to amputation.

The Pelvis. The pelvis may be fractured in any or all portions. Fractures of this bone are often comminuted and complicated with damage to the lumbar and sacral vertebrae, and have their seat mostly in the external angle of the ilium, in the acetabulum, or at the symphysis. They are often bilateral. An occasional complication is rupture of the urethra. Rectal or vaginal palpation is often of assistance in arriving at a correct conclusion. The prognosis is doubtful, permanent lameness often remaining, though simple fractures will sometimes make a good recovery provided the animal is restrained in its movements. In brood-females this accident is particularly dangerous owing to resultant constriction of the pelvic apertures which may necessitate delivery of the young by Cesarean section. Hertwig believed that fracture was the most common cause of pelvic deformity though rachitic conditions might produce distortion in some instances. F. Mueller witnessed a case in which the passage was so narrow that it would scarcely admit of introduction of the finger.

Treatment. There is no treatment possible except for fracture of the symphysis, and reunion of these parts is assisted by suturing with silver wire, as follows: Make the skin incision immediately over the symphysis and to one side of the penis in the male. Avoid injuring the dorsal vessels of the penis in the male and the plexus of veins from the clitoris in the female, as hemorrhage therefrom is somewhat difficult to control. Separate the subjacent muscular tissue until the fractured parts are exposed. Drill corresponding holes in each half, close to the symphysis, introduce the wire, approximate, twist the wire, and treat it and the wound in the way already described. After this operation allow the animal perfect rest and quiet until reunion is accomplished.

The Penial Bone. Ben-Danou has recorded an instance of fracture of this bone in a Bulldog which was probably the result of brutal handling by some person immediately after the animal had copulated. Taylor has also recorded a case resulting from a fight.

Symptoms and Diagnosis. In the Ben-Danou case the penis was tumefied and discolored. The animal made fruitless attempts to urinate during which a few drops of blood escaped from the meatus. Passage of the sound was arrested by an obstacle the nature of which could not be determined. Anuria being complete the bladder became much distended. The animal died three days later. At the necropsy it was found that the bone was fractured at its narrowest portion and the two broken extremities were overriding and embedded in the penial tissues. The urethra was twisted out of its natural position.

Treatment. Treatment in case of this nature would be by slitting up the prepuce and amputating the organ at the seat of injury, in the meantime withdrawing the urine by aspiration of the bladder.

The Femur. Fractures of the femur occur mostly in the middle third in adult animals and in the lower third in young ones. Stockfleth saw one case in which both the neck and inferior third were broken. They are usually accompanied by considerable overriding or displacement through muscular action, thereby causing shortening of the leg. In fracture of the shaft the broken ends are sometimes forced so far apart as to result in ligamentous union with permanent lameness unless remedied surgically.

According to Sir Astley Cooper's experimental observations,

fractures through the cervix entirely within the capsular ligament are incapable of ossific reunion. He ascribed this deficiency to the feebleness of ossific action in the heads of long bones and to the fact that the trochanter was much drawn up by muscular action so that the head and cervix were not in apposition. Where the experimental fracture continued compound the head of the bone became absorbed or discharged by ulceration. By way of contrast he divided the bone external to the capsule in five dogs and all healed by ossific union, as was also the case in longitudinal fracture.

Symptoms and Diagnosis. Dislocation of the hip-joint has been mistaken for fracture through the neck. In both accidents the leg is seen to be shorter than its fellow. In fracture through the neck this is due to muscular action drawing up the trochanter, and it is to be distinguished from dislocation by greater mobility of the leg. In fracture of the lower third the stifle is held fixed with the leg pointing backward, and with the foot raised from the ground. Such accidents are apt to result permanently in more or less lameness owing to distorted reunion or changes in the relationship of the fractures composing the stifle-joint.

Treatment. The German and English methods of treatment of shaft fractures are the same as for the upper bones of the fore-leg, viz., by means of the saddle bandage and pitch plaster, respectively. French veterinarians use strips of bandaging material which are wound round the parts and coated with pitch.

Where there is much overriding and consequent risk of pseudarthrodic formation bone suturing should be undertaken, the incision being made on the inner aspect of the leg with due regard to the position of the femoral vessels. Felizet treated a dog suffering from a fracture of the neck of the femur by strapping the animal to a board. In twelve days consolidation had taken place.

As a rule, fractures of the femur heal kindly, and some apparently hopeless cases of fracture near the neck will entirely recover without any treatment whatever.

The Patella. This bone being small in the dog is rarely fractured. Sir Astley Cooper's experiments on this bone show to what extent recovery may be expected. He was unable to produce bony reunion in transverse fractures, even when the rectus femoris was divided just above. In longitudinal fractures there followed com-

plete reunion provided the lesion did not extend into the tendon above or the ligament below so that the parts remained in apposition. Where both tendon and ligament participated there resulted separation of the broken portion and ligamentous union.

The Tibia and Fibula. Like the corresponding bones in the anterior extremity, the tibia and fibula sustain fracture mostly in the lower third. They require no modification of the general method of treatment. Fractures of these bones heal very kindly.

PSEUDARTHROSIS.

When, through extensive overriding or defective immobilization, approximation of the separated periosteum fails to take place, the indispensable source of bone supply is wanting, and reunion stops short at connective tissue formation without ossification, and thus is produced a false-joint. This is particularly true in old animals in which the potency of the regenerative power is often impaired.

Symptoms and Diagnosis. The symptoms of false-joint consist of persistence of functional impotency of the affected member, and mobility of the distal extremity but without crepitus or pain.

Treatment. The best method of remedying the defect is by resection operation, in which the false tissue is cut away, broken down, or cauterized. With the animal under general anesthesia, the part to be attacked is freely exposed by dissection. By means of a gouge or curette the fibrous tissue is scraped away. The operation is completed by drilling the ends of the bone and suturing them with silver wire, which will be found described more fully under Fractures. (See also Osteoplasty).

OSTEITIS. PERIOSTITIS. OSTEO-MYELITIS.

Inflammation of bone will be better understood if it is remembered that the essential element of osseous structures is connective tissue, forming a framework which, in the bone proper, is impregnated with earthy salts, in the central portion supports a vascular nutritive medulla, and on the surface is modified by the presence of an osteo-genetic or bone-constructive layer to form the periosteum, all parts freely intercommunicating by means of the Haversian canal system. Because of this intimate connection, inflam-

matory processes do not long remain confined to one part, but quickly extend to another. Most inflammatory disturbances of bone with which we have to deal in the dog are of a septic nature, and involve the bone proper and medulla. They are acquired either in cases of compound fracture or amputation, or as a result of acute infection as may occur in the course of a severe infectious disease, or in septic thrombosis. But in many cases the cause is wrapt in obscurity. Contusions may favor the occurrence of infection by production of a *locus minoris resistentiae* to the bacteria which may have gained access to the adjacent soft parts or which may be circulating in the blood. The course of the disturbance is similar to that of any other purulent inflammation with migration of leucocytes, occlusion of the Haversian canals, arrest of circulation, necrosis, and establishment of purulent foci. The latter coalescing, extend along the tract of the marrow and lead to its rapid disintegration. Pus breaks through the periosteum, burrows along the lines of least resistance, and finally reaches the skin. If the destructive process is allowed to continue, the entire shaft may be involved, and there is risk of septicemia and pyemia. The disease, when of other than traumatic origin, most frequently attacks the long bones.

Symptoms and Diagnosis. There is usually some lameness of the affected member. If there is not already a superficial wound when the animal is first seen by the practitioner, a swelling is observed in the soft parts covering the affected area, as soon as the pus penetrates the periosteum. The skin assumes a dark-red color and looks "angry." A fistula develops. The tract of the latter, when probed, leads to bone, and this is the chief diagnostic symptom.

Treatment. This must be energetic and radical. It is useless to treat this disease by means of antiseptic injections. The infected focus must be removed and the only way to accomplish this is to lay the fistula open, expose the medullary canal and scrape away the inflamed marrow. The technic is as follows: The animal being hobbled and given a general anesthetic, and a tourniquet applied to the leg both above and below the wound, the diseased focus is exposed by free incision and dissection down to the bone. Sufficient



No. 79. Bone Gouge.

of the outer compact tissue is next chiseled away with a gouge or curette to permit of inspection and direct treatment of the whole of the disease cavity. All adjacent granulating tissue as well as that which is necrotic is removed, and the cavity flushed out with a corrosive sublimate solution (1 : 1000). Then the wound is either packed with antiseptic gauze to stimulate the formation of granulation tissue or the cavity is allowed to fill with blood by loosening the tourniquet so that it may coagulate and become organized by connective tissue. The latter is known as the Schede aseptic moist clot method. It is described under Osteoplasty. In this case the outer wound is immediately closed. This is the preferable way to treat bone sinuses, but unless the parts are rendered perfectly aseptic, is apt to give trouble. When the packing method is followed, the gauze is left in place a few days until granulation is well established, the outer wound being in the meantime left open, but protected with antiseptic bandages. This method makes regeneration more protracted than the other.

Osteitis Deformans. This is a rare diffuse form of osteoperiostitis, affecting principally the bones of the skull and the long bones of the extremities. It runs a very chronic course. The bones become enlarged, soft, and spongy and covered by osseous vegetations. They are liable to become misshapen from bearing the weight of the body in their weakened state.

Kitt has described a similar condition in a one-year old Great Dane, which he regarded as of myositic origin, since the vegetations were confined to the areas of muscular insertion, the region of the joints remaining free. The vegetations were limited to the lower jaw and the lower extremities.

Symptoms and Diagnosis. The disease is recognized by the symmetrical uniform enlargement of the bones and by rheumatic symptoms. In Kitt's case, besides the deformity of the affected parts, there was little abnormal in the animal's ways, save an unwieldy gait.

Treatment. There is no known method of arresting the progress of this disease.

RACHITIS.

This disease, popularly known as "rickets," is characterized by incomplete ossification of the skeletal structure in young animals

with more or less arrest of development of the whole body. The ill-formed bone is produced principally in the epiphysial region of long bones, and the sutures of the cranial bones, which in new-born healthy dogs are well closed, are usually large in rachitic dogs. The disease has been ascribed to malnutrition, particularly to food lacking lime salts, to digestive disturbances, and also to hereditary taint. It is highly probable that hereditary or congenital influences play a part in its production, through insufficiency of the thymus gland, in view of the symptoms following experimental ablation of the gland practiced recently by Mendel. Dogs of the larger breeds (Great Danes, St. Bernards) are most often affected, principally between the ages of three and six months. It is important, however, not to confound with rickets a condition also seen in the young of the larger breeds, where, owing to the weight of the body the legs have to support before they are completely ossified, the latter become bent and misshapen.

Symptoms and Diagnosis. A dog affected with rickets exhibits a general disturbance of the system—indigestion, inappetence, weakness and lethargy. In a little while the typical bone lesions develop. In the long bones the epiphyses become greatly enlarged and the shaft curved. In advanced cases the inferior extremities give way, causing the knee and hock to come in contact with the ground, the vertebral column becomes curved, the thorax sinks in, and the ribs exhibit nodosities. The facial bones also show deformity. Sometimes the affected animal is unable to stand and experiences considerable pain at the slightest movement. The distortion may involve the pelvic bones to such extent as to prevent fetal delivery (Reichenbach).

Treatment. Practically nothing can be done in a surgical way to remedy rickets, the treatment being altogether medicinal. The diet must be stimulating and consist largely of meat, shaved green bone, milk, etc. Of medicaments, cod liver oil, lime water, and the official syrup of phosphate of lime are highly recommended. Treatment on similar lines is indicated for simple crooked development, but in the latter case the more the animal is confined and encouraged to rest the better.

OSTEOMALACIA.

This disease, somewhat similar in its nature to rachitis, is characterized by softening of the bones through resorption of their

earthy salts. While rachitis only affects the immature animal, osteomalacia is essentially a disease of adult life. It is very rare and the cause is unknown but it is believed to follow disturbances of nutrition. Any part of the skeleton may be attacked. Solby refers to some hounds in which the disease progressively affected one bone after another.

Symptoms and Diagnosis. The symptoms resemble those of rickets but in addition to the deformity paraplegia may be present and the bones easily fracture. The alveolar margins of the jaws also absorb and the teeth fall out prematurely.

Treatment. There is no remedial treatment known, and prophylactic measures must be depended upon when the disease is recognized. Prophylaxis comprehends a stimulating diet of animal food and administration of such preparations as are indicated for rachitis.

NEOPLASMS.

Both innocent and malignant types of tumor occur in bone. The innocent growths consist for the most part of osteoma, chondroma, and fibroma. The only primary malignant growth met with is sarcoma, carcinoma, when it occurs, being always secondary.

Osteoma. True bony tumors may spring from any part of bone, but most often from the periosteum. They are occasionally found attached to the jaw bone, and Mueller refers to an instance observed by himself of one attached to the transverse process of the fifth cervical vertebra. They are also found in other parts of the body.

Symptoms and Diagnosis. They are recognized as regular, round, hard, insensitive enlargements, sometimes attaining considerable dimensions.

Treatment. Under general anesthesia, such growth is exposed to its base by longitudinal incision and dissection of the skin. It is then removed with the aid of a sharp chisel and mallet, the external wound being closed in the usual manner.

Chondroma. Cartilaginous tumors are found attached to bone. They rarely ossify but may undergo calcification. Gurlt observed them in both the superior and inferior maxillae and on the digits.

Symptoms and Diagnosis. Chondroma is always firm, round or lobular and well demarked, and grows slowly.

Treatment. Removal is easily effected by ordinary methods.

Fibroma. Fibrous tumors of bone are of such rarity and in clinical features resemble chondroma so closely that they need not be considered here.

Sarcoma. This, the malignant type of growth occurring in bone, will be found fully described in the chapter on Neoplasms, and needs but a passing reference here.

Symptoms and Diagnosis. It is distinguished from the innocent growths by its steady, progressive and rapid development, and by other characteristics described elsewhere.

Treatment. Ablation of this form of growth is difficult to attain. When practicable it must always be most thorough.

Carcinoma occurs only as a secondary manifestation. Puetz has seen it in the epiphyses of the elbow joint.

OSTEOPLASTY

This term is applied to certain operations or processes by which defects in the continuity of bones are remedied. The value of its application to cases of severe comminuted fracture with absorption or necrosis of the detached portions, in the treatment of osteomyelitis, and the correction of pseudarthrodic formation following fracture, has long been recognized. We find the earliest known instance of its practice recorded by a Mongolian surgeon named Baber who lived between the years 1483 and 1530 and wrote his life-doings in the Turkish dialect. The reference concerns a man who broke his leg in such a manner that part of the bone of the size of the hand was completely shattered. He cut open the integuments, extracted the detached portions and inserted in their place a pulverized preparation, which was said to have grown in place of the bone, and resulted in its complete recovery.

A great many experiments in this direction have been carried out on dogs by Ollier, Schede, Schmitt (37 experiments), Adamkiewicz, Rydygier and others in Europe, and by Senn and Mackie and others in this country.

It was observed that cavities or serious breaks in the continuity of bones were always followed by protracted regenerative processes. Hence efforts were directed towards the finding of some substitute which, when implanted in the defect, would take the place of the missing bone and become intimately merged with the main body. Many substances were employed to act as substitutes, among them

ivory, cork, fresh bone procured from other animals, and decalcified bone. But it was soon found that implantation of all these substances was followed, as a rule, by their more or less rapid and complete absorption and the development in their stead of fibrous tissue which became ossified according as there remained sufficient periosteum, or not.

The practice of heteroplasty (*i. e.*, where implanted portions of fresh bone were taken from individuals of a different species) regularly resulted in encapsulation and absorption and rather hindered than hastened repair of the defect. Likewise portions of ivory and decalcified bone played but a temporary rôle and were very apt to induce pressure-atrophy or necrosis.

Recently, however, Morton has claimed to have successfully supplied a deficiency of bone in a man by transplantation from a dog, vascular attachment being maintained while the regenerative process was going on, the animal being securely bound to the patient for several days to secure this object.

Senn* advises the packing of bone cavities with decalcified bone cut in thin slices or chips. If the periosteum is carefully sewn over the wound with catgut, repair is said to be much quicker than without the implantation, the chips serving as a temporary nidus for advancing granulations which permeate in all directions, until the embryonic tissue becomes sufficiently organized.

In the skull discs of decalcified bone gave more favorable results in as far as they formed a mechanical protective covering which became encapsulated. Senn says that the implantation of decalcified bone in skull wounds prevents direct union between the pericranium and the brain or its membranes, and that a cavity two inches long and five-sixteenths of an inch wide will fill with new bone in from seventy-five to ninety days. Repair is much more rapid in young than in old animals. Darkschewitsch and Weidenhammer have also observed normal bone development in place of implanted decalcified bone plates, in skull wounds. Decalcified bone is obtained by steeping fresh living bone in ten per cent nitric acid or dilute muriatic acid. It is then immersed in a weak solution of caustic potash to remove the acid and preserved in two-tenths of one per cent alcoholic sublimate solution.

Homoplasty (*i. e.*, the transplantation of living bone from another individual of the same species) gave doubtful results. In

a few instances true ossific union may take place, more especially when the periosteum is carried over with it, but in most cases the same results were obtained as in heteroplasty.

Schmitt removed a portion of the ulna one and one-half ccm. in length and in its place transplanted a piece of bone from another dog. Complete bony union took place on one side and fibrous union on the other. No absorption was apparent and the vitality of the implanted portion seemed to be maintained by thickening of its periosteum.

Only when autoplasty (*i. e.*, where implanted portions were taken from the same individual) was practiced, was there indication of true union, and this was made more certain when the periosteum remained adherent or flaps were left intact at the site of operation. Even in this case there were signs of absorption.

All the above operations were done strictly aseptically. When the parts were not rendered fully aseptic, they suppurated and extruded the implanted portions. Thus it became evident that regeneration of bone can only take place from periosteum, and where the latter is entirely removed no true ossification can follow. A displaced fragment, when replaced, must have connection with periosteum which in turn is in vital condition either by connection with neighboring periosteum or adjacent tissues. Hence the surgeon aims to conserve the periosteum to secure its bone-constructive power.

The periosteum is capable of remarkable vitality, for it may live and produce bone after its transplantation into an animal of a different species. Trueheart recorded a case of a man in which he grafted pieces of periosteum to restore the middle third of a clavicle which had been shot away. Fresh transplants were inserted three times a month for two months when two and three-fourths inches of bone had been produced. The periosteum was from newly-killed dogs. A novel method was pursued by Rydygier. He tried separating flaps from the periosteum just above a pseudarthrodic defect, except at the border where it remained attached, turning them over so that the inner side lay outwards and vice versa, and laid them over the false tissue. Good results were achieved, but Schmitt who repeated the experiments, failed, on account of the movements of the animals, which could not wholly be restrained, tearing out the flaps. Schmitt then resected a piece of a long bone

one and one-half ccm. in length, and transplanted in its place a piece of the same size and sewed both periosteums together. The result was good.

All absorbable porous materials placed in bone cavities which create favorable conditions for healing do so by virtue of compression, occlusion, and diminishing wound secretion. Instead of supplying artificial means to this end, Schede advocated the natural method of allowing the cavity to fill with an aseptic *moist* blood-clot. The principle of this method is that coagula between surfaces of aseptic wounds do not undergo putrefactive or degenerative changes, but become supplied with bloodvessels and are organized. The technic is as follows: Apply a tourniquet on the proximal side, remove all diseased bone, disinfect the cavity thoroughly, suture the soft parts, and remove the tourniquet. The cavity fills with blood. Protect the wound with a layer of oiled silk, which secures at the surface the formation of a moist blood clot. This is an important point. Small cavities heal in from twelve to fourteen days, while large cavities require from three to six weeks. The cavity must be allowed to fill completely or the balance closes by the usual tedious process of granulation. Neuber modifies this method by filling the cavity with iodoform with which the blood mixes, and thus lessens the chances of sepsis.

OSTEOTOMY.

This operation—the division of a bone—is sometimes necessary to straighten a leg, one or more bones of which having sustained a fracture have reunited in abnormal alignment. Complete anesthesia is necessary and the parts should be rested on a sandbag to give necessary support. A free incision is made down to the bone at the site of the callus, on the outer side, and an osteotome (beveled on both sides) introduced parallel to the long axis of the bone and then turned across, or at a right angle to it. With repeated strokes with a mallet it is made to penetrate the dense bone for two-thirds of its thickness, but this must be done with due caution to check any undue impetus on the part of the osteotome. The rest of the bone can be “snapped” with a little manual force. But, if difficulty is experienced in doing this, it means that the chisel must be used a little more. The two extremities are then approximated so as to bring them into alignment and a suitable splint applied, a window

being arranged to permit of adequate drainage. It may be necessary to expose and "trim" the cut extremities with bone forceps to make them stay in alignment.

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CHAPTER XII

The Articulations

TRAUMATIC LESIONS.

Wounds of Joints. The joints of the extremities are most subject to traumatic lesions. A joint may be merely punctured or it may be laid freely open and complicated with injury of the neighboring structures. A joint wound is dangerous only if infected, simple non-infected puncture wounds often healing by primary intention, but the larger the wound the greater is the liability to infective inflammation and suppuration. Should the inflammatory process pursue a pernicious course, it terminates by destruction of the joint and local ankylosis, if in the meantime pyemia does not intervene. But if the cartilages escape destruction the usefulness of the joint may not yet be destroyed.

Symptoms and Diagnosis. A non-infected joint-wound gives vent to a flow of synovia, which is recognized by its glairy appearance. This fluid must not be confounded with that emanating from an open tendon sheath with which it is very similar in appearance. There is but little swelling or pain. When infection occurs, all movements of the articulation are suppressed. The whole articulation becomes tumefied and as the disease progresses, discharges a grumous purulent matter. Collateral edema ensues, the function of the member is totally suppressed, fever appears, the appetite fails and the body emaciates.

Treatment. All wounds of joints or of periarticular tissues should receive thorough antiseptic irrigation with a sublimate solution (1:1000) the hair in the vicinity being removed. If infection is not apparent, the lesion should be occluded with iodoformized collodion and the region covered with an antiseptic bandage. When infection has occurred, the joint must be laid freely open, irrigated night and morning with the sublimate solution, protective bandages being also applied.

Sprains of Joints. By this term is meant an incomplete rup-

ture of the ligaments of a joint but unattended with displacement of the articular surfaces. It is often accompanied with injury to the neighboring parts. It is generally produced by external violence, such as a blow or fall, but may be caused by a sudden twist of the joint during rapid progression. There results an increase of synovial secretion and consequent distension of the sac, or hemorrhagic extravasation, according to the degree of injury sustained. The condition may become chronic owing to incomplete absorption of the inflammatory products, imperfect repair of the torn ligaments, or periarticular fibrous ankylosis. The round ligament of the hip joint is a common seat of sprain.

Symptoms and Diagnosis. The lesion is recognized by the following symptoms: local tumefaction and pain particularly on pressure being applied, and pronounced limping or inability to bear weight on the leg. Absence of crepitus or modification of the outlines and length of the member serve to distinguish a sprain from a fracture or dislocation, though very often the swelling is so great as to render it difficult or impossible to make a diagnosis until the former has subsided.

Treatment. The indications are to enforce complete rest, and where possible to secure immobilization of the joint by bandages. A stream of cold water from a hose repeated several times daily is beneficial. Resolution takes place usually in from one to two weeks. Chronicity is recognized by persistent limping, in which case external painting with tincture of iodine may be tried.

Luxations. Dislocations.

LUXATIONS IN GENERAL

These terms are employed when the articular ends of one or both bones are displaced from their normal position. There are two principal types—the *Traumatic* and the *Congenital*. The first results from direct or indirect violence while a dislocation is said to be congenital when from errors or failure in development the normal contiguity of articular surfaces cannot be maintained. A luxation may also result from relaxation of ligaments owing to constitutional debility, or from pathologic changes in ligaments or tissues entering into the formation of a joint.

A luxation may be partial or complete, according to the degree of displacement present. Complete luxations are seen mostly in enarthrodial joints such as the femoro-coccygeal, but they are also very frequently partial in such joints. Partial luxations commonly occur in the digits. This lesion generally carries with it more or less bruising of the articular cartilages, rupture of ligaments, and contusion of the neighboring parts.

Symptoms and Diagnosis. The symptoms are: pain, deformity, either lengthening or shortening of the affected member, and immobility. In general, a luxation may be differentiated from a fracture by the absence of crepitus, but this is not invariably a guide since the synovia may become inspissated and crackle under motion. The chief distinguishing feature is the abnormal immobility, though movements are sometimes possible in certain directions, while in fracture there is abnormal mobility in all directions. The diagnosis may be rendered difficult by the presence of tumefaction sufficient to prevent the exact extent of the injury from being ascertained.

Treatment. The sooner a reduction is effected the greater are the chances of repair and restoration of function in the joint. If a luxation is allowed to remain undisturbed for a longer period than two or three weeks a change takes place in the relation of the parts. The head of the displaced bone becomes enveloped in a new capsular ligament formed from the surrounding cellular tissue, and reduction is no longer possible. While the displaced bone gradually adapts itself to its abnormal environment, so that a certain degree of motion becomes possible, lameness invariably remains permanently.

A case of luxation being presented, the first step is to secure the animal, place it in a convenient position and proceed to examine the seat of injury. If much swelling is present, the operation should be postponed until it has subsided. Subsidence of the swelling may be aided by playing a stream of cold water from a hose over the parts, or by applying a refrigerant lotion. Recourse to general anesthetics or preferably chloretone narcosis is of considerable assistance and in some cases absolutely essential in order to overcome muscular spasm. The parts are then manipulated with the aim to restore the normal contiguity of the articular surfaces. Traction is exerted on the member, sufficient to overcome muscular effort, and then either extension, flexion, lateral pressure, or rotatory move-

ments of the joint, according to the direction of dislocation, the movements being made in inverse direction to that in which the lesion has taken place. Reduction being effected, the joint does not, as a rule, tend towards relaxation, excepting in certain cases to be noted hereafter. But the joint should be maintained immobile until the local inflammatory changes have subsided and the parts assumed their normal relationship. For this purpose bandages and splints are utilized. At the expiration of fifteen days the latter may be removed and the joint submitted to massage and passive exercise.

LUXATIONS IN PARTICULAR.

The Temporo-Maxillary Articulation. The most frequent cause of this luxation is excessive opening of the jaws, as may occur at clinical examination, when dogs in worrying oxen attempt to seize them or are kicked by them, when a greyhound seizes a hare in the chase, or even when the animal yawns. The lesion may be unilateral or bilateral and it takes place in a forward and upward direction.

Symptoms and Diagnosis. In unilateral dislocation the symptoms are local paralysis with lateral displacement; in bilateral dislocation there is forward displacement. The facial expression is anxious, the animal salivates freely, howls with pain, and paws at its head. The head is depressed when the lesion is bilateral and inclined to one side when it is unilateral. The interior of the mouth is plainly visible, the back molars are seen to be separated, and inclined to one side in the unilateral form, and the tongue is discolored and protruding. The eyeballs may also protrude owing to pressure by the displaced coronoid processes. This condition has many points of resemblance to paralytic rabies, but anyone conversant with the symptoms of the latter disease need not confound the two. In rabies the jaw can be closed; in dislocation it cannot. The prognosis is good when there is no complication of fracture.

Treatment. Reduction is effected by depressing the angle of the jaw, and entails the exercise of considerable force and patience. An anesthetic is necessary and the animal should be secured on its back with the face flat on the table. The jaw is used as a lever, a fulcrum being formed of a stick from six to twelve inches in length and from one-quarter to one-half an inch thick, with a wrapping of

protective material. This is inserted crosswise between the jaws as far back as possible. An assistant must then bear down on the anterior extremity of the lower jaw, and endeavor to approximate incisors to incisors. The operator at the same time exerts traction on the stick in a forward and upward direction till the condyles are raised to a point where they slip back into the articular fossae. No solid food must be given for several days.

The Vertebral Articulations. Reference has already been made to this luxation in the chapter on Fractures. Complete luxation is rarely seen without being accompanied by fracture. It may be recognized by the unnatural curvature of the neck, and the presence at the site of lesion of a depression on one side and an enlargement on the other. It is necessarily fatal. Partial luxation is occasionally met with.

Symptoms and Diagnosis. When it occurs in the cervical vertebrae the neck is curved with the head turned towards the side from which the displacement has occurred, and the animal promenades in a circle with a staggering gait. On the concave side of the neck there is a depression, and on the convex side an enlargement. If the head is straightened out and let go again it immediately returns to the abnormal position unless by chance the luxation should become reduced by this procedure. If there is any pronounced pressure on the cord convulsions occur, and they are generally more manifest in the muscles on the opposite side of the body.

Treatment. If after three or four days a gradual improvement is noticed in the distorted parts the prognosis may be regarded as favorable, recovery taking place in the course of a month, but should the animal become progressively weak and emaciated, it should be destroyed.

The Scapulo-Humeral Articulation. The capsular ligament enclosing this joint is remarkable for its looseness, wherefore it possesses little power to oppose displacement. As a rule, the head of the humerus is thrust to the anterior or external aspect of the joint, internal or posterior luxation occurring when complicated with fracture. Complete luxation is seldom seen, whereas the partial form accompanied by little if any laceration of the ligament, is not at all uncommon. It is brought about by extreme flexion of the joint or traumatic influences.

Symptoms and Diagnosis. Lameness appears suddenly, the

leg seeming shorter than its fellow. The humerus can be extended and flexed only with the greatest difficulty. The position assumed by the head of the humerus is indicated by an enlargement, a hollow existing at the site of the joint, and the parts are painful. Partial luxations generally get well with treatment, but the prognosis of complete luxation is less favorable. Hertwig had one complete recovery.

Treatment. Reduction is effected by extension of the humerus and pressure over its head in the direction of normal position.

The Humero-Radio-Ulnar Articulation. This luxation may take place either inwardly or outwardly. It may be complete or partial between the humerus on the one hand and the radius and ulna on the other. The head of the radius may also be displaced alone and, as a rule, to the outside. In these cases the annular ligament uniting the heads of the radius and ulna is coincidentally ruptured. Curiously enough, luxation of the head of the radius, and sometimes of both radius and ulna, is often congenital in the Black-and-tan Terrier breed, involving one or both elbows. When it occurs under these circumstances the young are usually born in this condition, but may also acquire it in the first few weeks of life. I have also seen the congenital form in other breeds, and in one instance there was an additional deformity in the shape of a club-foot.

According to Carougeau, humero-radio-ulnar luxation may arise from various traumatic influences, from extreme flexion of the forearm with external displacement and rupture of the internal lateral ligament, or from twisting of the joint with slipping of the coronoid process from the trochlea of the humerus, in which case all the ligaments are ruptured. Luxation of the head of the radius with rupture of the annular ligament connecting this bone with the ulna is chiefly caused by leaping or falling from great heights.

Symptoms and Diagnosis. The symptoms of humero-radio-ulnar luxation are depression on one side of the articulation and enlargement on the opposite with infiltration of the neighboring tissues and muscles. In addition to the change of contour may also be noticed: turning of the foot in the opposite direction to that in which the displacement has taken place, shorter appearance of the leg than its fellow, a limping gait, and expression of pain when the seat of luxation is handled.

In dislocation of the head of the radius, there is a bulging postero-externally, making the region of the articulation look broader than natural. The forearm is flexed with the elbow held immobile, the animal going on three legs. The displaced bone can be plainly felt and if the elbow joint be forcibly extended and flexed a slight resistance is encountered in the parts and the animal exhibits considerable pain. The luxation is reducible and the joint moves freely, but as soon as the animal uses the leg again, it recurs, because the annular ligament, which supports the two bones in place, is ruptured. If the lesion is left to itself, the leg is permanently incapacitated, and is always extremely flexed and carried free of the ground. When both legs are affected, a standing posture is impossible, the animal being forced to sit on its haunches. The prognosis is unfavorable without operative measures, the lacerated annular ligament showing little tendency to heal.

In the congenital form there is absence of inflammatory phenomena and simply deformity which cannot be mistaken.

Treatment. The prognosis of acquired complete dislocation of the joint is good in recent cases when uncomplicated with fracture or extensive rupture of ligaments. It is reduced without much difficulty by extension, flexion, and lateral pressure, but tends to recur rather readily, so that it is imperative to keep the parts for some days in a permanent bandage until repair of the ligaments has taken place. Congenital luxation of the whole joint is seldom amenable to treatment.

The only possible way to treat radial luxation, whether acquired or of congenital origin is by wiring the bones together in the following manner: The animal being hobbled and anesthetized, an incision is made immediately over the annular ligament and the shafts of the two bones freely exposed by blunt dissection. Holes are bored through the radius and ulna, as described under Bone-Suturing, silver wire is passed through the holes, the two bones are brought into normal apposition, the wire twisted, the ends of the latter cut off close, the wound closed, and suitable splints and bandages applied to immobilize the parts, provision being made for free drainage. To prevent suppurative inflammation the operation must be done strictly aseptically. The wire should be removed after five or six weeks. The results of this operation often exceed the expectations of the practitioner, the leg being used with freedom though perfect use of the joint is not attained.

The Radio-Ulnar-Carpal Articulation. Both the radius and ulna may be displaced from their articulations with the upper row of carpal bones, either singly or together. The capsular band uniting the lower extremities of the two bones is ruptured in either case.

Symptoms and Diagnosis. Dislocation of either of these articulations deprives the animal of the use of the leg, and is attended with a change in contour of the parts, a bulging taking place in either an anterior or posterior direction.

Treatment. This lesion is easily reducible but recurs if not remedied by wiring the two bones together.

The Carpal Articulations. Any bone in this joint may become separated from the remainder.

Symptoms and Diagnosis. The symptoms are local stiffness and swelling with pronounced lameness and the joint may be bent either inward or outward.

Treatment. The prognosis is good, recovery taking place in about three or four weeks, when the bones are replaced in the ordinary manner and bandaged.

The Metacarpal Articulations. Luxations of these articulations may occur at either their superior or inferior extremities. A single bone may be displaced.

Symptoms and Diagnosis. In the case of a single bone the symptoms are only slightly in evidence. In complete luxation of the whole row the foot is raised from the ground and held obliquely.

Treatment is the same as already outlined.

The Phalangeal Articulations. The digits are quite commonly put out of joint.

Symptoms and Diagnosis. The animal limps and manifests pain at manipulation. The affected joint is found to be abnormally mobile.

Treatment. Reduction is effected in the usual manner, and the parts immobilized for some days.

The Coxo-Femoral Articulation. Luxation of this joint occurs not at all uncommonly. As a rule, the head of the femur is displaced in a direction immediately above the acetabulum, but may be forced into the foramen ovale. The displacement is more often partial with slight damage to the capsular ligament than complete. If complete, it is accompanied with rupture of both the capsular ligament and the ligamentum teres.

Symptoms and Diagnosis. At first the animal may walk on three legs but later gains imperfect control of the injured member. A swelling is observed over the joint, the trochanter has become prominent, and the leg appears shorter than its fellow. In displacement into the foramen ovale the leg appears longer than its fellow. When the animal walks, the stifle is turned outward and a certain swinging motion is evident. The prognosis is excellent provided reduction is effected soon after the accident. If the luxation is neglected a false joint is formed through development of a new capsular ligament from the surrounding cellular tissue, and the movements become comparatively free, though the leg is dragged somewhat. The longest period intervening between receipt of the injury and treatment in my hands which turned out satisfactorily was two weeks. Stockfleth found a false joint completely formed with a thick flask-shaped capsule two months after the dislocation had occurred, and Peuch failed to effect reduction in a dislocation of one month's standing.

Treatment. The leg must be forcibly extended by traction and abducted, downward pressure being at the same time applied over the trochanter.

The Patella. In the dog, the lateral patellar ligaments are little more than rudimentary, while the middle one is well-developed. Consequently the patella is very liable to become displaced either to the inner or outer aspect of the joint, but as a rule to the inner. The chief factor concerned in the occurrence of this luxation is relaxation of the feebly-developed lateral ligaments, coupled with a feebly developed internal ridge of the patellar groove of the femur, and to complete the lesion it is only necessary for a violent or excessive contraction of the tendon of the quadriceps femoris muscle to take place, particularly in conjunction with inward or outward turning motion of the lower part of the legs as, for instance, when a dog jumps up and through a window. Toy breeds, such as the Black-and-Tan Terrier and Japanese Spaniel suffer most, and it is in these that we find the internal femoral ridge lacking in development. The displaced bone is easily replaced when the whole leg is in an extended position forward but shows a great tendency to revert to the abnormal position upon flexion.

Symptoms and Diagnosis. This luxation is characterized by a peculiar carriage of the affected leg. The latter can no longer

help to support the weight of the body but is raised from the ground and flexed with the stifle adducted, the hock turned outward, and the foot carried inward and sometimes extending past the median line. When both bones are simultaneously displaced, the tarsal joint is extremely flexed and the hind parts assume a crouching attitude, the mode of progression resembling that of a ferret. In some cases locomotion is accomplished by a series of hops or the animal walks altogether on the forelegs and elevates the hind ones.

Treatment. In treating this trouble the object to be aimed at is to rest the entire leg for a period of several days, all the while maintaining the leg in an extended condition in the anterior direction, for it is in this position that the bone falls into its proper channel. The rest then gives the ligaments the opportunity to recuperate and recover their normal tone. The entire leg from the toes upward as far as possible above the stifle must be enclosed in a stiff bandage, preferably of plaster of paris. To show how all-sufficient the rest treatment is may be mentioned the case of one of Stockfleth's patients, that of a restless female which was about to whelp. It was impossible to keep her quiet and the bone in place, but as soon as her offspring arrived she calmed down and lay quietly with them a sufficient length of time for recovery to take place. In another instance he bound the affected leg to the trunk by means of bandages, so that the animal was forced to rest it. Recovery followed in three weeks. In still another case of bilateral luxation in a small animal splints of gutta percha were moulded to both legs extending from above the stifle to the toes, so that the animal which previously had crawled, walked as if on stilts. Some two or three weeks of this support sufficed to effect a cure.

In the cases dependent upon congenital structural defect in the femur the prognosis must always be doubtful for the tendency is towards recurrence.

The Tibio-Tarsal Articulation. Stockfleth has recorded one instance of this luxation. A hunting dog in chasing a cat had its right foot caught in a vice attached to a joist, with the result that the skin, ligaments and flexor tendens were severed, exposing the tibia which was only suspended by the extensors. On account of the hemorrhage the animal was destroyed.

The Caudal Articulations. Slight luxations sometimes occur in animals possessed of slender tails, as for instance, in the Greyhound.

Treatment. Reduction being effected, as light a bandage as possible is to be applied, similar to that used when this extremity suffers fracture.

SYNOVITIS.

By synovitis is meant inflammation of the synovial membrane alone. When other structures of the joint are involved, the term arthritis is employed. It may be acute or chronic. In the acute form the synovial membrane becomes red, congested and swollen, and at first stops secreting but later pours out an excess of turbid fluid; in the chronic it undergoes thickening. Either form is caused by some slight injury such as a sprain, contusion twist, or overuse. The articulations most commonly affected are the carpal, coxo-femoral, femoro-tibial, and digital.

Symptoms and Diagnosis. In acute synovitis the leg is held in any position giving the greatest ease, and any movement of the joint gives rise to lameness. Examination shows the joint to be hot and fluctuating and painful to pressure. In chronic synovitis lameness only becomes evident after use of the joint, but the sac fluctuates.

Treatment. Treatment comprises rest, immobilization of the joint with bandages, cold applications, and later painting with iodine. When the effusion is great, the sac should be aspirated with antiseptic precautions.

ANTHRITIS.

This term is applied to general inflammation of all the structures composing and surrounding a joint. It may occur as a local manifestation of rheumatism when it is of infectious origin though unaccompanied by suppuration, it may develop as a simple inflammatory disturbance consequent upon local sprains, luxations, etc., or it may result from pyogenic processes, the germs entering either by a wound, through extension of periarticular suppuration or osteomyelitis, or in a pyemic embolus as may occur in cases of omphalo-phlebitis of the newly-born.

Rheumatic arthritis may be acute or chronic. The former runs a rapid course, the symptoms appearing within twenty-four to forty-eight hours. The commonest seats of this form of the dis-

ease are the knee, stifle, feet, and hip joints. The affection is ambulatory in nature and tends readily to recur. Serous membranes are frequently involved, notably the pleura, pericardium, endocardium, and meninges. The chronic form commonly succeeds the acute, though it frequently occurs as such from the start, the femoro-tibial and carpal articulations being common seats. In this form there is thickening of the capsule with formation of peri-articular adhesions and sometimes osseous vegetations.

Purulent arthritis may also be acute or chronic. When acute, pyogenic microorganisms figure as the causative factor, and when chronic, tubercular bacilli. In the acute form, a free purulent secretion is characteristic, and when of pyemic origin, several joints may be affected. The disease pursues the same course as in the case of infected wounds of joints, the joint tending to rapid disorganization. The capsule gives way and discharges externally. Should the inflammation subside, interarticular granulations spring up, and these undergoing ossification, ankylosis results. In pyemic arthritis of the new-born following omphalo-phlebitis, the foci ordinarily develop in the shoulder, elbow, knee, hip, and stifle joints, and often undergo spontaneous recovery. In the chronic tubercular form, the internal face of the sac is covered with vegetations, the synovia is slightly purulent and reddish in color, the bacilli are found present, and there are invariably tubercular lesions elsewhere. This form of the disease is very rare. A case has been recorded by Cadiot.

Symptoms and Diagnosis. The symptoms of acute rheumatic arthritis are intense pain on the least movement as manifested by extreme lameness, marked local heat, constitutional disturbance, affection of one or more joints simultaneously, and very frequently, shifting of the disease from one joint to another. In chronic rheumatic arthritis, the affected joints are stiff and painful, the symptoms are aggravated by cold and dampness, and several joints may be involved. In simple arthritis of other than rheumatic origin, there is distension of the synovial sac, the movements of the joint are suppressed, and the member may be unable to bear the weight of the body. When chronic, there is little pain but hydrarthrosis.

The symptoms of purulent arthritis are similar to those that follow infected wounds of joints. There are fever and rapid pulse.

The joint is swollen, extremely sensitive, and fluctuates in places. Finally, the pus discharges by one or several fistulous tracts.

Treatment. In acute rheumatic arthritis the internal administration of alkalis and salicylates is indicated. Pending recovery absolute rest should be enjoined. The long-standing chronic form of the disease is incurable, but the symptoms can be somewhat mitigated by tonic treatment. Massage is also helpful. Excessive synovial effusions which do not tend to be resorbed may be aspirated with antiseptic care. Purulent accumulations must be promptly removed, the procedure comprising free incision in two or more situations, antiseptic irrigation with corrosive sublimate solution (1:1000) morning and evening, drainage, antiseptic dressing and immobilization.

Osteo-Arthritis. Arthritis Deformans. Differing from chronic rheumatic arthritis in extensive alteration in the joint structures, osteo-arthritis is a disease more commonly observed in members of the larger breeds particularly those which have been used for draught purposes. The pathologic changes are disposed to be symmetric and consist in destruction of the articular cartilages and increase in length and thickness of the periphery of the bone by ossific deposit. In advanced cases the tendons about the joints ossify. The cause is obscure but the disease is probably due to some form of malnutrition of nervous origin. The articulations usually affected are those of the knee, elbow, and stifle.

Symptoms and Diagnosis. Osteo-arthritis has a very slow evolution. As the deformity of the joints develops, lameness, rigidity, and articular crepitus appear.

Treatment. The disease being incurable, no treatment is of any avail, but the general health may be maintained by tonics.

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CHAPTER XIII

Neoplasms

This chapter is devoted to a description of the forms of Neoplasms that I have been able to find recorded as occurring in the Dog. Certain forms, known to occur in other animals and in man, are purposely omitted, because I have not succeeded in finding reliable data concerning their appearance in the Dog.

Surgical Neoplasms comprise about five per cent of all diseases the practitioner is called upon to treat (Froehner). In other words, in every twenty dogs treated, one is afflicted with some form of growth.

We may conveniently divide conditions of Neoplasia into four great groups:

- | | | | | |
|-----------------|---|---|---|--|
| (1) | } | In which there is excessive growth of a tissue in its normal position, the enlargement being due to | } | An increase in the size of the individual cells. |
| (a) Hypertrophy | | | | An increase in the number of cells. |
| (b) Hyperplasia | | | | |

(2) Inflammatory Neoplasms:

- (a) Simple Granulomata—Tumors formed of excessive granulation tissue.
- (b) Infective Granulomata—Tumors produced by inflammatory reaction in consequence of specific microorganisms.
- (c) Strictures—In which there is diffuse overgrowth of connective tissue producing structural changes in the walls of canals.

(3) Tumors Proper:

- (a) Simple Tumors—Tumors formed of tissues and cells of the individual, the type of which predominates, and which have taken on a functionless and excessive growth, and in which the power of growth is indefinite.

- (4) Cysts—Abnormal encapsulated collections of fluid.
- (b) Compound Tumors—Tumors formed of several tissues.

(1) **Hypertrophy and Hyperplasia**

(a) **Hypertrophy** is commonly seen in organs which have sustained an increase in functional activity. Thus, we see a simple "accommodative" hypertrophy of the Uterus during pregnancy with increase of size in the individual cells. The Cervix Uteri is also occasionally the seat of hypertrophy. Hypertrophy of the muscularis of the Bladder is sometimes seen when that organ contains calculi of large size. Johnes saw an increase two or three times above normal. A similar condition is seen in the wall of the Intestine on the proximal side of a constriction or chronic obstruction. When one of bilateral organs takes on the function of its fellow, it enlarges, and the condition is spoken of as "compensatory" hypertrophy. Thus, when one Kidney becomes hydronephrotic or is extirpated, or the renal artery is ligated, the opposite kidney enlarges. Gibson found the Mesenteric Glands distinctly enlarged in an animal that had undergone splenectomy six months previously. Hypertrophy of the Muscularis of the Heart is seen in varying degrees according to age, breed, sex, etc., in certain diseases, and particularly the character of the exercise indulged in. Strictly speaking, that which is termed hypertrophy of the Heart is both hypertrophy and hyperplasia. The hearts of hunting dogs are always relatively large. In old dogs a general increase in the amount of all the component tissues leads to hypertrophy of the Prostate Gland. The immediate cause of these cases of enlarged prostate is not known. Some have suggested increased vascular supply, but this is inadequate. Leisering described hypertrophy of the Sebaceous Glands situated on the posterior aspect of the fore-leg. According to Kitt, the Intestinal Villi may become hypertrophied to a size four times above normal through the irritation produced by the burrowing of tape-worms.

(b) **Hyperplasia.** As will be mentioned under Fibromata, no sharp distinction can be made between this condition and fibrosis. Irritation will lead to proliferation of connective tissue. A familiar example is seen in the Skin at points exposed to friction or pressure. Enlargements of the Thyroid Gland depending upon in-

creased development of the parenchymatous tissue are commonly associated with proliferation of the connective tissue stroma. Other hyperplasias develop without adequate discoverable cause, particularly in the Viscera, of which cirrhosis of the Liver is an example. Hyperplasia of visceral canals will be referred to again under Strictures.

(2) Inflammatory Neoplasms

(a) **Simple Granulomata.** A simple granuloma is a neoplasm which does not advance beyond the stage of granulation tissue and generally results from a wound. Wherever there is redundant granulation tissue it is probable that the excessive growth arises as a result of bacterial irritation. A granuloma involving the entire Cornea was witnessed by Beierle.

(b) **Infective Granulomata.** Included under this heading are the tumor-like formations produced by the agency of microorganisms. They are distinct from the simple granulomata in that they are produced as a rule not merely upon the surface, but throughout the various tissues. In some cases they are easily to be confounded macroscopically with true tumors. This is particularly the case with Visceral tubercular lesions which often assume a carcinomatous or sarcomatous appearance. At one time Pleural neoplasms were regarded as cancerous in nature, but the researches of Cadiot have shown the commonest form of growth in this locality to be of tubercular origin. Among seven thousand dogs examined at the Alfort School two hundred and fifty were found to be tuberculous. In twenty-seven of these animals, twenty-one showed the Lungs to be affected, fourteen the Pleura, fourteen the Bronchial and Mediastinal Glands, three the Pericardium, one the Heart, thirteen the Liver, twelve the Kidneys, six the Peritoneum and Omentum, four the Spleen, and two the Intestinal Wall. Tubercles were also found in the Testes, Bladder, and Ureter. The mode of infection is believed to be by ingestion of sputum of phthysical persons or inhalation of finely attenuated bacilli-bearing sputum or dust. Of the twenty-seven dogs six belonged to restaurateurs, in whose establishments it is not a rare thing to find infectious sputum, and where sweeping distributes the virulent dust in the lower strata of the atmosphere. The above statistics agree well with others recorded by Jenson who found the organs affected

as follows in a total of twenty-eight animals: Lungs nineteen, Kidneys twelve, Spleen two, and Pericardium two. Cramer once saw the Ovaries involved, and Mueller witnessed tubercular ulceration of the Skin. Tubercles vary in size from a pin-head to a pea, and when confluent may be of irregular dimensions. In color, they are usually grey or white, and in consistence, rather solid on serous membranes. They are productive of effusions.

Actinomycotic growths are occasionally witnessed in the dog. Torrance destroyed a pointer suffering from ascites, and at the necropsy found a large, solid, actinomycotic mass occupying the region between the heart and the diaphragm, and involving the posterior part of the Right Lung, part of the Pericardial Sac, and the Diaphragm. Gohn treated a case following a bite over the Tibia with secondary infection of the Mouth. The disease is also referred to by Cadiot & Almy and Friedberger & Froehner, while Murphy cites an instance in a woman whose dog had died with a large swelling under the Jaw. Rabé observed a microorganism resembling the actinomyces which he obtained from an animal suffering from multiple abscesses.

Under this heading I include conditionally the tumor-like formations which occur in the Genital Mucosa of both sexes. There is considerable diversity of opinion as to the histologic identity of these growths. Smith & Washbourn, in England, who have experimented considerably with this disease, recognize it as sarcoma. But it must be remembered that it is by no means an easy matter to distinguish between granulomatous cells and those of true sarcomatous nature. Both arise from connective tissue elements, the process of development in either stopping short of cicatricial transformation. It was Virchow who originally employed the term Infective Granuloma to emphasize the points of resemblance between such cellular growths and true forms of tumor. The growths in question have been variously described as papilloma by French authorities, as condyloma by Bruckmueller, as carcinoma by Wehr, Froehner, and other German authorities. Wehr inoculated minute portions of these growths in the subcutaneous tissue of healthy dogs with positive result in a number of cases. But with one exception, the growths after attaining the size of a hazel-nut became absorbed completely. In the exceptional case, secondary nodules developed in the internal lymphatics and spleen and caused the death of the animal by inhibiting the urinary outflow which led to

rupture of the bladder. In Smith & Washbourn's investigations one male was mated with twelve females, eleven of which became affected. A second male contracted the disease from the females and conveyed it to one of the two females with which it was mated. In the vaginal wall the growth resembled a raspberry, and gradually increased in size and extent until the whole passage was involved. It was situated most commonly in the neighborhood of the urethral orifice, but in some cases projected from the vulva. Sometimes the tumors were large enough to block up the vagina. Older animals suffered more particularly, and very old ones were severely affected. In the penis the growth was circumscribed, one about a quarter of an inch in width. The mass was lobulated, slightly constricted at the base, of a pinkish or purple color, and of a consistence varying between soft and firm, but never hard. On section, the surface was whitish and moderately firm. In one instance there was a secondary growth in the inguinal glands. Smith and Washbourn inoculated portions of the tumors into the subcutaneous tissue of dogs. In four, the experiment was unsuccessful, but tumors developed in the remaining thirteen. The following conclusions were reached: These tumors can be transplanted from the genitals, where they generally occur, to the subcutaneous tissue of other dogs. They can be transplanted from subcutaneous to subcutaneous tissue in other dogs. After reaching a maximum of growth they may disappear spontaneously with or without ulceration. They may continue to increase and cause death by secondary deposits forming in the viscera. If the tumor disappears, the animal is subsequently immune. Some animals are naturally refractory.

(c) **Organic Strictures.** These are lesions of slow development and may not become obstructive for a lengthened period. Their origin in some cases is obscure, but they are generally regarded as resulting from a true inflammatory process having its seat in the mucosa or submucosa. Stricture is occasionally seen in the Intestinal Canal, particularly in the Duodenal Region, as a circumscribed hyperplasia. Generally, the walls are greatly thickened at the point of lesion, the mucosa remaining intact. Hobday has seen strictures in the Colon. The lesion has also been known to follow the separation of a gangrenous intussusceptum and the coalescence of the resected bowel after end-to-end anastomosis. Stricture of the Urethra sometimes follows cicatrization of surgical

wounds or the irritation induced by the passage of calculi. Koch refers to stricture of the Vagina, and Siedamgrotzky and Almy have seen stricture of the Ureter.

(3) Tumors Proper

The effect of tumors on the organism is variable, but they all have their being at its expense, performing no physiologic function and contributing nothing to its support, and are therefore truly parasitic.

Malignant growths have for their chief characteristics: invasion of all the textures of the part in which they develop, rapidity of growth, profound influence on the general health from the first, tendency to recurrence after apparent extirpation, which means a continued growth of left-over particles, and metastasis to other and distant organs through the medium of the circulation or by the lymphatic channels. They commonly ulcerate. On the other hand, **Innocent** growths are generally well encapsulated, and do not infiltrate the surrounding structures, they grow slowly and with few exceptions disturb the general health but little, they do not return if completely removed, and do not produce secondary growths in other parts of the body. While innocent tumors rarely undergo a true process of ulceration, yet they are very frequently rendered raw and sore by constant licking on the part of the animal, or by abrasion through contact with the ground. They are sometimes dangerous by reason of pressure they may exert on vital structures. For instance, simple enlargements of the prostate gland are frequently provocative of urinary troubles, and mediastinal neoplasms, whether malignant or innocent, tend to give rise to nervous, cardiac, respiratory, vascular, and digestive troubles. In the anterior mediastinum are found two groups of lymphatic glands—the bronchial, situated in the angle of bifurcation of the trachea, around the origin of the bronchi, adjacent to which they extend for a short distance into the pulmonary tissue,—and two trains of lobules extend along the inferior face of the trachea from the base of the heart to the first rib. Intimately related with these groups are the anterior aorta and vena cava, cardiac, recurrent, and diaphragmatic nerves, inferior cervical ganglia of the great sympathetic, base of the heart, and vena azygos. Inflammatory tumors, such

as tubercles, and tumors proper, and even simple adenitis following Distemper, may encompass or compress the intramediastinal vasculo-nervous organs, the trachea, and the esophagus, giving rise to manifestations of impairment of cardiac and respiratory functions. It is not uncommon to observe a violently convulsive, dry cough, without the usual concomitant symptoms of bronchitis or pneumonia proceeding from compression of the pneumogastric, a condition to which the name of whooping-cough has been given. Paralysis of the nerve finally develops and results in accelerated cardiac action of such violence as to be perceptible at considerable distance from the animal.

(1) SIMPLE TUMORS.

Connective Tissue Tumors

(a) *Approximating to fully formed tissue:*

Fibromata.
Chondromata.
Osteomata.
Lipomata.
Myomata.
Hemangiomata.
Neuromata.

(b) *Formed of immature tissue:*

Myxomata.
Sarcomata.

Epithelial and Glandular Tumors

(a) *Approximating to fully formed tissue:*

Adenomata.
Papillomata.

(b) *Formed of immature tissue:*

Carcinomata.

(2) COMPOUND TUMORS

Formed of several tissues:

Teratomata.

(1) SIMPLE TUMORS.

(a) **Connective Tissue Tumors Approximating to Fully Formed Tissue.**

Fibromata. A fibroma is an innocent growth composed of completely developed fibrous tissue grouped in irregularly arranged bundles. With other tissue elements the fibromata commonly form mixed tumors, such as fibro-myoma, or fibro-lipoma. They are closely related to the hyperplasias of connective tissue resulting from chronic irritation, and in some cases can hardly be differentiated. For instance, the diffuse form of chronic interstitial mastitis characterized by the proliferation and projection of connective tissue might be equally well classified as a hyperplasia. Froehner regards the fibromata as standing second to the carcinomata in frequency of occurrence, placing their percentage at thirteen.

They exist generally singly, but are often found in numbers. They are commonly hard, but may be soft when situated in the looser textures, and are of variable size and shape. In contrast with the malignant tumors they are generally smaller, the average size being that of a walnut; their growth is very slow, and they remain quiescent for years. In further contrast with carcinomata they are seen in quite young animals (from one to two years or younger). Characteristic are their sharp demarcation from surrounding textures, regularly firm consistence, intact surface, and paucity of vascularity. They are sometimes rendered sore, however, by licking and gnawing. In shape they resemble a pea or a nipple, and are occasionally pedunculate.

Fibromata occur most frequently in the Dermis and Subcuticular connective tissue and exhibit a predilection for the Breast, Extremities, Eyelids, Back, Tail, the Mammae, and Submucous Tissue particularly of the Vagina and Uterus (Petit, Leisering, Watson, Penberthy, Leblanc, Romani). Rigal saw a large fibroma attached to the Gastro-colic Omentum.

Chondromata. Cartilaginous growths may be innocent or malignant. Innocent chondromata are frequently of mixed type, such as osteochondroma. Very often the chondromata are associated with sarcomatous elements when they are more or less malignant. Chondromata may also be malignant to the extent of forming metastases without the secondary nodules being histologically true sarcoma. The following recorded cases will serve as examples: Virchow described a large ossifying chondroma of the mamma, and a large tumor with a cystic interior in the omentum. On the lungs there were numerous small nodules, most of which

were on the pleura. Histologically, these nodules were found to be composed of fibro-hyaline cartilage which had commenced to calcify in the center. Ramifications extended from some of the nodules into the lymphatics, and these had commenced to chondrify in the center, but at the periphery there were collected groups of cells without intercellular substance. Nocard removed an osteo-chondroma from the left inguinal mamma. A year later an analogous tumor had developed in the anterior left pectoral mamma, which was also extirpated. In seven or eight months' time an incessant dry, harsh cough appeared without symptoms of bronchitis but with violent and rapid cardiac action. The animal was destroyed. At the necropsy were found: small osteo-chondromata in the kidneys, and a multitude of similar tumors in the parenchyma of the lungs. The right pneumogastric and cardiac nerves were compressed and atrophied. Generali saw a mammary chondroma form secondary growths in the lungs and kidneys, and one on the pons Varolii. Cadéac saw an ossifying chondroma in the neck, the size of a fist. It resembled abscess, which is often seen in this region. It was blistered, but continued to enlarge until respiration became impeded. Death followed in a few days. Post mortem examination showed a voluminous tumor compressing the trachea and esophagus. It was formed of a number of small nodules, some of which were hard and some soft. On the mucosa of the larynx were small miliary tumors, and on the mucosa of the trachea, and in the lungs were other nodules. Boutelle worked out the pathology of one of these tumors. An encapsulated, slightly lobulated calcifying chondroma of the mamma was removed surgically in February, 1892. In August, 1894, the subject was destroyed suffering from abdominal tumor. The latter was found enclosed between layers of peritoneum and attached to the stomach, omentum, and spleen. A small portion of detached hepatic tissue was also adherent to it. There were other secondary growths in the lungs, pancreas, and axillary and mesenteric glands. The case also presented another interesting feature. At the site of operation in the mamma a sinus had developed, and from this had arisen a small growth which was histologically a carcinoma. Following is the explanation of the process by which these tumors develop. In the growth of chondromata the new cartil-

age cells do not develop from pre-existing *cartilage* cells, but from what may be termed "mother cells" of cartilage. At the edge of a growing chondroma there are cells of an embryonic type, looking like ordinary connective tissue cells, and it is these cells which proliferate, and their "daughter cells" develop a matrix around them and become cartilage cells. So that such a chondroma grows by the continuous accretion of new tissue at the periphery. The cartilage cell as such is so surrounded by the matrix, that manifestly it cannot form metastases, but these proliferative or "mother cells" can easily be carried by the blood stream to the various parts of the body, and coming to rest in suitable relationships will then proliferate and the resulting cells become true cartilage cells. It is in these primary cartilaginous tumors that there occurs later on the osteoid or truly osseous change.

Mixed chondromata have been found in the Lungs (Cadéac), the Thyroid (Siedamgrotzky, Kitt), the Tympanic Cavity (Siedamgrotzky), the Cardiac Valves (Hamburger), in the Nasal Cavity (Kitt), on the Digits, and they are very common in the Mammary Gland. Of two hundred and fifty-six tumors of the mammae removed at the Alfort School between October 1871 and December 1876, two hundred and eleven were osteo-chondromata.

Osteomata. These, the bony tumors, are not very common. They are occasionally found on the Inferior Maxilla, the Penial Bone, and on the Internal Face of the Cranium, particularly in dogs suffering from ossifying pachymeningitis (Siedamgrotzky, Cadéac). They have also been seen attached to the transverse process of a Cervical Vertebra (Mueller), the Connective Tissue of the Neck (Leisering), and on the Pulmonary Pleura (Vulpian).

Lipomata. Pure fat tumors are rare compared to other tumors. They are more liable to show other forms of connective tissue, such as fibro-lipoma, lipo-myxoma. They occur most commonly as fibro-lipoma, and often attain enormous dimensions. They are characterized by their subcutaneous situation, soft, lardaceous texture, sharp demarcation, slow growth, and slight vascularity. They are generally lobulated, due to septa of connective tissue. In size, they may vary from a small nut to the human head. They are the largest of all tumors. They are sometimes pendulous, and not always round, but large and cylindrical. Froehner saw one ten inches in length. Huidekoper saw one growing from the in-

side of the thigh which nearly touched the ground. They are observed mostly in well-nourished animals, and their favorite location is on the Extremities, the inner surface of the Thigh, the Breast, the Shoulder, the Belly, the Anal region, the Vagina (Oreste, Falconio). They also occur in the Medulla of the Kidney (Bruckmueller), the Liver (Trasbot), the Trachea, Pleura, and Lungs (Kitt, Semmer), and the Intestinal Submucosa. Two tumors attached to the Uterus, one of which had grown through the muscular wall of the abdomen, were seen and described by Edgar as lipomata. It is doubtful if they could have been true lipomata, because a feature of lipomatous tumors is that they do not tend to grow *through* surrounding tissues.

Myomata. A myoma is a tumor composed of unstripped muscle fibers (leiomyoma) containing as a rule a considerable proportion of fibrous tissue. It is of fleshy consistence, pinkish in color, quite vascular, and may attain the size of the human fist. They are seldom seen, but have occurred in the Heart (Jungers), in the Bladder (Liénaux), within the Vagina (Mueller), and in the Prostate. They are occasionally found in the Genital Tract of females, but are extremely rare in the bicornate uterus. Fibromata of the uterus are often in part myomatous, and Sutton has suggested that many tumors described as fibroids are in the first instance leiomyomata, but become degraded into fibrous tissue.

Hemangiomata. A hemangioma is a tumor composed largely of blood vessels. Some authors include in the term localized dilations of blood vessels, such as hemorrhoids and the scrotal varicosities seen by Moeller, but these are not true angiomas of proliferation. Virchow states that angiomas are comparatively rare in animals. A lobulated angioma composed of groups of vessels held together in a stroma of connective tissue and situated in the Subcutis of the Right Groin was observed by Siedamgrotzky. The term Cavernous angioma is used to indicate enlarged spaces lined with endothelium, forming an erectile tissue, such as exists normally in the corpus spongiosum. They occur in the Liver, and while quite common in the cat are not often met with in the dog. Sutton has observed them as multiple enlargements, the size of walnuts, occupying the liver substance and forming prominences on its exterior. There is a very good specimen of this condition in the Army Medical Museum at Washington. Lucet saw a cavernous

angioma on the Left Shoulder. The term Plexiform angioma, "Aneurism by Anastomosis," is used to describe a condition where vessels become dilated and convoluted and their walls thickened at the spot. These by pressing on the intervening tissue cause it to atrophy. This condition, properly speaking, is not one of neoplasia, but a pathologic alteration of the vessels. It has been seen in the Pectoral Mammæ, in the Inferior Eyelids, and on the Prepuce (Rigot). Crisp and Stibel also refer to this condition, the former having possessed a good specimen.

Neuromata. This term is commonly applied to any tumor arising from nerve tissue, such as overgrowths of the perineurium and connective tissue of the nerve sheaths, but is properly only employed in describing growths of nerve fibers with the complete nerve cell undergoing proliferation. They are exceedingly rare, but occasionally appear in the form of bulbs, composed of newly-formed nerve fibers on the ends of severed nerves, and according to Sutton, particularly when the proximal end is irritated by the presence of a silk ligature.

(b) Connective Tissue Tumors Formed of Immature Tissue.

Myxomata. These tumors are composed of connective tissue cells and an intercellular substance containing mucoid material, the whole being traversed by thin-walled vessels and forming a spongy structure. The more fully developed connective tissue tumors (fibromata, lipomata, chondromata, etc.,) sometimes show areas of myxomatous growth. Myxomata are fairly common, and may attain considerable size. One as large as the human head was seen by Scoffié. A typical myxoma is soft and flabby, with a limiting capsule, and either projects from a surface or hangs by a narrow pedicle in the form of a polyp. Common situations are the submucous and Subcutaneous structures. They occur in the Pharynx (Moeller), the Membrana Nictitans (Huidekoper), the Bladder (Van Tright, Johne), the Penis (Koch), the Mammary Gland (McFadyean), and the Vagina.

Sarcomata. By the term sarcoma is meant a tumor composed of any variety of cell of connective tissue origin, which cells before reaching maturity proliferate and divide, so that the whole growth is composed of incompletely developed cells, like those of embryonal

connective tissue. Ordinary healthy connective tissue is formed from cells which have undergone a process of transition from cellular to fibrous condition. In sarcomatous tissue, these cells show a tendency to continuous proliferation instead of the formation of fibrous trabeculae. Consequently, the consistence of sarcomata is usually soft, but they may be mixed with more or less fibrous tissue, when they are hard. They are often enclosed by a capsule, but frequently infiltrate neighboring tissues. They are very prone to undergo partial or complete mucoid changes. The partially degenerate form is described as "sarcoma myxomatodes." Instances have been recorded by Creighton.

The Sarcomata occur with less frequency than the carcinomata, Froehner placing their percentage at six or seven, but they are equally variable in appearance. A mixed form is rather common, such as fibro-, chondro-, osteo-, lympho-, myo-, and myxosarcomata. In their gross appearance the sarcomata often manifest a close resemblance to the carcinomata. They are remarkable for their development in young as well as adult dogs, for their rapidity of growth (some, however, grow slowly), their soft consistence (some are also hard), their partiality for periosteal surfaces, their inclination to metastasis, and their tendency to ulceration when located in the skin and mucous membranes. Metastatic dissemination is mostly by the veins and particles becoming detached to be carried along as emboli. By reason of this it is a common thing to find secondary sarcoma in the lung or even right heart, and where the portal vein is invaded, the liver. The tendency to ulceration is probably dependent on the incompatibility of nutrition with rapidity of growth.

Primary Sarcoma exhibits a predilection for the Frontal Region, the Superior Maxilla, the Sternum, Bones of the Extremities, the Skin, the Muscles, and the Mammary gland. Other organs sometimes invaded are the Nasal Bones (Kitt), the Testes (Siedamgrotzky), the Vagina, the Uterus (Moeller), the Heart (Cadiot, Bournay, Kitt, Johne), the Thyroids (Cadiot), the Lungs and Pleura (Cadéac, Kitt, Leisering), the Stomach (Benoit, Mégnin), the Intestine (Petit), the Omentum (Siedamgrotzky), and the Peritoneum (Bournay). The cases of round-cell sarcoma of the Penis and Vagina described by Smith & Washbourn are of very great interest, but there is some doubt as to whether they were dealing with ex-

cessive granulosomatous formation or true sarcoma. This form of growth is referred to under Infective Granulomata. True sarcoma of the Vagina does, however, sometimes occur, for myxomatous growths have been observed to undergo sarcomatous transformation.

The disease occasionally occurs as a general sarcomatous formation (Mégnin, Froehner). A variety known as myelogenic sarcoma is sometimes seen attacking the interior of Bone Cavities, principally of the fore-arm and the shoulder. The distinguishing feature between myelogenic sarcoma and periosteal sarcoma is that the former is an excessive development of the bone marrow and the latter of the periosteum, so that the cells forming the two are of a different type.

Lympho-Sarcoma is the term used to denote primary sarcoma of lymphatic structures. The lympho-sarcomata are composed of the same kind of cells, but have a stroma of reticulated lymphadenoid tissue. They are not to be confounded with lymphadenoma nor with specific inflammatory enlargements involving lymphatic structures. The dividing line between lympho-sarcoma and lymphadenoma is absolutely vague, as again between lymphadenoma (Hodgkin's disease) and leukemic lymphadenoma (lymphatic leukemia.) Where the growth remains within the capsule of the lymphatic glands then the term lymphadenoma or "Hodgkin's disease" may be applied. Where accompanying such glandular overgrowth there is increase in the lymphocytes in the blood, the condition is one of leukemic lymphadenoma or lymphatic leukemia; where the excessive growth of the lymphatic tissue goes on to infiltration and metastases, it is lympho-sarcoma. The lympho-sarcomata are the most malignant of all the sarcomata, and are very infiltrating. On account of their rapidity of growth and profound effect on the general health it has been suggested that they are the product of some very active species of microparasite. Their consistence varies from soft to moderately firm with occasional calcareous deposits, and the color on section is pinkish or reddish, and they sometimes undergo cystic transformation, containing a reddish viscous, inodorous liquid. The lymphatics of the Neck and Pubic region are most commonly affected, but any or all the glands of the body may be involved. These growths are extremely metastatic.

Melano-Sarcomata or Melanomata are characterized by deposition of a blackish pigment, both in the cells and intercellular substance. While common in the horse, they are rare in the dog. They arise especially from regions where there are already pigment-containing cells, notably from pigmented moles. They are extremely malignant, and secondary deposits are often found at considerable distances. They have been found in the Lips and Mouth, whence they have traveled to the Lungs, appearing there in the form of black interlacing lines (Lafosse, Bruckmueller). This condition must not be confounded with the more common one of coal-dust deposits (anthracosis pulmonum). Melanoma has also been seen at the Base of the Brain in the form of little nodosities (Bruckmueller). According to Leblanc, mixed melanotic growths are not uncommon. There is a very good specimen of melanotic sarcoma of the Pectoral Mammae in the Army Medical Museum at Washington. Sutton refers to a variety of melanosarcoma which seem to become mainly a source of pigment, which may enter the circulation and be discharged in the urine as melanin. Such a tumor was observed by Bunker. It was situated Subcutaneously and discharged an offensive black matter through several openings. Another tumor composed of fungoid growth mixed with melanotic matter was removed from the Breast by Crisp, and the animal succumbed twelve months later to the same disease in the Lungs.

Glio-Sarcomata. A glio-sarcoma is a tumor containing neuroglia-cells mixed with sarcomatous elements, occurring in the central mass of the brain or spinal cord. With regard to gliomata and glio-sarcomata a difficulty presents itself in dividing tumors according to their embryology. The ordinary sarcoma is derived from ordinary mesoblastic connective tissue. The glioma which closely resembles it in structure is derived from the neuroglia, the connective tissue of the brain and retina, but this connective tissue, like the nerves themselves, is of epiblastic origin. A tumor of this nature, situated in the neighborhood of the Gasserian Ganglion was observed by Gratia.

Endothelial Sarcoma or Cholesteatoma is a term applied to a proliferation of endothelial cells aggregated into nodules of a peculiar glistening pearl-like appearance. They originate from serous membranes, lymphatics, blood vessels, and from the pleural and cerebral membranes, and also occasionally in glandular organs.

They are highly vascular, but run a slowly malignant course. They are extremely rare. They have been seen the size of a pea occurring on the Choroid Plexus and in the Lateral Ventricles (Cadéac, Dexler), and the size of a nut occurring in the Parotid region in two different animals (Liénaux).

(a) Epithelial and Glandular Tumors Approximating to Fully Formed Tissue.

Adenomata. An adenoma is an innocent growth originating from pre-existing glandular tissue and formed by proliferated gland cells arranged in an orderly manner, and supported by a fibrous stroma. But these cells differ from normal ones in that they have no power of producing the normal secretion peculiar to the gland tissue from which they grow. That is to say, if any secretion at all is produced, it is a modified one, and the gland has no means of discharging it externally by proper ducts. There are adenomas of the liver which clearly show bile pigmentation, and thyroid adenomas may lead sometimes to exophthalmic goiter brought about by excessive production of excretion, which often disappears upon removal of the tumors. Tumors of this class show no tendency to infiltration of neighboring lymphatics, but under certain conditions are capable of developing malignant characters. (See Carcinomata).

The adenomata are often of mixed type, such as fibro-adenomata, myxo-adenomata. Common seats are the Mammary Glands (Sutton), the Peri-anal Glands, the Prostate Gland, and the Sebaceous and Sudoriparous Glands of the Trunk and Extremities (Liénaux, Leisering, Siedamgrotzky). Other organs in which this form of tumor has been observed are: Harder's Glands (Froehner), the Liver (Hobday), the Ovary (Sutton), the Vagina (Camardi), the Lungs (Stockman), the Thyroid (Woelfler), and the Cerebrum (Penberthy).

Lymphadenoma. This term is used to denote a form of neoplasm affecting lymphatic tissues and having the structure of lymphadenoid tissue. It occurs as a purely innocent local affection, a common seat of which is the spleen, and also as a more or less malignant disease. The difference between the latter and splenic leukemia and lympho-sarcoma has already been pointed out under

Sarcomata. The malignant form of growth may or may not be associated with the condition known as splenic leukemia in which there is also an augmentation of splenic pulp and an actual increase in the number of leucocytes in the blood. There is no tendency to extension of the disease process beyond the capsule of the glands, the latter retaining their shape, so that the condition might be referred to as one of malignant hyperplasia. Single or several groups of glands may be involved. The growths are soft or hard, according to the amount of connective tissue present. They are dangerous in that they may exercise destructive compression of vital organs, particularly intrathoracic ones, and the disease is eventually fatal through production of cachexia and exhaustion.

Papillomata. A papilloma is a benign tumor arising from a surface and having a framework of fibrous stroma and bloodvessels with a covering of squamous epithelial projections or proliferations. In common parlance it is termed a wart. According to Froehner, the papillomata form ten per cent of all tumors. They occur chiefly in young animals, and like other benign tumors, often in multiples, and seem to arise in a spontaneous manner through causes which are not understood. They also disappear with equal spontaneity. Two forms are recognized, the hard growing on the Skin, and the soft growing generally on Mucous Membranes. They are frequently seen at the junction of mucous membrane with the skin. The hard form exists as smooth hemispheric elevations, and the soft as dendritic growths, *i. e.*, arborescent masses growing from a common base, or as cauliflower-like pedunculate growths. They are always sharply defined from the neighboring parts. In general, they are not very large, varying in size between a pea and a walnut. In the skin they appear commonly on the Head, Back, and Prepuce, and on the Extremities, particularly round the Pads of the Feet, but may occur in any part of the body. Skin warts are frequently the seat of melanotic deposits—the so-called pigmented moles. In old animals there is good reason to believe that they may become the starting point of true malignant epithelial ingrowths, and it is noteworthy that they grow in places commonly the seat of epithelioma. Sometimes the epithelial layers decompose and ulcerate, especially when irritated, by which they undergo dessication, and fresh material being continually added to the base, a Wart-horn is produced. In the Vestibule of the Outer Ear papil-

loma occurs as a peculiar flat, coin-shaped excrescence, which is very troublesome, invariably giving rise to a noisome otorrhea. On mucous membranes they occur at the edge of the Eyelids, on the Membrana Nictitans, and on the Lips, Gums, Hard Palate, Tongue, and Trachea (Mouquet). In the buccal cavity they are seen particularly among puppies and young dogs, and as they are often observed to occur in several animals in the same kennel they are regarded as contagious or infectious in character. Experiments conducted by McFadyean and Hobday prove at least their inoculability. These gentlemen succeeded in inoculating other dogs by rubbing excised wart on a small area of scarified mucous membrane on the lips. The growth developed in that locality in from six to eight weeks, but failed to do so on the penis. Attempts to re-infect dogs which had recovered gave negative results. These tumors always disappear of their own accord, though successive crops of them will develop at intervals of a week or two for a certain period. They may be compared with the growth of warts on the hands of young boys. Papilloma have been observed in the Pelvis of the Kidney by Bruckmueller and Siedamgrotzky.

Endothelial Papilloma of the Pleura has been described by Hutyra and Kitt. In the former's case there were fine villous clusters an inch in length, and those attached to the mediastinal portion formed a tumor as large as the infantile head, displacing the heart. The histologic structure was richly vascular with a simple endothelial lining.

(b) **Epithelial and Glandular Tumors Formed of Immature Tissue.**

Carcinomata. According to Froehner, these constitute by far the commonest of all the neoplasms, averaging forty per cent of the whole. Two main types are included in the term, viz., the EPITHELIOMATA and the MALIGNANT ADENOMATA.

The Epitheliomata are derived from *squamous epithelium*, which proliferate and form new growths. They arise most commonly at the seat of junction of skin and mucous membrane, or where two different kinds of epithelium merge.

The Malignant Adenomata are composed of proliferated *glandular cells*, appearing as an overgrowth of follicles with a tendency to retrogressive metamorphosis of cells and infiltration of neighbor-

ing textures. When such an overgrowth of follicles tends to retain the glandular form it is termed Adenoma, but when the overgrowth is characterized by infiltration and development of an embryonic type of cells it is termed Carcinoma. If both types are present in the same tumor it is termed Adeno-Carcinoma. The histogenesis of cancer remains a mooted point. There are some who zealously advocate the parasitic theory, and others who as ardently oppose it. Still other authorities are willing to concede the possibility of a parasitic origin in the first instance sufficient in itself to initiate the atypical cell proliferation, or so to speak, to start the cells running wild on a wrong track, but suggest that the habit once having been acquired may continue independent of the initial stimulus. At the present time the majority opinion is against the parasitic origin of the disease. Heredity is generally recognized as a potent predisposing factor in the dog as in man, but it must be remembered that the lineal and clinical histories of our patients are seldom traceable with accuracy. It is recognized that benign adenomatous tumors offer conditions favorable to the development of carcinoma. As they contain both glandular cells and connective tissue cells it is easy to comprehend this capacity of transition. The phenomenon might be aptly described as "progressive carcinomatosis," and it is particularly prone to occur in consequence of repeated injuries or prolonged continuous irritation. A typical example is afforded by the following case which occurred in my practice: A male hound, aged eight years, for some years had been secured by a chain, one end of which was attached to a ring which ran on a wire about forty feet long. In this manner the animal was enabled to run to and fro within a limited area. On its right side, as it left its sleeping quarters, was a high wall, while on the other side, a short distance away, was its master's residence. Hence, on running to and fro the length of the wire, it would invariably get on the side looking towards the house, and it so happened that the chain tended always to get between its front legs and rub continuously on a certain spot on the posterior and inner aspect of the right leg. About two years previous to the time the case was brought to my notice, an abrasion was noticed on this spot, which gradually gave place to a sessile fibrous growth which enlarged slowly for eighteen months. It then suddenly began to increase at a much more rapid rate, its weight causing it to become

pedunculate. Having removed the growth, I submitted it to Professor Adami, who pronounced it a fibro-adenoma undergoing what could not be regarded as otherwise than an early cancerous change. In an instance recorded by McFadyean a carcinoma appeared to have developed as a secondary growth from an anal adenoma. But in no part of the body are such striking instances of progressive malignancy afforded as in the mammary gland. While true malignant adenoma of these glands is far from uncommon, the usual type of growth met with in this region is *fibro-adenoma exhibiting a modified malignancy* with proneness to recur after ablation but with a tardy tendency towards general dissemination. This recurrence may take place in the area from which the initial tumor has been removed by continued growth of left-over particles, or it may take place in the neighboring mammae owing to a latent tendency towards this form of tumor-formation existing in the mammary glands as a whole, and which may break out in individual glands at different times, the growths forming in the later years of the animal's life being more inclined to exhibit malignant character. In an instance which I observed a firm mammary tumor appeared in a Skye terrier female at the age of eight years. After reaching a moderate size it remained quiescent for seven years, when it suddenly commenced to enlarge at an alarming rate in addition to giving birth to numerous secondary growths in the neighboring glands. It proved on examination to be carcinoma. In the middle of the last century Leblanc observed this phenomenon and referred to "simple hypertrophic enlargements" as being commonly mistaken for cancer. He made some consecutive examinations of recurring mammary tumors and noticed a gradual transition into malignancy. The first growth removed was found to be simple adenoma, but malignant characteristics become more and more accentuated according as the recurrence increased in frequency. Froehner believes that the majority of such tumors are malignant in character, while McFadyean has expressed the view, after examining a series of these growths that the commonest form of enlargement is of the nature of a fibrous induration, the groups of cells scattered through the fibrous stroma being in reality the compressed remains of the glandular acini, the compression resulting from the formation of new connective tissue.

There is a specimen in the Army Medical Museum at Wash-

ington showing primary adeno-carcinoma of the mamma with secondary growth in the liver and spleen.

The carcinomata are notable on account of their rapid growth, but curiously enough, they may remain quiescent after attaining a certain degree of development. Strong proof of carcinomatous character is the progressive extension of a tumor to adjacent tissues. Regional extension takes place through lymphatics with which they are abundantly supplied, while general dissemination mostly takes place through the venous system through perforation of a vein-wall by carcinoma cells. Dissemination is less frequent in epithelioma than in malignant adenoma.

Adult animals are the principal sufferers, and the average age is in the neighborhood of eight years. Froehner based some statistics on sixty-five cases he had treated by surgical procedure, as follows:

| Number of dogs affected. | Aged. |
|--------------------------|--------------|
| 10 | 2—4 years. |
| 18 | 5—6 years. |
| 22 | 7—8 years. |
| 12 | 9-10 years. |
| 3 | 12-13 years. |

In a hundred observations on the part of Cadiot and Almy the proportions were similar:

| Number of dogs affected. | Aged. |
|--------------------------|--------------|
| 6 | 1—3 years. |
| 18 | 3—5 years. |
| 33 | 6—9 years. |
| 26 | 9-12 years. |
| 14 | 12-15 years. |
| 3 | 15-20 years. |

In microscopic appearance, carcinomata vary according to their situation and period of existence. A typical carcinoma as occurring in the skin is a more or less uneven, indurated, and sensitive growth with a metastatic tendency to infiltrate neighboring tissues. It has a circumscribed edge and a raw, ulcerating, crater-like center, from which an offensive discharge is emitted. Ulceration is often absent, and instead, the surface has an irregular scarred appearance. The tumor is freely mobile from the surrounding tissues but intimately adherent to its cuticular covering. Its dimensions may vary

from the size of a pea to that of an apple or even the infantile head.

Carcinoma of the Skin manifests a predilection for the Ears and Eyelids or their proximity, the Edges of the Lips, the Root of the Tail, the Legs, the Paws, and the Scrotum. Carcinoma of the Testes is not uncommon though there has been some difference of opinion among veterinary pathologists as to the identity of these tumors. Malignant growths of the testes are peculiarly difficult to classify, as there may be every kind of deviation from the pure connective tissue tumor through the mixed connective, adenomatous, or cystic tumor, to the tumor of the almost purely glandular cancerous type. The liability for tumors to show both proliferation of the tubes and proliferation of the interstitial tissue, a peculiarity which is also seen to some degree in the kidney is the explanation of the so-called carcinoma-sarcomatodes. Kitt refers to the condition when confined to the testicle as *Hypertrophia adenosarcomatosa testis* but when it assumes a progressive character he names it *Carcinoma testis sarcomatodes*. In cryptorchids the retained organ is often cancerous. (Leisering, Sutton)

Primary Carcinoma of the Viscera is a comparatively rare disease. The organs in which either primary or secondary forms occur are: the Bladder (Schulz, Demeurisse), the Prostate Gland, the Kidneys and Supra-renals (Bruckmueller, M'Fadyean, Kitt, Bourne), the Ureters (Siedamgrotzky), the Uterus (Leblanc, Bruckmueller, Camardi), the Thyroid (Siedamgrotzky), the Intestinal Canal (Mueller, Cadéac, Laborde, Huidekoper, Eberlein), the Pancreas (Nocard, Cadéac), the Liver (Siedamgrotzky), the Spleen, the Peritoneum (Cadéac), the Lungs (Kitt, Cadéac, Liénaux), and the Heart (Cadiot).

(2) COMPOUND TUMORS.

Teratomata Comprising (a) Dermoid Tumors and Cysts and (b) Parasitic Fetuses.

Dermoid Tumors and Cysts. These arise from sequestered portions of the epiblast, occurring usually in unnatural positions. A familiar example of Sequestration Dermoid is seen in the small cutaneous nodules furnished with vibrissae which are constantly present on the Cheeks in a line with the angle of the mouth. The mucosa lining the surface of the Eye-ball is occasionally the seat of congenital patches of skin, bearing tufts of hair, which have re-

ceived the name of *congenital moles*. The explanation of their occurrence is based upon the development of the eye-lids. In early fetal life the tissue covering the outer surface of the eye-ball which ultimately becomes the conjunctiva is directly continuous with the skin. Cutaneous folds arise and approach each other from the margin of the orbit to ultimately become the eye-lids, and their surfaces, which are continuous with the covering of the eye-ball, become converted into conjunctival mucous membrane. This conversion (into mucous membrane) is dependent upon the complete occlusion of the covering of the eye-ball, and if a portion or even all of the latter remains uncovered, it persists as skin (Sutton).

Dermoid Cysts occur in the Ovaries. They may be composed of skin or mucous membrane together with the appendages peculiar to these structures such as hair and sebaceous glands, and contain a mucoid fluid. Mueller quotes Esser as authority for their occurrence in the dog. Dermoid Cysts containing rudimentary molar teeth also occur in the Temporal Region (Werwey, Cadiot & Almy). They usually undergo regressive metamorphosis, the cells constituting the lining of the cyst becoming detached to form part of the cystic contents. Inflammation of the interior follows entrance of pyogenic microorganisms, and the matter gains exit by fistulous tract in or near the auricular region.

Parasitic Fetuses are composed of cells of parts of individuals parasitic upon another individual. They are not common. A very interesting case was witnessed by Hodgkins where the parasite had two fully developed feet and was attached to the umbilicus of a normal puppy.

(4) Cysts

A cyst is a tumor containing one or more cavities filled with fluid or semi-fluid contents resulting from abnormal dilation of pre-existing tubules or cavities. Strictly speaking, a cyst is not a neoplasm, the whole style of a cyst being totally distinct from the tumor proper, and so many widely differing factors may lead to cyst formation that it is better to treat them as a totally distinct section. Nevertheless, the purpose of the work will perhaps be best served by including them in the same chapter.

Closely following Sutton's classification, we recognize in the dog:

(1) True Cysts.

- (a) Retention and Gland Cysts....Hydronephrosis, Hydrocholecyst, Ranula, Chylcysts, Ovarial, Uterine, Mammary, Sebaceous, and Mucous cysts.
- (b) Tubulo-CystsCystic tumors associated with remnants of the Ducts of the Fetal Mesonephros.
- (c) Hydrocele.....Of the Tunica Vaginalis Testis.

(2) Pseudo-Cysts.

- (a) BursaeSynovial, etc.
- (b) Contusion and Extravasation CystsHematomata, etc.
- (c) Neural Cysts ..Hydrocephalus and Hydrocele of Ventricles
- (d) Parasitic CystsHydatids
- (e) Emphysematous CystsOf the Mesentery
- (f) Degeneration CystsOf solid Tumors

(1) True Cysts.

(a) **Retention and Gland Cysts** are formed by accumulations of fluid which is hindered from escaping by some obstruction. Should the condition persist, the glandular tissue undergoes pressure-atrophy and finally the gland and its duct become converted into a cyst, the contents of which are usually of a brownish-yellow color. The condition known as Hydronephrosis is due to dilation of the pelvis and infundibula of the kidney as a result of intra- or extramural obstruction in some part of the urinary tract. If the obstruction occur in the Ureter from tumor, calculi, etc., or at its vesical orifice, there is a unilateral accumulation, but if it occur at the Neck of the Bladder or in the Urethra from enlarged prostate or impacted calculus, the condition becomes bilateral. Unilateral hydronephrosis does not necessarily exert a baneful effect on the health of the animal, the remaining kidney taking on the function of its defunct fellow, but bilateral hydronephrosis is speedily lethal through non-elimination of urine. The condition has been observed by Roell,

Siedamgrotzky, Almy, Cadéac, Sutton, Znamensky. Minute cysts occur in the kidney as a result of interstitial nephritis.

Hydrocholecysts result from obstruction in or about the Ductus Choledochus, due to gall stones (Froehner), carcinoma of the head of the pancreas (Nocard) or of the duodenum (Eberlein). This condition is common to obstructive icterus. The term Ranula is applied to all cysts occurring in the Floor of the Buccal Cavity, whether of submaxillary, sublingual, or mucous origin. These cysts arise through cohesion of the margins of the ducts.

Chyle-cysts are formed of separated layers of Mesentery and contain a chyle-like fluid. Caparini saw an enormous perigastric cyst extending from the stomach to the pelvic inlet, which seemed to have arisen under the peritoneal coat of the stomach at its greater curvature and burrowed between the layers of the omentum.

Ovarial cysts represent accumulations of unruptured ripe Graafian Follicles and probably owe their origin to thickening of the follicular wall owing to chronic inflammation of the ovary. They develop after incomplete oophorectomies, when sufficient glandular tissue is left to function.

Uterine Cysts, under the name of Hydrometra, are characterised by accumulation and retention of the products of glandular secretion. This condition is caused by cicatricial occlusion of the cervical canal as a result of endocervicitis originating through injury received during parturition, or it may arise through pressure at the cervix by the ring in inguinal hernia. The cavity of the uterus becomes much distended and coincidentally the walls hypertrophy until finally the organ attains a size simulating pregnancy. Should pyogenic microorganisms gain entrance, they develop rapidly in the highly albuminous contents and produce the condition known as Pyometra.

Sebaceous cysts have received the name of Athéroma. They are usually small and contain a semi-fluid material. They are liable to undergo secondary changes through irritation leading to inflammation and suppuration. According to Sutton, the contents may burst through the capsule and becoming exposed to the atmosphere, dry, and assume a brownish-black color and become very hard. The mass is composed of epidermal scales which in consequence of the exposure resembles horn in appearance and consistence. If the dried mass is allowed to remain, growth continues at the base until at

length a Cutaneous Horn is produced which may be many inches in length. Lebert cites observers who have recorded the occurrence of these horns.

Atheromata sometimes acquire a peculiar formation when they are known as Proliferous Cysts. Through constant accumulation of the contents the tumor is projected inwardly, the glandular epithelium becoming pathologically inverted, and the whole surrounded by proliferated connective tissue. Growth being unequal, the cavities become distorted, branched in various directions, and filled with polypoid excrescences. Werner has minutely described this condition, and Siedamgrotzky described a villous fibroid cystoma which occurred near the Preputial Orifice.

Mucous Cysts are seen to occur as very general minute cystic dilations of the uterine mucosal glands and their ducts in chronic endometritis. They develop through stricture of the mouths of the glands occurring in consequence of proliferative overgrowth of the upper layers. These cystic dilations have also been seen in numbers in the Esophagus by Eichenberg.

(b) Tubulo-Cysts. Tubulo-cysts are formed by dilation of obsolete canals and ducts. It will be remembered that there is, a certain stage of indifference in the fetal development of the urogenital system where neither sex is apparent. The Wolffian body or mesonephros which ultimately becomes either testicle or ovary, gives rise to certain tubules and two ducts—the Wolffian and Muellerian, the former becoming the epididymis and vas deferens in the male, and the latter the oviduct, uterus, and vagina in the female. In the female dog the Wolffian duct remains rudimentary and partly disappears. In the cow it persists as the duct of Gaertner, which makes its way between the layers of the broad ligament and runs downwards on the uterus to open into the vagina near the orifice of the urethra. In the female dog the terminal segments sometimes become the seat of small cysts, rarely exceeding a pea in size, though I have seen them quite large, lobulated, and multilocular, which are seen lining the uterine cornua at the margin of the broad ligament. They have no pathologic significance.

(c) Hydrocele. The free communication between the general peritoneal cavity and the funicular pouch permits intra-abdominal accumulations of fluid to gravitate into the pouch but these disappear when the animal is placed on its back. Inflammatory effu-

sions and hemorrhagic extravasations (hematocele) may occur as a result of injury, or secondary to orchitis.

(2) Pseudo-Cysts.

(a) Bursae. Synovial Cysts occur in the immediate neighborhood of Joints or in the Bursae of Tendons, following acute or chronic traumatic or rheumatic inflammations.

(b) Contusion and Extravasation Cysts. These include the so-called adventitious bursae or cysts of true neoformation. They are seen in situations where the skin lies in close contact with bony prominences, as on the Elbow, and Digits, particularly in members of large, sluggish breeds, and are due to unusual intermittent pressure from lying on hard surfaces. Another familiar form of this cyst is that seen in the Earflap and known as Othematoma but in this case the contusion is generally so severe as to produce a primary extravasation of blood. Blood in serous sacs does not readily coagulate, but sometimes a clot forms when it is known as a thrombus. Subcutaneous collections of extravasated blood rarely suppurate, and if left to Nature sooner or later undergo absorption and organization by a process of reactive inflammation, but during the process the resultant cicatrization sometimes causes considerable shriveling and deformity. Siedamgrotzky observed the occurrence of a cyst in the subcutaneous tissue extending from the larynx to the left shoulder-blade, the development of which followed a bite received by the animal in the neck a week previously. The same authority described an extravasation hematoma occurring under the serosa of the Bladder, near its neck, which brought about a triple torsion of that organ. Recent, as well as old-standing organized, hematomata are quite commonly found in the Spleen.

(c) Neural Cysts. These occur as Hydrocephalus and Hydroorrhachis, leading rapidly to paraplegia, psychic disturbances, coma, or death. The dura is found distended by an accumulation of colorless serous fluid.

(d) Parasitic Cysts. The varieties of these cysts are fairly numerous. They have been found in the Liver, Mesentery, Omentum, Muscular Tissue, etc.

(e) Emphysematous Cysts. These which are common enough in the Mesentery of the hog, are sometimes seen in the same situation in the dog (Williams).

(f) **Degeneration Cysts.** Solid tumors often break down and soften, their contents becoming fluid. The commoner examples are tubercular Bronchial Glands, and malignant Mammary growths.

Treatment of Tumors

Only the general principles of treatment as applied to Tumors Proper and Cysts will receive consideration here, special methods and the treatment of the several Hypertrophies, Hyperplasias, Granulomata, and Strictures having pathologic significance being described elsewhere under their respective headings.

While innocent growths with few exceptions seldom exert any ill-effect on the organism, nevertheless, in superficial positions, they are mostly unsightly blemishes, and for this reason alone their removal is usually desired. Furthermore, as has already been pointed out, some innocent growths are capable of assuming a malignant activity, under certain conditions. Moreover, in many cases it is impossible to distinguish between the two types, so that it is safe to adopt and observe the rule of *early removal of all tumors growing in accessible positions*. In the case of growths of undoubted malignancy the only hope lies in early and radical operative treatment with coincident removal of adjacent lymphatic glands when the latter are involved. The earlier the knife is used the greater is the prospect for permanently eliminating the disease. Cancer is a local disease at the outset and in the early stages can be eradicated without fear of recurrence. But in making ablation it is necessary to cut wide of the diseased area without regard to subsequent deformity and to avoid disseminating cells of the growth in fresh tissue. Operative measures are contraindicated and should never be attempted when there is more or less generalization, feebleness, or cachexia present.

There is only one method of ablation worthy of consideration and that is by excision with the knife. It is true that in certain conditions, such as inaccessible papilloma of the auditory canal, or tumors growing from solid structures it is sometimes necessary to rely on the thermo-cautery to completely eradicate all traces of diseased tissue, but the employment of such means must be regarded as supplemental to the use of the knife rather than as substitutive. The method of ligating and allowing the growth to slough off is only to be mentioned to be rigorously discountenanced as typical of the crud-

est of surgery, illustrative of which I need only mention the following incident related to me by a practitioner. A silk ligature was applied late one night to a wart growing at the edge of the eye-lid. In the morning the corresponding eye was found to be damaged to such extent that the sight was destroyed. The animal had practically scratched its eye out during the night in its frantic efforts to rid itself of the pain-giving ligature.

The cleanest and best surgery calls for excision with the knife and ligation of all severed bloodvessels. Where the main nutrient vessels of a growth are not of large caliber and are comprised in a distinct pedicle, the last step in the removal including hemostasis may be effected by means of a good emasculator instead of ligatures, but the operator must be sure of the adequacy of his instrument for fear of secondary hemorrhage. Anesthesia, either local or general, should always be instituted. Growths which can be ablated without much cutting can be removed painlessly by narcotizing the subject with morphine hypodermically administered some thirty to sixty minutes previous to operation and then employing hypodermic injections of cocaine locally, but those involving extensive cutting require a general anesthetic. It is always best to securely hobble the animal. Instruments must be sterilized and the parts thoroughly cleansed and freed of hair. When tumor and skin have coalesced, an incision is carried through the latter on either side well into the healthy texture. The subcutaneous tissue is divided all around the diseased area by blunt, or if necessary, sharp dissection until one or more pedicles supporting the nutrient vessels are exposed. The latter should then be ligated with silk and severed on the occluded side with scissors, or they may be divided at their origin with an emasculator, which, however, should be allowed to remain clamped for some little time to guard against subsequent hemorrhage. Every trace of diseased neighboring lymphatics must also be freely removed by dissection. All bleeding points should then be seized with hemostatic forceps and either twisted or ligated. The wound being cleaned, preferably with a stream of sterilized water, the divided skin is reunited with the subcuticular suture, redundant portions being removed with scissors. A drainage tube or strand of sterile gauze should be inserted and stitched in place in extensive wounds, particularly where the formation of pockets in the subcutis cannot be prevented, and where drainage is not employed the parts must be daily inspected for accumulation of pus to which free exit must be

given. Circumscribed and encapsulated innocent subcutaneous neoplasms require simpler measures. A single skin incision is made immediately over the growth and the latter being exposed is removed by blunt dissection or enucleation. Healing, when uninterrupted, takes place in from two to six weeks.

The treatment of retention and extravasation cysts comprises two methods. It must be remembered that a cyst is but an accumulation of fluid limited by a wall of concentrated connective tissue lined in whole or in part with actively secreting cells, and that as long as a portion of this wall remains in place secretion will continue and reaccumulation of fluid take place. Hence, the surgeon always seeks to remove or destroy every vestige of the lining membrane. The preferable way to accomplish this is by blunt dissection of the sac intact. Dissection must be performed with extreme care and delicacy, because should the sac be inadvertently punctured, it immediately collapses through escape of the fluid and its complete removal is attended with difficulty and in some cases rendered impossible. The other way is to destroy the secretory power of the lining cells leaving the sac in position. This method is frequently resorted to when the cyst lies in an inaccessible position or in proximity to important blood-vessels, but it must only be employed with due regard to the establishment of drainage as the object is to induce an active suppuration. The contents of the sac must first be evacuated either by means of an aspirating syringe, or by puncture when too tenacious to pass through a needle. Some irritating solution, such as tincture of iodine or nitrate of silver solution, is then injected. In a few hours this is followed by local inflammatory phenomena and at the expiration of forty-eight hours the aspirator should again be employed to ascertain the presence or absence of pus. If suppuration has not taken place the injection is to be repeated every three or four days until it does. Should pus be present it is evacuated by lancing and the parts treated as an ordinary abscess.

Certain of the Pseudo-Cysts are treated by simple aseptic aspiration.

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