MANUAL OF OBSTETRICS

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BY

JOHN OSBORN POLAK, M.Sc., M.D., F.A.C.S.

PROFESSOR OF OBSTETRICS AND GYNECOLOGY IN THE LONG ISLAND COLLEGE HOSPITAL; PROFESSOR OF OBSTETRICS, DARTMOUTH MEDICAL SCHOOL; OBSTETRICIAN AND GYNECOLOGIST TO THE COLLEGE HOSPITAL; GYNECOLOGIST TO THE JEWISH HOSPITAL; CONSULTING OBSTETRICIAN TO THE METHODIST EPISCOPAL HOSPITAL; FELLOW OF AMERICAN GYNECOLOGICAL SOCIETY, AMERICAN ASSOCIATION OF OBSTETRICIANS, GYNECOLOGISTS AND ABDOMINAL SURGEONS, NEW YORK OBSTETRICAL SOCIETY, ETC.

WITH THREE COLOR PLATES
AND ONE HUNDRED AND NINETEEN
ILLUSTRATIONS IN TEXT

SECOND EDITION

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ON
ENDOCRINOLOGY

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PREFACE

The object of this Manual is to place the essential facts and fundamental principles of the Science and Art of Obstetrics within the easy grasp of the student and the busy practitioner who wishes to refresh himself on basic obstetric principles. It is further intended to be a systematic introduction to the more elaborate treatises, and serve as a guide in following the didactic and practical teaching given in the college course.

Over twenty-five years' experience in the teaching of undergraduates and post-graduates in obstetrics, has demonstrated that if the student can be made to master the elements of the subject, complete and systematic knowledge of it becomes a matter of easy growth. In the preparation of this volume special attention has been given to practical topics; the arrangement is such that the reader will, at a glance, be able to get the more important points which have been emphasized by being *italicized.*

Theoretical discussions, matters of merely historical interest and the elaboration of details, have, in the main, been purposely excluded.

The general desire, on the part of the practitioner, to know something of the practical application of endocrines and the influence which the ductless glands have on the development of pregnancy, and the toxemias occurring in the pregnant woman—has led me to review the present status of endocrinology and add a chapter on this subject.

The author desires to express his appreciation to Dr. Norman P. Geis, who has aided in the preparation of the chapter on Anatomy; to Dr. George W. Phelan, for his collaboration in the work on Endocrinology, and to Dr. Frederick Tilney, for his chapter on Reproduction and Organology.

Many of the drawings are the work of H. C. Lehman and W. F. McKenna.

JOHN OSBORN POLAK.

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MANUAL OF OBSTETRICS

CHAPTER I

ANATOMY OF FEMALE GENITAL ORGANS

The genital organs are commonly divided into the external and the internal genitals and the vagina, which connects the two sets of organs.

EXTERNAL GENITALS

The external genitals, commonly called the pudendum and the vulva, consist of the following structures: the mons veneris, the labia majora, the labia minora, the clitoris, the vestibule, the vulvo-vaginal glands, and the hymen.

The Mons Veneris.—The mons veneris is a triangular pad of fat supported by trabeculæ of fibrous and elastic tissue which run through the adipose layer in all directions. It overlies the pubis and is covered by short, crisp, curly hair after puberty. Its base is the hypogastric crease; its sides correspond with the groins, and its apex below merges into the labia majora. The round ligament may be traced into the mons on either side.

The Labia Majora.—The labia majora, or larger external lips, are two prominent folds, covered by skin, continuing downward and backward from the mons on either side of the median line. They are large above, and gradually become smaller as they are lost in the skin of the perineum. Each is triangular in form, with its base along the pubic ramus; the external side is toward the thigh, and the internal side is, in the young nullipara, in contact with its fellow of the opposite side, except when the thighs are strongly abducted (*vulva connivens*). When the labia are not in contact, as in old age, or after childbirth, and allow the labia

minora to protrude between them, it is called *vulva hians*. The outside is rough and in adult life is covered by heavy hair. The inner surface is smooth and is sparsely covered with very fine hair. In

The minor lips are covered with delicate integument having numberless sebaceous glands on both surfaces and few, if any, hairs. Bundles of smooth, unstriped muscular fibers, a rich supply of nerve filaments, and venous spaces in the interior produce the effect of erectile tissue. Fat is absent. In Bush women and in many Hottentots the labia minora are excessively hypertrophied.

The fourchette, or frenulum vulvæ, is a transverse, crescentic fold of skin, connecting the labia majora posteriorly. When the labia are separated it appears as a tense tranverse fold between the posterior commissure and the hymen. In the nulliparous woman its distance from the anal orifice is 3 cm.

The fossa navicularis is a boat-shaped depression, formed between the fourchette and the hymen when the labia are separated.

The rima pudendi is the median cleft between the labia majora of the right and left sides.

The Clitoris—The clitoris is situated in the median line below the anterior vulvar commissure. It is a small cylindrical body, and is slightly curved, with its convexity outward.

It is made up of two corpora cavernosa and a glans, analogous to those of the penis, but has no corpus spongiosum, and is not perforated by the urethra as is the penis.

Continuous with the corpora cavernosa are the crura by which the clitoris is attached to the ischiopubic rami. The clitoris is attached to the pubes by a suspensory ligament. It is concealed behind the skin and inclosed in a firm fibrous sheath. Its internal structure is largely made up of erectile tissue, and its mucous surface is richly supplied with nerve papillæ. The clitoris is hidden from view by the labia majora; the glans, the only visible portion, lies partly concealed in the preputial fold formed by the anterior folds of the nymphæ. The thickness of the glans during erection is about 5 cm., while the entire length of the clitoris is about one inch or 25 cm. The glans has a few sebaceous follicles.

The vascular supply is from the pudic artery through the dorsal and the profunda arteries, while the dorsal vein empties into the vesical plexus. The nerve supply of the clitoris is much more abundant than that of the penis in the male; it is derived from the internal pudic and the hypogastric plexus of the sympathetic. The clitoris is the chief seat of voluptuous sensation in the female.

The Vestibule.—The vestibule is a triangular surface, with

its apex at the glans clitoridis, bounded laterally by the labia minora, and below by the anterior margin of the vaginal orifice. It is covered by a mucous membrane, which is marked by faint transverse ridges. The external urinary meatus, or meatus urethræ, appears as a small tubercle, or prominence, with a median cleft directly below the center of the base of the vestibule and one inch below the clitoris. This meatus has in its posterio-lateral margins two lips (urethral lips), in which are found *Skene's glands* or *ducts*. The ducts open just anterior to the center of the urethral lips. The "pars intermedia," an intricate plexus of veins connecting the opposite vesti ately underlies the mucous membrane of the vestibu

The Bulbi Vestibuli.—The b estibuli, or vaginal bulbs, are two masses containing a plexu eins, connective tissue, and some smooth muscular fibers, situated on either side of the vestibule and vaginal orifice, behind the labia minora and immediately in front of the triangular ligament. They are pyriform in shape and 3.5 cm., or one and one-quarter inches, in length. Each is inclosed in a fibrous capsule derived from the inferior layer of the triangular ligament. Anteriorly, at their small end, they communicate with the veins of the clitoris. They also communicate with the veins of the labia majora and minora, the vagina, and those of the pelvic floor.

The Vulvovaginal Glands.—The vulvovaginal glands, or glands of Bartholin, are two compound racemose glands, about one-half inch in length (the analogs of Cowper's glands in the male), situated on either side of the vaginal orifice, just posterior to the vaginal bulbs (bulbi vestibuli), by which they are overlapped. They are usually placed on the deep surface of the inferior layer of the triangular ligament, from which they receive an investing sheath. If not thus placed, they are located anterior to both layers of this ligament. The ducts of these glands are two-thirds of an inch in length, and run along internal to the bulbi vestibuli and open, just external to the hymen, in the posterior end of the minor lips at the sides of the vaginal orifice. Their secretion is yellowish, tenacious mucus, which is poured out freely during sexual excitement and during labor.

The Hymen.—The hymen is a thin septum or fold of mucous membrane partially or wholly occluding the vaginal orifice. It is a

thinned outfold of the vaginal wall, which contains a few muscular fibers. Its shape is usually crescentic, situated at the posterior margin of the introitus, but it may be annular, cribriform, fimbriated, or imperforate. It is usually torn at the first coitus. An untorn hymen, however, is not an absolute sign of virginity, nor is a torn one necessarily evidence that sexual intercourse has been practiced.

The carunculæ myrtiformes are the remnants of the hymen torn in labor by the passage of the child. These appear as small projections or tags of mucous membrane, three or four in number, around the vaginal opening, particularly at its posterior lateral margins.

VESSELS, LYMPHATICS, AND NERVES OF THE EXTERNAL GENITALS

Arteries.—The arterial supply of the external genitals is derived from the superficial perineal branches of the internal pudic; the transverse perineal arteries; the branches of the superficial perineal; or by direct branches from the internal pudic and from the branches of the external pudic arteries which come off from the common femoral artery.

The veins accompany the arteries. They form large plexuses, communicating with one another, and empty into the internal pudic and inferior branch of the small sciatic veins. Varicosities of the labia majora are common during pregnancy, while the venous plexuses of the labia become turbid during sexual excitement.

Lymphatics.—The lymphatics of the external genitals empty into the superficial inguinal glands, which in turn communicate with the internal and external sets of glands.

Nerves.—The nerve supply is derived from the superficial perineal nerve, a branch of the pudic, the inferior pudendal of the small sciatic, and communications from the inferior hypogastric plexus of the sympathetic.

THE VAGINA

The vagina is a musculo-membranous tube, which connects the uterus and the vulva. It surrounds and is firmly attached to the uterus above, while below it terminates in the hymen. With the bladder and rectum empty, its direction is nearly parallel with

the plane of the pelvic brim. Its opening at the vulva is called the *vaginal orifice*. Where the upper part of the vaginal tube surrounds the cervix and forms a roof it is termed the *fornix*. That part of the upper extremity of the vagina in front of the cervix is known as the anterior, while that back of the cervix is the *posterior fornix*. The lateral portions of the vaginal roof are called the *lateral fornices*. The posterior fornix is deeper than the anterior because of the higher attachment of the posterior vaginal wall to the cervix, or the actual or relatively deeper invagination of the cervix posteriorly.

Shape.—The vagi[illegible] is a collapsed tube, with its anterior and posterior [illegible]er. On cross section it is shaped like the letter H, the side[illegible] which are convex inward. When distended its shape is app[illegible]ately that of a truncated cone, with its larger end up. The vaginal axis is approximately a straight line and runs anteroposteriorly. The orifice, the *introitus vaginæ*, is nearly circular, and is its narrowest part.

Size.—The size of the virginal vagina is 2½ inches in length, along the anterior wall, and 3½ inches along the posterior wall. The walls, however, are extremely distensible, and become permanently enlarged and relaxed in parous women. The greater length posteriorly is due to the higher attachment of the posterior vaginal wall to the cervix. The widest part of the vagina is at the fornix, measuring [illegible] inches in the virgin, and 2¾ inches or more in women who have borne children.

Relations. The vagina is attached to the cervix just below its middle, and the lower portion of the cervix projects into the vagina at nearly a right angle. The posterior vaginal wall, for [illegible] of its length [illegible] relation to the recto-[illegible] of Douglas. Its [illegible] the rectum by [illegible] *septum*. The [illegible] The anterior wall [illegible] tissue, ex-[illegible] The struc-[illegible] lower half. [illegible] to the [illegible] the levator [illegible]

Structure.—The vagina has three coats, (1) the external or fibrous coat, (2) the middle or muscular coat, (3) the internal or mucous coat.

The *fibrous coat* is a prolongation of the rectovesical fascia, while the *muscular layer* is composed of an inner coat of unstriped muscle fibers, running in a circular direction, and an external longitudinal layer. It is thin near the vault, but increases in thickness gradually until at the vaginal orifice it is thickest. The bulbocavernosus, a weak voluntary muscle, encircles the vaginal orifice. The mucous coat, which is reflected on to the cervix, covering its vaginal portion to the external os, is of a light pink color. The mucous coat is arranged in two median ridges, known as the anterior and posterior columns of the vagina. The mucosa is thrown into numerous transverse folds, the *rugæ*. These transverse *rugæ*, or *Cristæ*, run outward from the longitudinal columns, being more developed in the lower two-thirds of the tube and near the vaginal orifice on the anterior wall. The fornices are devoid of them. They are more or less effaced by childbirth and by inflammation of the vagina. The epithelium is of the squamous variety. The normal secretion of the vagina is acid, due to the presence of an acid-producing bacillus.

The arterial supply is derived from the anterior division of the internal iliac through the vaginal, uterine, middle hemorrhoidal, and internal pudic, all of which anastomose with one another and with the rectal and vesical arteries.

The veins form plexuses entirely encircling the vagina. They communicate with the hemorrhoidal, vesical, pudendal, and pampiniform plexuses.

The nerves are from the pudic and fourth sacral and from the lower hypogastric plexus of the sympathetic.

THE URETHRA

The urethra is of obstetric interest. Therefore, while not properly a generative organ, it warrants a brief description.

The urethra is intimately connected with the lower portion of the anterior vaginal wall. Beginning at the middle of the base of the vestibule, it passes backward beneath the pubic arch to the bladder. The direction of the urethral canal is nearly parallel

with the plane of the pelvic brim. It is imbedded in the anterior vaginal wall, for the lower three-fourths of its course, and supported by the pubovesical ligament. It pierces the layers of the triangular ligament, and that portion of the urethral canal which lies between the layers of the triangular ligament is encircled by the compressor urethræ muscle.

Its course is st[illegible]urved, with its convexity looking downward a[illegible]

In structure it i[illegible]ving three coats, an outer muscular coat of ur[illegible]d an inner longitudinal layer. It is lined w[illegible]rane which lies in longitudinal folds; these folds a[illegible]ed near the bladder. The mucosa is lined with squamous ep[illegible]m, which becomes transitional as it approaches the vesical [illegible]e. Its meatus is a vertical slit; its vesical end terminates abruptly in the bladder. The urethra is about 4 cm., or 1⅝ inches, in length, and has an average diameter of 6 mm. It is smaller at the meatus and enlarges near the vesical end. The canal is very distensible.

The vascular and nervous supply are the same as those of the vestibule.

Glands of the Urethra.—The surface of the mucous membrane contains numerous lacunæ and racemose glands.

Skene's tubular glands—first described by Malpighi, on either side of the median line, on the floor of the urethra—are two small tubules in the wall of the urethra, about ¾ of an inch in length. Their orifices lie just at or within the meatus. These tubules are

with the plane of the brim, except that the end of the rectum turns backward nearly at a right angle with the vagina. The pelvic floor extends from the pubis to the coccyx, and its lateral limits are the rami of the pubis and ischium, the tuberosity of the ischium, and the sacrosciatic ligaments. The anterior vaginal wall and the soft parts in front of it constitute the *pubic segment;* the posterior vaginal wall and the soft parts behind it the *sacral segment* of the pelvic floor. It helps support and maintain the pelvic viscera. The meeting of the two halves of the pelvic floor in the median line between the vagina and the rectum is known as the *median raphe;* that portion between the rectum and the coccyx is called the *rectococcygeal raphe.*

Measurements.—From the coccyx to the anus, in the nullipara, 4.5 cm. (1¾ in.); from the anus to the lower edge of the vulvar orifice, in the nullipara, 3.1 cm. (1¼ in.); in the parous woman, 2.5 cm. (1 in.); in the primigravida at term, 3.8 cm. (1½ in.).

The greatest transverse width on the bisischial line is 10.7 cm. (4¼ in.); while the perpendicular thickness of the pelvic floor at the anus is 5 cm. (2 in.).

In the nulligravida the average projection of the pelvic floor below a line drawn from the top of the coccyx to the lower end of the symphysis is 2.5 cm. (1 in.); in the pregnant woman at term, 9.5 cm. (3¾ in.).

The length of the sacral segment during labor at the moment of expulsion, from coccyx to the lower edge of the vulvar orifice, is 15 to 17.5 cm. (6 to 7 in.).

Pelvic Fascia.—The *most important* supporting structures of the pelvic floor are its *fascial sheets* and the *levatores ani muscles.* Its strength and supporting power depend mainly on its fascial sheets.

The pelvic fascia is continuous at the iliopectineal line with the iliac and transversalis fasciæ. It consists of two parts, the obturator fascia and the rectovesical fascia.

THE OBTURATOR FASCIA is the special fascia of the obturator internus muscle, which it covers on its inner surface. It is attached above to the iliac portion of the iliopectineal line; in front to the posterior surface of the pubic bone; behind to the anterior margin of the great sciatic notch and the great sacrosciatic ligament; and

below it joins the falciform process of this ligament, through which it is attached to the ischiopubic rami. This fascia forms the outer boundary of the ischiorectal fossa. The internal pudic vessels and nerves covered by their sheaths are imbedded in this part of the fascia. From the posterior part of this fascia a thin layer (fascia of the pyriformis) is continued to the sacrum and covers the pyriformis muscle.

muscle join the median line, forming the rectococcygeal raphe and the median raphe.

THE TRIANGULAR LIGAMENT.—This is a trapezoid, musculotendinous ligament, which is stretched across the triangular space, bounded by the ischiopubic rami and the bisischial line. This ligament consists of two layers of fascia making the anterior and the posterior layers of the triangular ligament. They unite superiorly and inferiorly, forming a slit-like space partly inclosing the bulb of the vestibule and completely covering the deep transversus perinei muscles, the sphincter urethræ muscle, and the artery, vein, and nerve of the clitoris. This fascia arises from the rami of the pubis and ischium and unites with its fellow from the opposite side in the median line. The two layers blend at the bisischial line with each other and with the deep layers of the superficial fascia, which are continuous with that of the rest of the body and form the perineal ledge or ischioperineal ligament. These sheaths of fascia are perforated by the urethra and the vagina.

Muscles of the Pelvic Floor.—LEVATOR ANI MUSCLE.—Each levator ani muscle lies superficial to the rectovesical fascia, and is composed of three parts, or bundles of muscle fibers.

The pubic bundle, *pubococcygeus,* takes its origin from the intrapelvic surface of the os pubis and from the deep layer of the triangular ligament. Its fibers run nearly horizontally backward to the coccyx. Some of its fibers are inserted into the vagina, the perineal body, the rectum, and the rectococcygeal raphe, but the main body of the muscle goes to the coccyx. The entire bundle of the muscle is a half inch wide and a quarter of an inch thick, and, as it passes backward, it runs one-quarter of an inch from the lateral wall of the vagina. The two divisions of the pubic portion of the levator comprise the *pubococcygeus,* whose fibers run toward the coccyx, and the *puborectalis* or anterior division, the larger part of whose fibers unite with its companion of the opposite side behind the perineal flexure of the rectum.

The second bundle, or *obturator-coccygeus,* arises from the white line, and is thin and membranous. The fibers run downward, inward, and backward toward the rectum and the rectococcygeal raphe, below the pubococcygeus. None of the fibers reach the rectum. Some are inserted into the rectococcygeal raphe,

while the greater part go to the coccyx, reaching it directly or by an aponeurotic attachment.

The third portion, the *ischiococcygeus*, arises from the spine of the ischium, and forms a small, spindle-shaped bundle of fibers, thicker and distinctly separable from the fibers of fascial origin. The course of this bundle is nearly transverse, most of its fibers being inserted into the tip of the coccyx. A few turn forward upon the rectococcygeal raphe.

The second and third portions of the levator are often called the *iliococcygeus* portion of the levator ani muscle.

The *coccygeus* muscle takes its origin from the spine of the ischium, and is inserted into the sides of the coccyx and sacrum. This muscle is commonly considered a part of the ischiococcygeus. None of the fibers of the levator ani muscle crosses the median line to join those of its fellow on the opposite side, except those few deeper fibers of the puborectalis which enter into the formation of the external sphincter ani muscle. The anal fascia below and a very thin fascial layer on the upper surface of the levator form

3 cm. wide, one on either side of the anus, taking their origin from the tip of the coccyx and the adjacent skin and fascia, and inserted into the tendinous center of the perineal body; these are, in part, derived from the puborectalis muscle.

THE PERINEAL BODY is the term applied to that span of tissue intervening between the anus and the posterior commissure of the vulva and the lower end of the rectum and the vagina. It is made up of elastic and muscular tissue. Into this are introduced the superficial transversus perinei, the bulbocavernosus and the external sphincter. Its height is 3.7 cm. (1½ inches), its transverse width 3.7 cm. (1½ inches), and the length of its anterior posterior base 3.1 cm. in the nullipara.

Blood and Nerve Supply.—The blood supply of the pelvic floor is from the pudics and the hemorrhoidals, the nerve supply from the internal pudic and the third and fourth sacral nerves.

INTERNAL GENITALS

These include the uterus, the Fallopian tubes, and the ovaries.

The Uterus.—SITUATION.—In the erect position of the woman the uterus is situated in the cavity of the pelvis between the bladder and the rectum, a little nearer to the sacrum than to the pubic bones. This organ does not occupy a fixed position in the true pelvis. It is freely movable within the limits of its ligaments and the vagina. The condition of the bladder and the rectum influences its position: a full bladder pushes it backward, while a distended rectum may displace it forward. The position of the uterus may be said to be normal when it occupies a central position in the space between the pubis and the sacrum, and is about in the median line below the level of the brim of the pelvis and above a line drawn from the summit of the subpubic arch to the tip of the sacrum, or in the plane of the ischial spines and the cervix posterior to a central position. It is normally in anteversion. Its long axis is nearly perpendicular to the plane of the pelvic brim and forms a right angle with the vagina. The peritoneal covering of the body is as follows: The peritoneum comes from the anterior abdominal wall and is reflected over the fundus of the bladder. It then dips down between the bladder and the uterus and is reflected on to the uterus, covering the upper two-thirds of its an-

terior surface. The space between the bladder and the uterus is the *anterior cul-de-sac* or *uterovesical space.* The peritoneum then

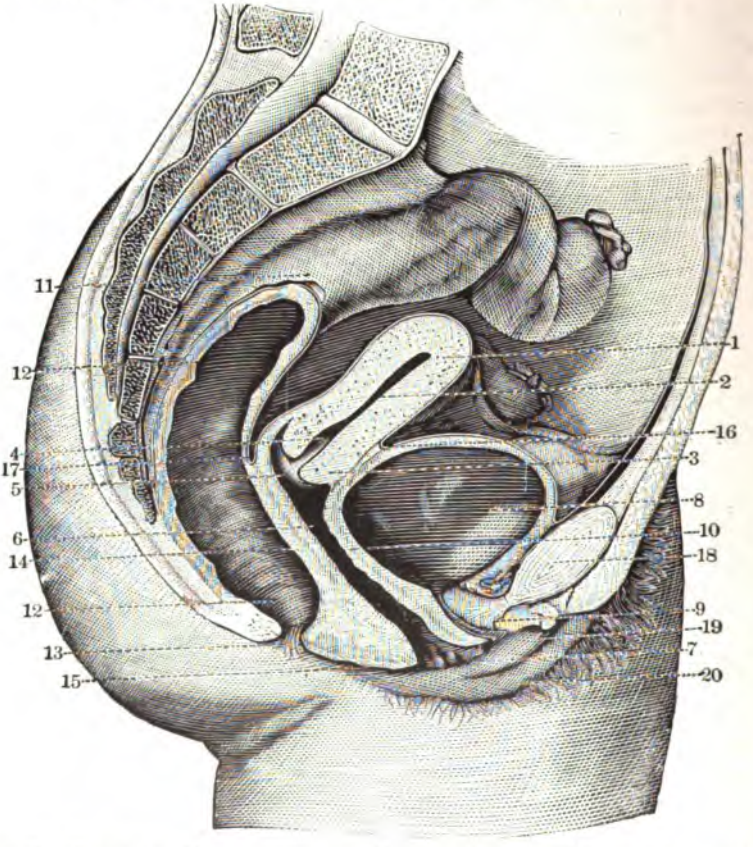


FIG. 2.—SAGITTAL SECTION OF THE PELVIS, SHOWING RELATIONS OF THE GENERATIVE ORGANS, BLADDER AND RECTUM, MODERATELY DISTENDED.—1. Body of the uterus; 2. Cavity of the uterus; 3. Neck or cervix of the uterus; 4. Cavity of the cervix; 5. Infravaginal portion of the neck; 6. Vagina; 7. Vaginal orifices; 8. Bladder; 9. Urethra; 10. Vesicovaginal walls; 11. Rectum; 12. Rectal cavity; 13. Anus; 14. Rectovaginal wall; 15. Perineum; 16. Vesicouterine cul-de-sac; 17. Uterorectal or cul-de-sac of Douglas; 18. Pubic symphysis; 19. Small lip; 20. Great lip.

pelvis. The space between the uterus and the rectum is the *posterior cul-de-sac*, or *the cul-de-sac of Douglas.*

RELATIONS.—The anterior surface of the uterus is usually in relation with the bladder, though the small intestines occasionally occupy the uterovesical space. Posteriorly, it is in relation with the small intestine and sigmoid, which fill the uterorectal cul-de-sac; laterally, are the broad ligaments and their contents. That part of the uterus between the peritoneum and the vagina, anteriorly, is attached to the bladder by loose connective tissue. The lower extremity of the uterus projects into the upper end of the vagina for nearly half an inch.

SHAPE.—The uterus is a hollow muscular organ. It is pyriform in shape, with its larger end uppermost. The posterior and the upper surfaces are convex, its anterior surface nearly flat, and it is slightly flattened from before backward. The long axis is slightly curved, with its concavity forward.

SIZE.—(a) In the *nulliparous uterus* the average measurements are 1 in. (or 2.5 cm.) thick, 2 in. (or 5 cm.) wide at the Fallopian tubes, and 3 in. (or 7.5 cm.) long. It weighs one ounce and its cavity holds 16 drops.

(b) The *parous uterus* has all of its measurements increased by ¼ in. Its weight is nearly 2 ounces. Marked atrophy takes place after the menopause.

REGIONAL DIVISIONS.—The uterus may be divided for study into a body and a cervix.

Divisions of the Body.—The *body* is approximately the upper half of the uterus in the nulliparous and the upper two-thirds in the parous woman.

The *isthmus* is the slight constriction at the junction of the body and the cervix.

The *fundus* is that portion of the body above the level of the Fallopian tubes.

The *cornua* are the two lateral angles of the uterus at which the Fallopian tubes enter and the ovarian ligaments and the round ligaments are attached.

Divisions of the Cervix.—The *infravaginal portion,* or the *portio vaginalis,* is that part of the cervix below the vaginal roof. In the parous woman it projects into the upper end of the vagina for ½-¾ of an inch.

The *supravaginal portion* is that part between the isthmus and the portio vaginalis. Its average length in the parous woman is slightly more than ½ inch.

Uterine Cavity.—The *cavity of the body* in the non-parous woman is somewhat triangular in shape, its anterior and posterior walls lying practically in contact. It has three openings, one communicating with the cervical canal, and one with each of the Fallopian tubes.

The *cavity of the cervix* is slightly flattened from before backward, and is laterally elliptical, thus having an irregular, fusiform shape.

The *os internum* is the upper opening of the cervix connecting the cervix and the body, and is about 1/10 inch in diameter.

The *os externum* is the lower orifice of the cervix, and is slightly

where on the free surface it is goblet-shaped without cilia. The gland cells are cuboidal and non-ciliated. In the lower third of the cervical canal, as well as upon the external surface of the portio vaginalis, the epithelium is squamous, like that of the vagina. The cervical secretion is a clear tenacious mucus having an alkaline reaction.

The *muscularis* constitutes the greater part of the thickness of the uterine walls. It consists of unstriped muscular fibers. The muscular wall is composed of three layers; but they can only be distinguished at or near the end of pregnancy. The center and inner layers are very thin. The middle layer comprises the bulk of uterine muscle.

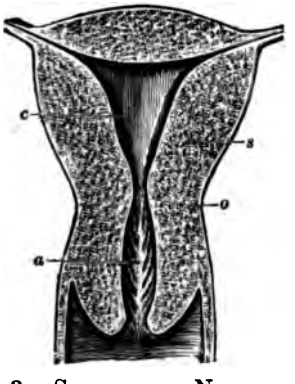


FIG. 3.—SECTION OF NULLIPAROUS UTERUS, SHOWING THE SHAPE OF CORPOREAL AND CERVICAL CAVITIES.

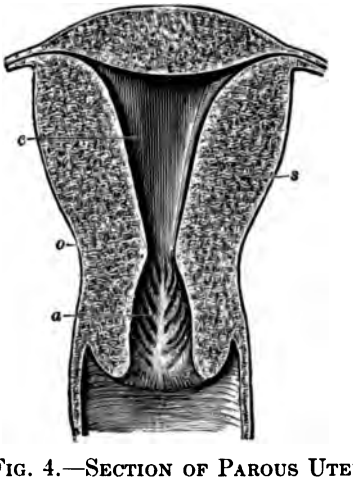


FIG. 4.—SECTION OF PAROUS UTERUS, SHOWING THE SHAPE OF CORPOREAL AND CERVICAL CAVITIES.

The *outer layer* consists mainly of longitudinal fibers. These are continuous with the muscular layers of the Fallopian tubes, the ovarian, round, and uterosacral ligaments.

The *middle layer* is composed of a network of interlacing longitudinal and circular muscle bundles which make up the greater part of the uterine muscle wall.

The *inner layer* is made up of extremely thin circular muscle bundles. It surrounds the orifice of the Fallopian tubes and forms a sphincter at the os internum.

The *cervix* consists mainly of connective tissue. A well-marked band of circular muscular fibers exists in the cervix at the vaginal junction.

The Peritoneal Coat.—The uterus is partially enveloped in a transverse fold of pelvic peritoneum, which invests the upper portion of the uterus, extending over the entire length of the organ posteriorly and to the isthmus anteriorly.

oping a few muscular fibers, extending one on either side of the median line, from the uterus to the bladder. The space between them is the *anterior cul-de-sac of Douglas,* or the *uterovesical space.*

The round ligaments are two flattened musculo-fibrous cords attached to the cornua of the uterus just in front of the Fallopian tubes. Each ligament passes upward, forward, and outward through the inguinal canal, and there becomes lost in the tissues of the mons veneris and the labia majora. The muscular fibers come from the uterus. Their length is 10-12 cm., or 4-5 inches. An artery and vein pass through each. The round ligament, when passing into the inguinal canal, recovers a peritoneal sheath, which is usually obliterated during development; when it persists it is called the *canal of Nuck.*

The uteropelvic ligaments are bands of muscular fibers in the base of each broad ligament running outward from the uterus to the pelvic wall. These are the principal lateral supports of the uterus.

The Arteries.—The arterial supply of the uterus is from the two uterine and the two ovarian vessels. They are remarkable for their frequent anastomoses and for the tortuousness of their course. The uterine artery is a branch of the internal iliac artery, while the ovarian is given off from the aorta and reaches the uterus at the level of the cornua. Both pass between the folds of the broad ligament. The uterine artery enters the base of the broad ligament; it passes under the ureter about one-quarter of an inch from the supravaginal cervix, and reaches the uterus just above the vaginal junction, then up along the lateral border of the uterus to the cornua, where it anastomoses with the ovarian artery. The uterine artery, in its tortuous course up the side of the uterus, sends off numerous arterial tufts, whose branches penetrate the muscle and form spirals within the uterine walls, which break into a capillary network supplying the endometrium and end in a meshwork of capillaries about the utricular glands. Other branches from the uterine artery run in the anterior and the posterior walls, but do not cross the median line of the uterus, nor do they anastomose with the corresponding arteries from the other side. The circular artery surrounds the cervix at the isthmus, and unites the uterine arteries of the opposite sides with each other.

The circular artery is made up from the anastomosis of the anterior and posterior branches of the uterine arteries given off at the isthmus.

The cervicovaginal artery is given off from the uterine just before it reaches the uterus. This supplies the lower part of the cervix and the upper part of the vagina. At the junction of the uterine with the ovarian, a fundal and a tubal branch are given off. The artery of the round ligament, which is a small one, is a branch of the vesical given off at the internal abdominal ring. It anastomoses at the cornu [illegible] nd ovarian.

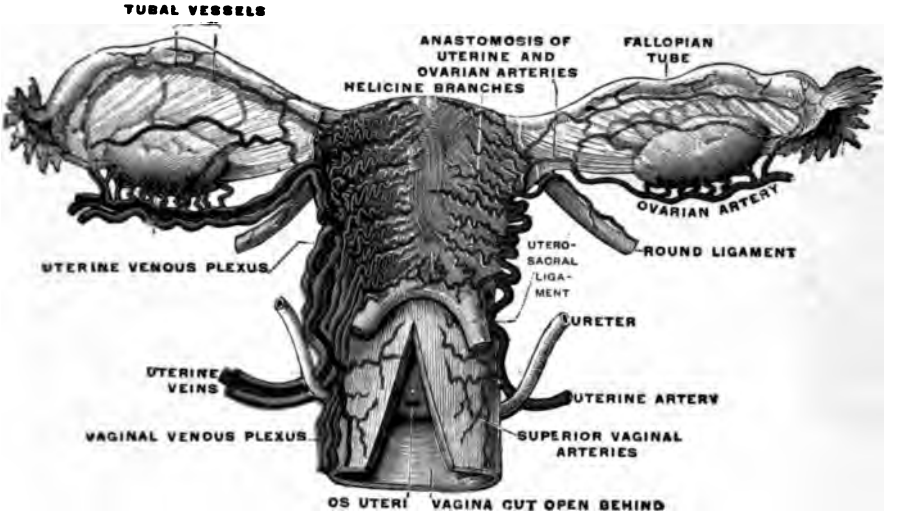
THE VEINS.—The [illegible] veins lies immediately beneath the peritoneal coat [illegible] and extends between the folds of broad ligaments. The vei[illegible] very large and form plexuses and sinuses in the middle mu[illegible]r coat and are encircled by muscular bundles. They anastomose with the vaginal and the vesical plexuses. Their outlet is the hypogastric vein and the pampiniform plexus from the ovary.

THE LYMPHATICS.—The lymphatics are very numerous in the body of the uterus, and they communicate with the lymph spaces of the mucous membrane and of the muscular coat, and form with the latter a network of vessels, just beneath the peritoneal coat, which communicate with those of the Fallopian tubes. The uterine lymphatics are fully developed only during pregnancy. Two or more of the lymphatics of the body of the uterus empty into the upper hypogastric group of glands. Most of the lymphatics of the uterine body empty into two large vessels which leave the upper margin of the broad ligament to join the middle group of lumbar glands. The cervical lymphatics follow the course of the uterine arteries to the upper hypogastric and iliac glands. The lymphatics from the upper third of the vagina pass to the lower hypogastric glands.

The nerves of the uterus are [illegible] hypogastric and the spermatic plexuses of the sympathetic system and from the third and fourth sacral nerves. [illegible] terminate

The Fallopian Tubes [illegible] are

PLATE I



UTERINE CIRCULATION

ligament for an inch to an inch and one-half; from here on they take a tortuous course, passing above, then external to, and finally beneath the ovary, partially surrounding it. The right is a little longer than the left. The oviducts serve to convey the ovum from the ovary to the uterus.

DIVISIONS.—(a) The *isthmus* is the inner third of the tube. As the tube runs outward from the uterus, it expands gradually, from 2 mm., or 1/12 inch, to 4 mm., or 3/16 inch, in diameter.

The *ampulla* makes up about one-half the length of the tube, and extends from the isthmus to the neck. It is the dilated portion of the tube next beyond the isthmus; its diameter is about 1 cm., or 1/3 of an inch.

The *neck* is the constricted part of the tube between the ampulla and the infundibulum.

The *infundibulum, fimbriated extremity,* or *pavilion,* is the free trumpet-shaped end of the tube, the margin of which is fringed with fine processes called *fimbriæ.* The fimbriæ, four or five in number, vary in size; one is longer than the others, and is attached to the ovary; it is called the *fimbria ovarica.* At the pavilion the tube abruptly expands to about 2 cm., or 3/4 of an inch in diameter.

The *ostium uterinum* is the opening of the tube into the uterus and is 1 mm., or 1/25 of an inch, in diameter.

The *ostium abdominale,* or *externum,* is the constricted opening at the neck, and is four times as large as the ostium uterinum. It will admit a small goose-quill 5 mm. in diameter.

STRUCTURE.—Each tube is made up of three layers continuous, respectively, with the corresponding layers of the uterus.

1. The *outer,* or *peritoneal, coat* is continuous with the serous coat of the uterus and with the peritoneal fold of the broad ligament. That part of the broad ligament between the tube and the ovary is termed the *mesosalpinx.*

2. The *middle,* or *muscular, coat* is composed of an inner circular and two outer longitudinal layers of unstriped muscular fibers. The outermost layer is limited to the uterine end of the tube. The muscular coat contains a rich plexus of blood vessels.

3. The *inner,* or *mucous, coat* except in the intrauterine portion of the tube, is thrown into longitudinal folds, which become

extremely complex in the ampulla. Like the uterus, it has no distinct submucous layer, and, like the uterus, it is lined by columnar ciliated epithelium. The mucous membrane is continuous with that of the uterus and at the outer end blends with the peritoneal covering of the tube. *This makes the peritoneal cavity of the female open to direct external infection by continuity through the vagina, uterus, and tubes.*

THE ARTERIES of the Fallopian tubes are from the branches of the uterine and the ovarian arteries.

THE VEINS open into the *pampiniform*, or *ovarian, plexus*, lying between the folds of [illegible] below the tube.

THE LYMPHATICS jo[illegible]e body of the uterus and the ovary and empty into the lum[illegible]lands.

THE NERVES are derived from [illegible]terine and ovarian plexuses.

The Ovaries.—The ovaries in the female correspond to the testicles in the male.

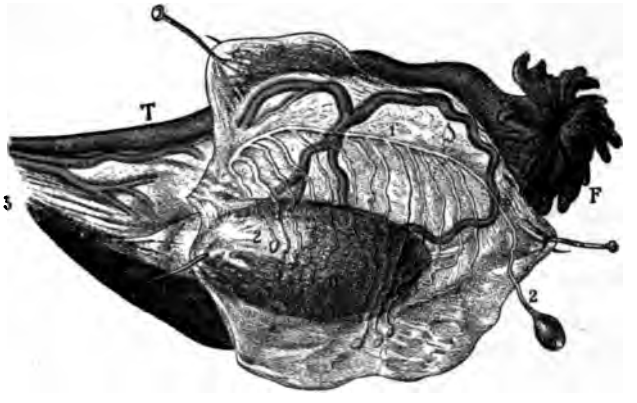
SITUATION.—These organs, two in number, are located one on each side of the uterus and are in the posterior fold of the broad ligament in a shallow, crescent-shaped fossa, an inch or more below the level of the iliopectineal line. They are about one inch from the uterus, to which they are attached at the cornua by the ovarian ligament.

SHAPE.—The usual shape of the ovary is a *flattened ovoid;* its free border is convex; its anterior edge, or *hilum,* is nearly straight. The ovary is thinnest at the hilum, thickest at the convex border. The inner end is pointed and merges into the ovarian ligament, which connects it with the uterine cornua; the outer is more obtuse and bulbous. The shape is variable, and the ovary enlarges during menstruation and pregnancy.

SIZE.—The average ovary is 3.5 cm. or 1½ inches long, by 2 cm. or ¾ inch wide, and 1.2 cm. or ½ inch thick, and weighs about 100 grains (6.5 grams). The size and weight increase during menstruation and pregnancy.

STRUCTURE.—1. *External.*—In early age the external surface is smooth, of velvety softness, and of a pinkish or grayish pearly color. After puberty it gradually becomes uneven and wrinkled in appearance, owing to cicatrices from ruptured Graafian follicles. Its color now is pearl-gray. In old age it becomes smaller, harder, and paler in color. The free surface of the ovary is covered with a

PLATE II



OVARIAN AND TUBAL CIRCULATION

T. Fallopian tube
F. Fimbriated extremity of same
O. Ovary
1. Remnant of Wolffian duct
2, 2. Remnants of cecal tubes of Wolffian bodies
3. Ovarian ligament

modified peritoneum. The epithelium is columnar and non-ciliated, the germinal epithelium of Waldeyer.

2. *Internal.*—The stroma is made up of connective tissue, elastic fibers, and a few unstriped muscular fibers.

The *tunica albuginea* is a dense layer of stroma immediately underlying the germinal epithelium, or the ovarian surface.

The *zona parenchymatosa* is the cortical portion of the ovary. It has a grayish color.

The *zona vasculosa*, or *medullary zone*, is the portion about the hilum, of a reddish color, at which the blood vessels, nerves, and lymphatics enter.

The *ovarian ligament*, 0.5 mm., or 1/5 inch, in width, and about 2.5 cm., or 1 inch, long, extends from the cornua of the uterus to the inner end of the ovary, between the folds of the broad ligament. Its origin is posterior and inferior to that of the tube. It is made up of connective tissue and smooth muscle fibers from the outer muscular layers of the uterus.

The *arterial supply* of the ovary is from the branches of the ovarian artery which enter the hilum.

THE VEINS issue from the hilum, and correspond to the arteries. The veins empty into the pampiniform plexus.

THE LYMPHATICS empty into the lumbar glands with those of the body of the uterus and tube.

THE NERVES are from the ovarian portion of the inferior hypogastric plexus.

The Graafian Follicles.—The Graafian follicles are the sacs in the cortical layer of the ovary in which the ova are developed. The follicles are developed from the germ epithelium in the stroma by the outgrowth of connective tissue. Each follicle usually contains but one ovum. The number of rudimentary Graafian follicles at birth is from 50,000 to 70,000 for each ovary. At any time during the child-bearing period, ten to twenty follicles may be found in different stages of development upon the ovarian surface. The mature Graafian follicle is 1/100 to 1/16 inch in diameter.

STRUCTURE.—The constituent parts of a Graafian follicle are: 1. The theca folliculi. 2. The tunica granulosa, a multiple layer of polyhedral epithelium. 3. The discus proligerus, or germinal eminence, a heaped-up mass of cells of the membrana granulosa

at one side, containing the ovum. 4. Liquor folliculi, a clear albuminous fluid.

The Parovarium.—The parovarium consists of a series of 10 to 20 tubules, running between the folds of the broad ligament from the ovary toward the ampulla of the Fallopian tubes. It is the remains of the Wolffian body.

CHAPTER II

REPRODUCTION

The process by which a species perpetuates itself is known as *reproduction*. The laws of this process govern all forms of living matter. These laws themselves vary in many details, even among the vertebrates, but in the higher mammals and man they are carried out with striking uniformity. If we were required to select the most fundamental principle involved in the reproduction of these higher forms, and, for that matter, of the vertebrates in general, we should at once concede that it depends upon the conjugation of two sexually different elements, namely, a female element, the ovum, and the male element, the spermatozoön. From this starting point we should be led to inquire into the nature and history of these two elements, particularly their structural character and physiological peculiarities.

THE OVUM

Structurally the ovum is a typical cell, the largest found in the human body, with the exception of some of the larger nerve cells in the brain and spinal cord. It has a spherical form (Fig. 5a) and measures from 0.15 mm. to 0.2 mm. in diameter. Surrounding its generally granular *cytoplasm* is a thick *cell-membrane,* while near the center is a large, vesicular *nucleus.* Another outer investment is added to the cell, and this, because of its pale appearance on section, is called the *zona pellucida.* On closer study this zone represents a series of parallel striations extending from its outer to its inner surface, which, because of their radial arrangement, constitute the *corona radiata.* In reality these striations are minute canals, through one of which the spermatozoön makes its way into the ovum. The cytoplasm of the ovum has certain peculiarities. It is coarsely granular and less translucent than in most cells, for this particular cell has to carry with it a very considerable amount of foodstuffs to meet the demands of

nutrition in the early stages of development prior to the time when it establishes a permanent base of supply in the parent host. The coarse granules are fatty and albuminous compounds, which

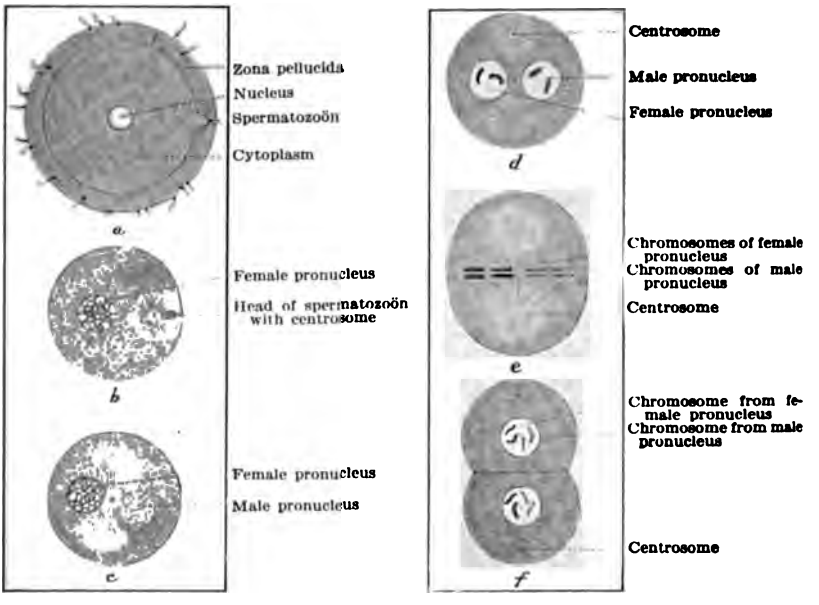


FIG. 5.—DIAGRAM SHOWING FERTILIZATION OF THE OVUM. (The somatic number of chromosomes is four.)

serve as food, and hence are known as *deutoplasm.* In the human ovum their distribution is not even; many of them are clustered about the nucleus and the rest scattered throughout the remainder of the cytoplasm.

The nucleus has a distinct *nuclear membrane,* which incloses the *nuclear sap,* the *chromatin,* the *achromatic network,* and a single *nucleolus* or germinal spot. Ameboid movements have been observed in the nucleolus of the fresh human ovum, but their significance is little understood. A centrosome, although probably present, has never been observed in the human ovum.

THE SPERMATOZOÖN

The male element differs in certain striking particulars from the ovum. Although it is a cell, it has become so highly modified

as to make us overlook this essential character of its structure. As a result of its specialization, the spermatozoön has acquired a type of motility without which it could not fulfill its office in reproduction. Structurally it presents a head, a middle piece, or body, and a tail (Fig. 6).

A. The Head.—This portion of the male germ cell is 3 to 4 micra long and half as broad; seen on the flat it is oval in outline, while on edge it is pear-shaped, with the small end directed forward. The head represents the nuclear portion of the cell. A thin layer of cytoplasm, however, surrounds the nucleus, forming what is known as the *galea capitis,* or *head cap,* while the free edge of this latter forms the *acrosome,* or *apical body.* In many species the acrosome is drawn out into a hook-shaped or corkscrewlike prolongation, called the *perforatorium,* whose function appears to be that of perforating the cell-membrane of the ovum.

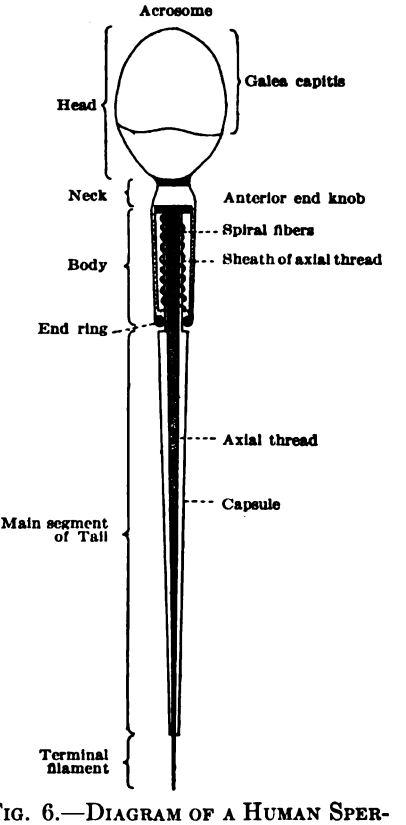


FIG. 6.—DIAGRAM OF A HUMAN SPERMATOZOÖN (after Bonnet).

B. The Body.—The body of the human spermatozoön is about as long as the head. It has a cylindrical form. In the majority of mammals a short neck connects the head with the body.

C. The Tail.—The tail varies in length in different animals. In the human spermatozoön it is from 40 to 50 micra long. It consists of an axial filament surrounded by a thin sheath of cytoplasm. Near its tip the tail is devoid of any cytoplasmic covering. This portion is called the terminal filament.

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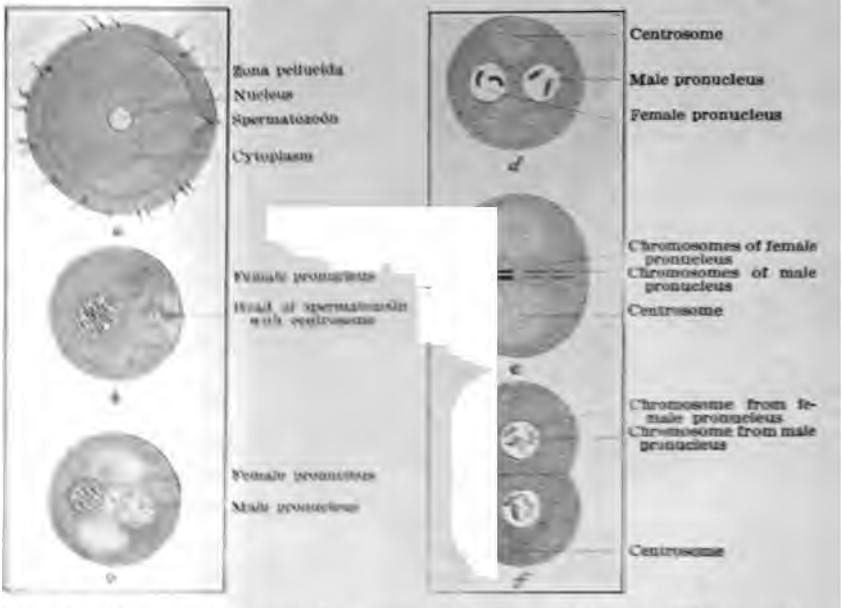

FIG. 3. DIAGRAM SHOWING FERTILIZATION OF THE OVUM. (The somatic number of chromosomes is four.)

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THE SPERMATOZOÖN

The male [illegible] particulars from ovum. [illegible] highly modified

the several organs and system of organs of the body itself. For this reason they are called the *somatic* or *body cells.* A much smaller number is allotted to an entirely different course; they show but little differentiation and resemble closely the original cell from which they sprang. These are the *germinal,* or *sex cells,* and it is to them that the responsibility of perpetuating the species is delegated. The germinal cells multiply less rapidly than do the body cells, but, as they grow in number, they become collected into a definite area of the developing individual. At first this area is relatively large and diffuse, but later on it becomes distinctly circumscribed, until it forms a well-defined organ, called the *gonad,* or *sex gland.* It seems to be the chief function of the *gonads* in the early stages to gather the sex cells together in one locality and there supply them with proper nourishment. Subsequently the gonads afford the sex cells a place in which to develop and mature. So that, in the female, the gonad becomes the ovary and in the male, the testis. In its inception, then, the male sex cell differs little from the female sex cell, and it is only at that critical phase in which the gonad in the one case becomes the ovary and in the other the testis that differences first make their appearance. If we carefully scrutinize these differences of development in the male and female sex elements, we will see at once that they are more apparent than real, and we must soon convince ourselves that the evolution of the ovum, on the one hand, and the spermatozoön, on the other, have a common ground-plan. Although these two cells differ so greatly in their final appearances, they have passed through fundamentally the same processes of development, and their differences depend upon certain adaptations which fit ovum and spermatozoön respectively for the functions which they have to perform.

Oögenesis and Spermatogenesis.—After the germ cells have been collected in the ovary or in the testis, they must undergo certain critical changes before they actually become ova or spermatozoa. The most essential of these changes has to do with the number of chromosomes or chromatin segments in the nuclei of these cells. It has long been known that the nuclei in the *body* or *somatic cells* of different species differ in the number of the chromatin segments. Thus, in man, it is 24, in the rat 24, in the ox, 16, etc. The original germ cells resemble the somatic cells

Considered as a cell, then, the spermatozoön presents a *nucleus* contained within the *head*; the body represents the centrosome; [illegible] protoplasm is found in the acrosome and sheath of the tail. The other parts of the spermatozoön, namely, the tail and the [illegible] are accessory portions which have been acquired in the [illegible] of bringing the male element into contact with the ovum and also of affording a preliminary attachment between the two. [illegible] functions performed, the acrosome and tail disappear, leaving the head and body as the *parts essential to fertilization*. The [illegible] length of the human spermatozoön is 50 to 60 micra. Although characterized [illegible] spermatozoön does not present [illegible] typical activity [illegible] after its formation. In [illegible] of the testis it is not m[illegible] but in the semen its tail [illegible] flagellate movements. Th[illegible] spermatozoön, under normal [illegible] retains its motility in the seminal fluid, as well as in [illegible] of the female genital tract. It is able to travel at an [illegible] speed of 1.5 to 3.5 mm. per minute, and at this rate [illegible] through the uterus and oviduct, although the ciliary wave [illegible] passage seems to be directed against its progress. [illegible] vitality of the spermatozoön in the female genital tract has [illegible] satisfactorily estimated. In one reported case of double [illegible] living spermatozoa were found in the tubes three [illegible] weeks after coitus.

PREPARATION OF THE SEX ELEMENTS

[illegible] Development of Germinal and Somatic Cells.—Recog[illegible] the sexual elements neces[illegible] into their history, with [illegible] how these special cells [illegible] development of the body, so that [illegible] reproducing the particular [illegible] and thus, as has been [illegible] immortality upon each [illegible]

[illegible] process of cell differen[illegible] process is called [illegible] part in forming

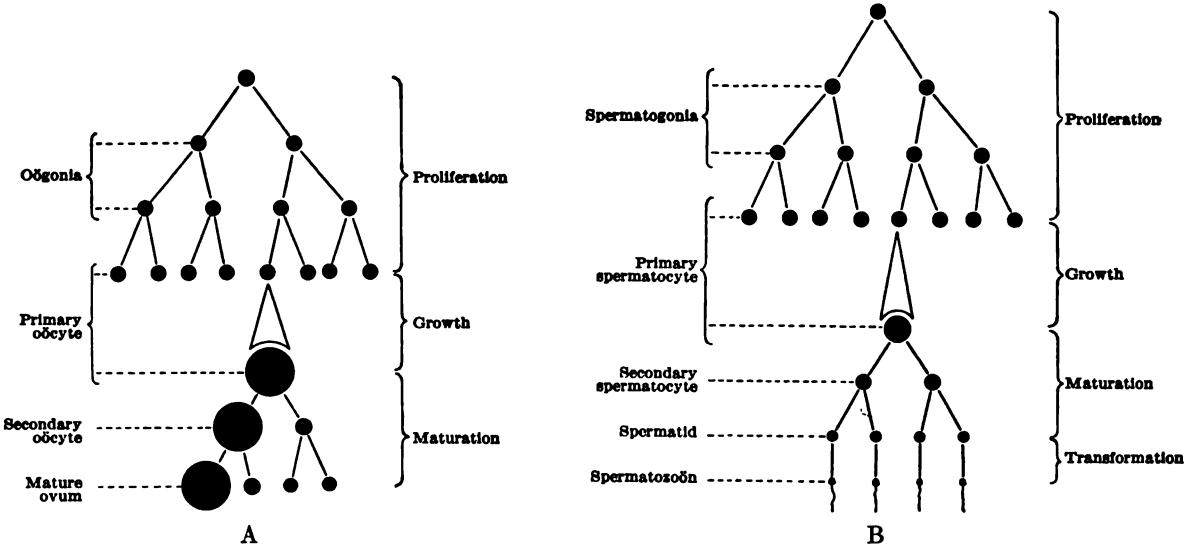


FIG. 7.—DIAGRAMS REPRESENTING THE MATURATION OF (A) THE FEMALE SEX CELLS AND (B) THE MALE SEX CELLS (Bailey and Miller, modified from Boveri).

one from each dyad, passing [illegible] accompanied by a small mass of cytoplasm. The [illegible] two chromatin rods, or chromosomes, [illegible] number of this species. These chromosomes [illegible] the center of the cell again, forming [illegible] and the ovum ready to combine with the [illegible] said to be [illegible]. In many forms maturation [illegible] before [illegible] of the ovum from the Graafian [illegible] carried [illegible] the passage through the Fallopian [illegible]. In the human [illegible] it is probable the greater part of [illegible] takes place [illegible]. The female germ cell before [illegible] is termed [illegible] ovum. After the formation of the first polar body [illegible] the primary oöcyte, while after the second polar body [illegible] is called the secondary oöcyte.

[illegible] is the process in the male germ cell which [illegible] oögenesis. It has as its object the reduction of the [illegible] one-half the species number. In addition to this [illegible] certain peculiarities of form and function [illegible] is the ultimate [illegible] of the spermatozoön. This process takes place in the seminiferous tubules [illegible]. The stratified epithelium of the tubules [illegible] presents two distinct kinds of cells: (1) The [illegible] cells of Sertoli, and (2) the [illegible] the male sex cells or spermatogenic cells [illegible] arranged in the more active portions of the [illegible]. Upon the basement membrane [illegible] cells whose nuclei stain deeply [illegible]. The next stratum toward the lumen is [illegible] larger oval cells with large vesicular nuclei [illegible] bordering upon the lumen is a layer of [illegible] contain closely packed chromatin [illegible]. Scattered among the spermatids [illegible] spermatozoa, either free in the lumen or [illegible] in the Sertoli cells. The latter cells [illegible] membrane to the lumen of the tubule [illegible] the same rate of development in all [illegible]. Sections of any one tube will [illegible] stages of spermatogenesis, while adja-[illegible]

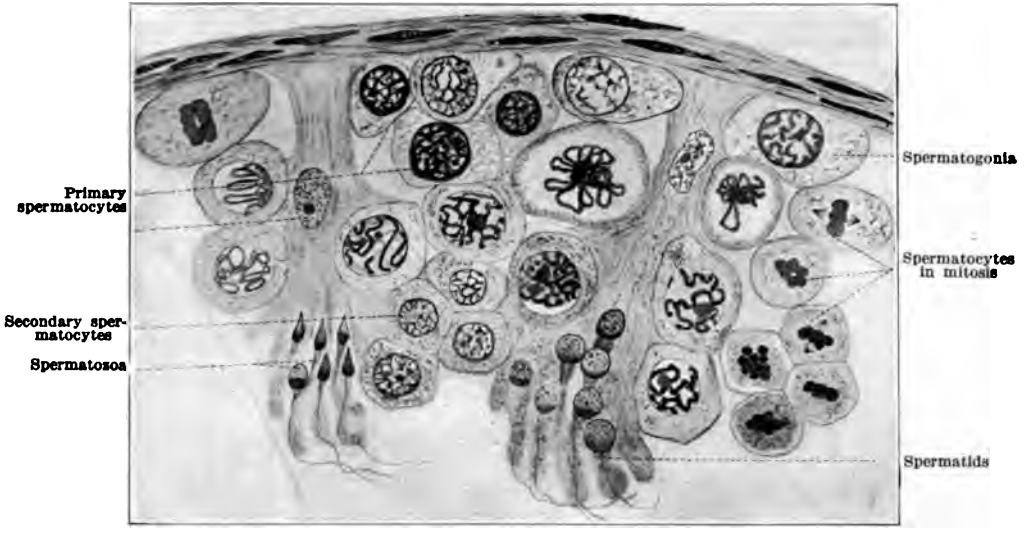


FIG. 8.—VERTICAL SECTION OF SEMINIFEROUS TUBULE IN MAN, SHOWING SPERMATOGENESIS (after Retzius).

tozoa. The spermatogonia multiply by ordinary mitosis, and this process is constantly going on during the maturity of the individual. Many of the spermatogonia cease to proliferate and enter upon a period of growth. When they attain a size considerably larger than the cells from which they spring they are known as *primary spermatocytes.* From this point the further divisions of the spermatocytes are concerned with the reduction of the number of chromosomes in the nucleus. In other words, a process of maturation, which, as in the case of the ovum, reduces the chromatin segments to one-half the species number (Fig. 7B). Certain peculiarities have been described in this process as it is observed in man and other forms. Not all of the primary spermatocytes mature in the same way, and, as a result of this, sex differentiation is determined. Some of the male sex cells acquire two *accessory chromosomes* during maturation. These spermatozoa give rise to female offspring, while the spermatozoa which develop without the accessory chromosomes give rise to male offspring. In this manner sex is determined in the male germ cell, while the female germ cell plays no part in sex differentiation.

In recent years much study has been devoted to the question of sex determination. This problem has been approached by means of three principal methods: 1. Experiments in the influence of external conditions, as affecting the germ. 2. Experiments on the heredity of sex and sex-limited characters. 3. Microscopic studies of the sex cells. Some important facts have been brought to light by this last method. It has been proved beyond question that the male and female sex cells show a distinct difference in the number of their chromosomes. In most animals there are two types of spermatozoa and but one type of ova. In a few species there are two types of ova and only one type of spermatozoa. In both of these varieties one sex is *digametic* and the other *homogametic.* In man the male sex cell is *digametic;* that is to say, some of the spermatozoa will produce females and some males. The spermatozoa which are capable of producing females have two extra or accessory *chromosomes* in their nuclei. Those spermatozoa giving rise to males have no *accessory or sex chromosomes.* The human ova are also without sex chromosomes. The accessory chromosomes make their appearance during the maturation of the sperm-

When the spermatid is formed the cell soon begins to assume the structural characteristics which distinguish it as the spermatozoön (Fig. 6). The nucleus, passing into the resting phase, acquires a membrane and intranuclear network; the centrosome divides completely, or assumes the dumb-bell shape; the nucleus becomes oval, and passes to one pole of the cell, forming the greater portion of the *head* of the spermatozoön. The *centrosome* enters into the formation of the *middle piece* or *body*. From the more peripheral of the two centrosomes a long delicate thread grows out, the *axial filament*, which is surrounded by a sheath of cyptoplasm to form the *tail*. The cyptoplasm surrounds the head, and, forming the acrosome, is the remnant of the more abundant cyptoplasm of the spermatid. When the spermatozoön is fully developed it lies free in the seminiferous tubule.

In order that convention of ovum and spermatozoön may be accomplished, it is necessary for the two sex elements to leave the ovary and testis, respectively. The spermatozoön follows a relatively simple course in its egress. After passing out of the seminiferous tubule, it enters the rete testis, is carried through the epididymis and vas deferens as far as the seminal vesicles. Here it encounters the secretions poured out by the vesicles and for the first time becomes motile. Its previous transportation has depended upon the ciliary movement of the various tubes through which it passes. From the seminal vesicles it makes its way to the prostatic urethra through the ejaculatory ducts, and is finally expelled from the penile urethra during the act of ejaculation.

Ovulation and Menstruation.—The mode of egress of the ovum from the ovary is a more complicated process. It consists of a periodic discharge of the female sex cell from the Graafian follicle and is known as *ovulation*. In man, the primates, and some of the higher mammals, it has long been considered that menstruation and ovulation are synchronous. Menstruation is the regular periodic discharge of blood and mucus from the uterus, accompanied by certain changes in the uterine mucosa. It is probably more correct to consider these two processes as closely associated and yet occurring quite independent of each other. It is known, for instance, that, whereas the two phenomena usually occur every twenty-eight days, fertilization may occur during lactation, when menstruation is normally suspended; again, young

girls have become pregnant before the establishment of their menstrual periods, and the same is true in some instances of women long after the menopause. The ovum extruded from the Graafian follicle normally passes into the fimbriated end of the Fallopian tube, and thence into the uterus. In some cases the ovum remains in the tube and develops after fertilization; or, if it chances to escape into the abdominal cavity, it may there become fertilized and give rise to an abdominal pregnancy. Both of these occurrences are known as *ectopic gestation*. At the time when the ovum

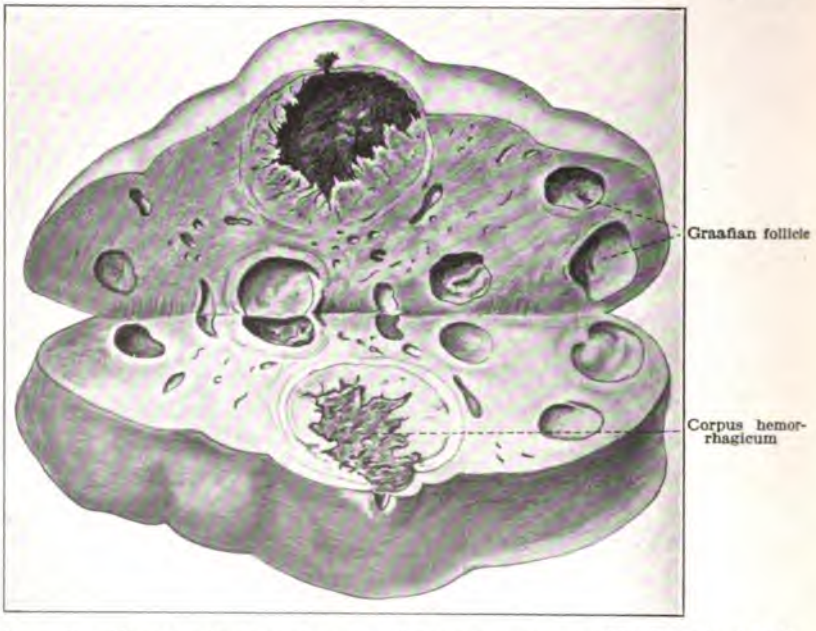


FIG. 9.—HUMAN OVARY OPENED LONGITUDINALLY (Kohlman's Atlas).

lutein cells. By absorption and degeneration the corpus luteum gives place to a whitish body, the *corpus albicans,* which later is replaced by a small scar of fibrous tissue. After ovulation not followed by fertilization, the corpus luteum attains its greatest development in about twelve days. In a few weeks it has almost entirely disappeared. If fertilization occurs after any particular ovulation, the corpus luteum becomes much larger, reaches its maximum at the fifth or sixth month of pregnancy, and is still present at the end of the pregnancy. This has led to the somewhat arbitrary distinction of designating the corpus luteum of pregnancy as the *true corpus luteum,* and that of menstruation as the *false corpus luteum.* As a matter of fact, there are no actual histological differences between them.

FERTILIZATION AND CLEAVAGE

In man and the higher mammals only one spermatozoön gains entrance into the ovum, and the only parts which actually enter are the head and middle piece, the latter portion carrying in the centrosomes. Once within the ovum the head of the spermatozoön assumes the appearance of a typical nucleus and is known as the male pronucleus, while the nucleus of the ovum is termed the female pronucleus. These two pronuclei draw closer together, their nuclear membranes disappear, and the chromosomes intermingle. Fertilization is then said to have taken place (Fig. 5). An amphiaster is formed, and the chromatin segments take up positions in the equatorial plane. From this time the process of ordinary mitosis is carried forward.

The mitosis immediately following fertilization results in the formation of two cells, each of which gives rise to two other cells, and so on. This multiplication of cells is known as *cleavage,* or *segmentation.* The mass so formed is called the morula, or mulberry, while the cells forming it are called the blastomeres. In the cleavage of mammals, two general laws are found to hold true:

1. Each cell tends to divide into equal parts.
2. Each division plane tends to intersect the preceding division plane at right angles. After the formation of the morula, the next step in mammalian development is a differentiation of the

superficial layer. In this way a single layer of surface cells is formed surrounding a solid mass of cells. The latter soon acquires a cavity by vacuolization. At this stage the ovum presents a central cavity, an outer covering, or trophoderm, and an inner cell mass.

FORMATION OF THE GERM LAYERS

of the former. The space formed in this manner is the *amniotic cavity.* It is roofed in by the trophoderm, while its floor is the inner cell mass, which has now become arranged as a distinct layer, and indicates the position of the embryonic disk. From this disk the embryo will develop. The disk, as studied in the dog and bat, consists of two layers, the outer layer, or ectoderm, which has just become differentiated, and the inner layer, or entoderm, which made its appearance at a somewhat earlier stage. The first sign of development observed in the embryonic disk is the differentiation of an opacity near its posterior margin. As the disk grows, an opaque line or streak extends forward from the first opacity along the median line. This corresponds so nearly to the conditions observed in the chick that it seems correct to liken the linear opacity to the primitive streak. At its anterior extremity this streak has a club-shaped enlargement, which corresponds to Hensen's node in the chick.

The third or middle germ layer is known as the *mesoderm.* It arises in part from the entoderm and in part from the ectoderm. It first appears in the region of the primitive streak, and then, growing out in all directions, interposes itself between ectoderm and entoderm as a relatively thick layer of cells. In its subsequent development three main divisions are observed in the mesoderm: (a) That portion nearest the median line of the embryo and later to surround the neural tube, the *paraxial mesoderm,* (b) the *intermediate cell mass or nephrotome,* and (c) the *peripheral mesoderm.* This latter portion of the mesoderm is primarily a solid plate, extending outward from the intermediate cell mass, between the entoderm and ectoderm. Later this splits into two layers; the outer layer becomes the *somatic mesoderm.* It fuses with the ectoderm, and the layers thus combined constitute the *somatopleure.* The inner layer becomes the splanchnic mesoderm; it fuses with the entoderm to form the *splanchnopleure.* The split which determines the splanchnic and somatic layers of mesoderm becomes the *body cavity;* it is known as the *cœlom or pleuroperitoneal space.* The *paraxial mesoderm* is later subdivided transversely into a number of somatic or body segments. Little is known of the formation of the germ layers in man. The earliest stages have not been observed. An ovum described by Leopold shows no structure which could be interpreted as an embryonic disk. A

[illegible] older specimen of Peter's has all three layers present, [illegible] older one of Professor Spee shows a primitive groove, a [illegible] head process and neural groove.

Derivatives of the Germ Layers.—

[illegible] Ectoderm:

[illegible] The epidermis and its appendages, including the nails, [illegible] and sweat glands, the hair and epithelium of the [illegible] glands.

[illegible] mucosa of the mouth, enamel of teeth, salivary glands, [illegible] mucosa of the [illegible] bri.

[illegible] Nasal mucosa and glands.

[illegible] External auditory canal [illegible] outer layer of tympanic [illegible].

[illegible] Mucosa of anus and penile portion of male urethra.

[illegible] Conjunctiva and crystalline lens.

[illegible] Central nervous system.

[illegible] Epithelium of internal ear.

[illegible] Entoderm:

[illegible] Mucosa of respiratory and digestive tracts.

[illegible] Accessory intestinal glands (liver and pancreas).

[illegible] Middle ear and Eustachian tube.

[illegible] and thyroid glands. Parathyroids.

[illegible] Mucosa of bladder: prostatic and membranous portion of [illegible] urethra, entire female urethra.

[illegible] Mesoderm:

[illegible] All connective tissue and its derivatives, such as bone, [illegible] lymph, blood, cartilage, fibrous and areolar tissues.

[illegible] Muscular tissue.

[illegible] All endothelial cells, as in joint cavities, bursal sacs, blood [illegible] and endocardium, the mesothelium of the pericardium, pleura and peritoneum.

[illegible] kidney, ureter, testes and ducts, ovary, oviduct, [illegible] and vagina.

FETAL MEMBRANES AND IMPLANTATION

[illegible] growth of all vertebrates, except fishes and am- [illegible] accessory and extra embryonic

structures. These structures are necessary to the embryo, for they not only afford it protection, but play an important rôle in supplying it with food, and carrying off its waste products. They are called the *fetal membranes*, and, as such, include (1) the *amnion*, (2) the *chorion*, (3) the *allantois*, and (4) the *yolk sac* and *umbilical cord*.

In man the fetal membranes are characterized by the high development of a portion of the chorion participating in the formation of the *placenta*, the early appearance of the amnion, and the rudimentary condition of the yolk sac and allantois.

The Amnion.—The earliest stages of this membrane in the human subject have not yet been observed. Many facts point to the probability that it is formed in the same manner as in the bat, dog, and other animals already studied. By a process of vacuolization a single layer of ectodermic cells is delaminated from the inner cell mass, giving rise to a relatively large cavity between the dorsum of the embryonic disk and the amnion. This is the *amniotic cavity*. As the disk bends ventrally inward, it carries the amnion with it, until the cavity of the latter completely surrounds the embryo. The amnion itself, at this time, is attached only ventrally in the region of the developing umbilical cord. By the third month the amniotic cavity has so much increased in size that it is now in contact with the outer membrane or chorion. It consists of two layers of cells, an inner ectodermic layer and an outer mesodermic layer. Under normal conditions the amniotic cavity contains a thin watery fluid; this is slightly alkaline, contains one per cent. of solids, composed chiefly of urea, albumin, and grape sugar. The source of fluid is not known. Normally its quantity varies from two pints to two quarts. If excessive in amount, the condition is termed *hydramnios*. If scanty, the amnion often forms adhesions to the embryo, and thus produces malformation. Even if the normal amount of amniotic fluid is present, fibrous bands often stretch across the cavity, and, in many cases, cause such deformities as splitting of the lip or nose, or amputation of an extremity. The amnion, with its contained fluid, serves to aid dilatation of the cervix in the first stage of labor. When dilatation is nearly complete, the amnion ruptures, and the greater portion of the fluid escapes. This is known as the "breaking of the membranes," or the "coming away of the waters." Some of the

fluid usually remains in the amnion and escapes after the delivery of the child. In some cases the amnion ruptures at the beginning of labor, and the dilatation must then be accomplished by the presenting part. This is called a "dry labor." In rare cases the amnion does not rupture at all, and the child is born within a bag of intact membrane. Under such circumstances the child is said to be born with a "caul."

The Chorion and Decidua.—The ovum becomes fertilized in the Fallopian tube. It then enters the uterine canal and attaches itself to the mucosa on the upper part of the dorsal wall of the uterus. In some cases this attachment is established with the mucosa of the oviduct, thus causing the form of ectopic gestation known as "tubal" pregnancy. In other instances the attachment is delayed until the cervix uteri is reached, and, in this way, as will be seen later, determines one of the most serious complications of labor, called *placenta prævia.*

Once in the uterus the fertilized ovum comes to rest upon the mucosa. Prior to this, however, it has advanced in its development to such a degree that it is now surrounded by an outer covering or membrane, the *chorion.* This structure is of ectodermic origin. It is composed of an outer layer of epithelial cells, the *trophoderm,* and an inner layer of somatic mesoderm. This membrane is thought to possess the special function of eroding the uterine mucosa, and excavating a small depression into which the ovum makes its way. The mucosa of the uterus has also been preparing itself to receive the ovum. The essential nature of this preparation is a thickening of the *stratum compactum,* and the development of a specialized mucosa, which is cast off at the time of labor, hence the name decidua. After the ovum has buried itself in the mucosa, an *entrance plug,* consisting of coagulum, desquamated cells, and fibrin, marks the site of the crypt in which it lies. Almost immediately following the attachment of the ovum the mucosa undergoes changes, which vary somewhat with reference to the relation they bear to the ovum in different areas. Thus the mucosa upon which the ovum rests is the *decidua basalis* or *serotina;* that covering the surface which projects into the uterine cavity the *decidua capsularis* or *reflexa;* while that lining the rest of the uterine cavity is the *decidua parietalis* or *vera.* The *decidua parietalis* extends to the internal os of the uterus, where it

ends abruptly, there being no decidua formed in the cervix. In the superficial layer the uterine glands disappear and their place is taken by the proliferation of the connective tissue elements of the stroma. During the latter half of pregnancy the decidua parietalis becomes very thin and much less vascular.

The *decidua capsularis* has essentially the same structure as the decidua parietalis. At about the fifth month the rapid growth of the embryo, with its membranes, has filled the uterine cavity, and the decidua capsularis, which surrounds the embryo, is pressed against the decidua parietalis at all points. Ultimately it disappears or fuses with the decidua parietalis.

The *decidua basalis* is that portion of the mucosa to which the chorion frondosum becomes attached, thus forming the placenta. It is evident, therefore, that the organ called the placenta has a double origin, one part coming from the chorionic membrane of the embryo (fetal portion), the other from the decidua basalis of the uterine mucosa (maternal portion).

The chorion, as already stated, forms the outer covering of the embryo. At a very early period there grow out from this covering a great number of delicate processes, called *chorionic villi.* At first they consist of projections from the ectoderm alone. Later the mesoderm grows into them, forming a core in each, and thus affording it support and vascularization. When the ovum has imbedded itself in the uterine mucosa the villous processes show a distinct difference in their behavior. Those in contact with the decidua basalis grow rapidly to form the *chorion frondosum,* which gives rise to the fetal portion of the placenta; those which are not in contact become atrophic and finally disappear; these form the *chorion læve.*

The *chorion frondosum* consists of two layers which are not sharply separated:

(a) The compact layer, which lies next to the amnion and consists of connective tissue.

(b) The villous layer, which consists of chorionic villi. These structures branch rapidly, forming a tree-like system of projections, which presents secondary and tertiary villi. Each villus is covered by a double layer of epithelium, an outer or *syncytial layer,* called the *plasmoditrophoderm,* and an inner layer, the layer of Langhans, or *cytotrophoderm.* The epithelium of the

villus surrounds a core of mesoderm. Toward the end of the third week this mesoderm assumes the characters of embryonic connective tissue, and in it are vascular channels which connect with the allantoic arteries and veins. In this manner the fundaments of the placental circulation of the embryo are laid down.

In the later months of pregnancy the villi lose their distinct epithelial covering and appear to be invested only by a thin homogeneous membrane of a syncytial nature. Certain of the uterine cells become unusually large, giving rise to the so-called *decidual cells.* Late in pregnancy they assume a brownish color. They vary in size from 30 to 100 micra. As each villus grows it makes a space for itself in the uterine mucosa, probably by a process of erosion. This space is always larger than the villus which is growing into it, and ultimately it forms a spacious sinus or blood space, filled with maternal blood. Into this sinus the villus projects and so becomes bathed in the blood of the mother. Some chorionic villi float free in these blood spaces; these are the *floating villi;* others are attached to the uterine mucosa; they are the *fastening villi* (Fig. 10). Connective tissue septa separate the villi into groups or lobules; the septa are the placental septa, and the lobules constitute cotyledons.

The decidual cells and chorionic villi are of much importance as proof of pregnancy in cases requiring diagnosis from scrapings of the uterus.

Branches of the arteries in the muscular wall of the uterus pass to the decidua basalis. Smaller branches empty into the intervillous spaces, and thus bring the maternal blood into contact with the villi. The wall of the villus always serves as a barrier which prevents the direct passage of the mother's blood into that of the fetus. The interchange between the blood of the fetus and that of the mother must, therefore, depend on diffusion through the wall of the villus.

At birth the placenta is a discoidal mass of tissue, 15 to 20 cm. in diameter, 3 to 4 cm. thick, and weighing from 500 to 1,200 grms. Its connection with the fetus is by means of the *umbilical cord.* This cord in man is a tortuous, bluish-gray structure, 50 cm. long and 1.5 cm. thick. Great variations in its length have been observed. Its disposition during pregnancy is of great importance. It may become coiled about the fetus and so prevent growth or

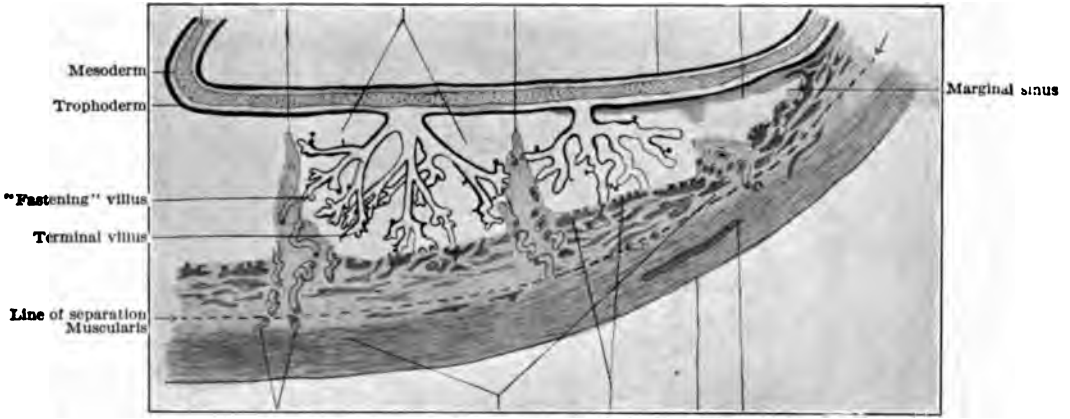


FIG. 10.—DIAGRAMMATIC SECTION OF PLACENTA (Strake, Bonnet).

produce deformities. It may also cause a serious dystocia during birth. The umbilical cord is invested by the amnion, and consists of a substantia propria (Wharton's jelly), three umbilical vessels (two arteries and one vein), and remnants of the allantois and yolk stalk (Fig. 11).

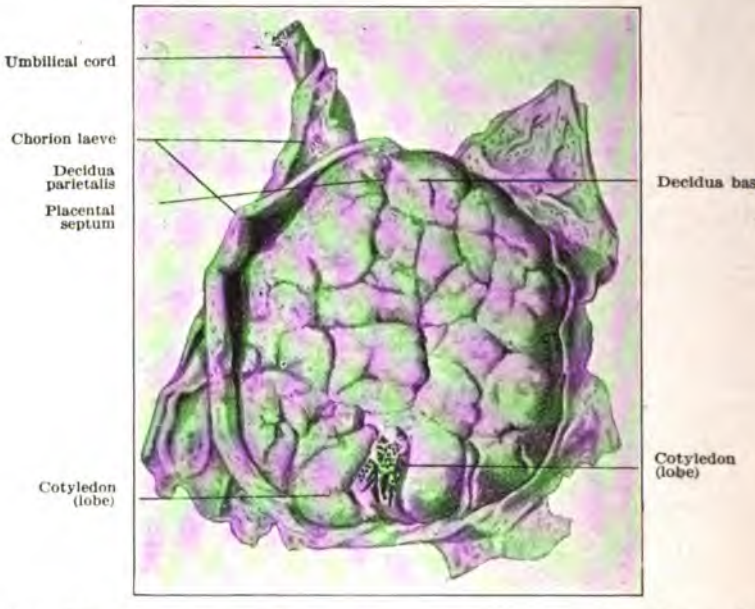


FIG. 11.—PLACENTA AT BIRTH, SEEN FROM UTERINE SIDE (Bonnet).

Shortly after birth the uterine contraction usually expels the placenta and membranes. The line of separation of the placenta is through the deeper portion of the spongy layer of the decidua basalis.

Numerous anomalies in the formation of the placenta occur. The villi may give rise to an *annular placenta*. Persistency of the chorion læve causes a thin *placenta membranacea;* this type of placenta is usually very adherent, and thus causes trouble after labor. The development of the villi, in groups or patches, gives rise to *polycotyledonary placenta*. Two partially separated placentæ are called *placenta* [illegible] *tita*. Two completely separated placentæ are termed *plac*

plex. Placenta succenturiata is the condition in which a small accessory lobule develops, and is connected with the main organ by blood vessels, while an accessory lobule without vascular connection is called *placenta spuria.*

The yolk sac in the early stages is a large vesicle which communicates freely with the intestinal canal. As the body wall of the embryo develops, this connection becomes more and more restricted, and finally only a small canal marks the original passageway. When the placenta is formed the yolk sac becomes imbedded in it, while remnants of its stalk are found in the umbilical end. *Meckel's diverticulum* is the persistence into post-natal life of the connection between the intestine and the umbilicus by means of the yolk or vitelline canal. Occasionally the umbilicus remains patent, in which event feces make their escape at this point; this condition is called *congenital fecal fistula.* The allantois is a second and later saccular evagination from the intestinal canal. It arises from that portion of the canal which forms the urogenital sinus. In birds and reptiles it serves both as a respiratory organ and receptacle for the emunctories. In man its function is at most but transient and rudimentary. The extra-embryonic portion of the allantois becomes incorporated as an atrophic remnant in the umbilical cord; its intra-embryonic portion forms the urachus of the adult. In rare cases this last structure, which extends from the summit of the bladder to the umbilicus, remains patent and so allows the escape of urine from that point. This is called *congenital urinary fistula.*

DEVELOPMENT OF THE EXTERNAL FORM OF THE BODY

It is customary to describe the development of the external form of the body in three stages. The *first stage,* or *blastodermic stage,* in man includes the first and second weeks of intrauterine life. The *second,* or *embryonic stage,* extends from the second to the fifth week. The *third,* or *fetal stage,* comprises the remainder of the period of gestation. In the blastodermic stage the ovum acquires the form of a hollow sphere. One of the youngest ova described in this period is that of Peters, in which the vesicle measured 1 mm. in diameter. It had a well-formed chorion; on section the *embryonic* disk was found to be present and measured

0.19 mm. This was in relation dorsally with the amniotic cavity, and ventrally with the yolk sac.

The feature of the embryonic stage is the infolding of the disk in such a way as to outline the future body wall. In addition to this, the central nervous system is foreshadowed by the appear-

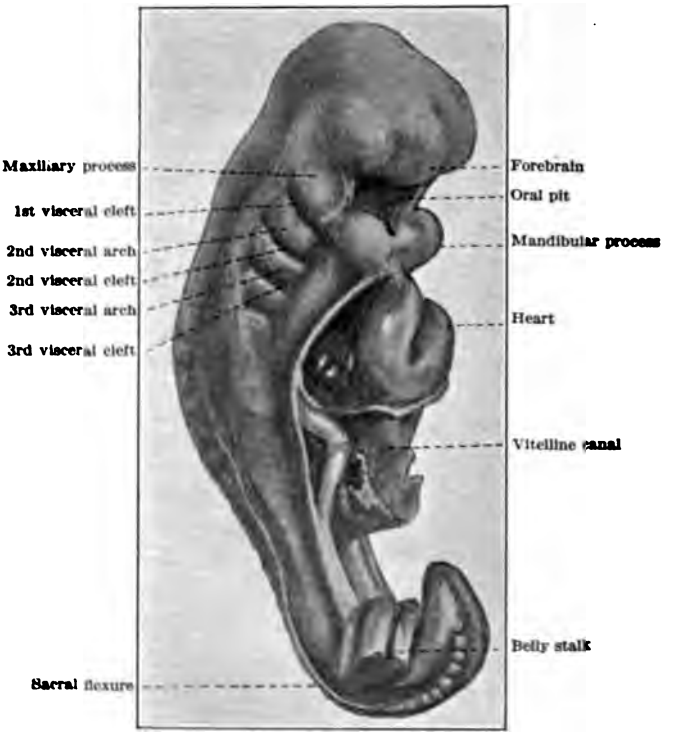


FIG. 12. HUMAN EMBRYO OF THE THIRD WEEK (His).

ance of the neural groove extending from the cephalic to the caudal pole of the embryonic disk. This groove is bounded by the neural folds. These folds are higher and more prominent at the head end of the embryo. The neural folds become still more prominent until they meet and fuse across the median, in this way giving rise to the neural tube. This entire structure is derived from the ectoderm. It gradually becomes depressed below the surface of the disk and the surface ectoderm grows over it. At the cephalic

extremity of the neural tube there soon appear three dilated vesicles—the forebrain, the midbrain, and the hindbrain. From these the entire encephalon develops. A depression in the surface ectoderm, between the forebrain and the large ventral protrusion of the cardiac vesicle, marks the position of the future mouth. This is the *oral pit.* During the third week the lens vesicles and otocysts develop. Later these elements give rise to important portions of the eye and ear. At about this time, also, certain more or less parallel ridges appear along the side of the embryo at the junction of the head and trunk. These ridges are the *visceral arches,* or bars. They are separated from each other by well-marked depressions, the *visceral clefts* (Fig. 12). These are often spoken of as *gill clefts.* By the twenty-first day the fundaments of the limbs appear as buds or sprouts from the trunk. A large ventral projection between the yolk sac and the forebrain marks the position of the heart.

As late as the twenty-first day the embryonic body is straight. By the twenty-third day it begins to show certain flexures of its long axis. The most anterior of these is the *cephalic,* or *head flexure,* which corresponds to the position of the future sella turcica. A second flexure occurs in the neck region and is called the *cervical flexure.* Further caudad there appear the less prominent *dorsal* and *sacral* flexures.

So much of the development of the head depends upon the changes in the *visceral arches* that it is necessary to follow their history somewhat in detail. The morphological significance of these arches is best understood in the light of some of the lower forms. In birds and mammals the number of the clefts between the arches is four; in fishes it is five, and, in some cases, six. The arches and clefts in all aquatic animals constitute the gills, or branchiæ. During the course of evolution the necessity for gills became diminished, as the habits of air-breathing were acquired. Under these conditions the gills became rudimentary in function and were transmitted to the terrestrial animals merely as transient remnants of an aquatic ancestry.

Each arch consists of a dense core of mesoderm, covered on the outside by ectoderm and on the inside by entoderm. In the mesodermic core is an artery, the *visceral artery.* Each visceral cleft presents a depression between two adjacent arches. The depression

From the inside appears as an out pocketing of the entoderm t
the pharynx. These pockets are therefore referred to as
pharyngeal pouches, or *throat pockets*. The two contiguous l
of cells, the ectoderm on the outside, the entoderm on the in
which prevent communication between the pharynx and th
terior, constitute the *closing membrane*.

Although these visceral arches and clefts are transmitte
the higher vertebrates as vestiges, the metamorphosis of their
damental structures plays an important rôle in the differenti
of the body. The first arch divides into two limbs to form
maxillary and mandibular or jaw arches. The cartilaginous fr
work of the mandibular arch is known as *Meckel's cartilage*
not only aids in the forming of the mandible, but participat
the development of the malleus, and, perhaps, the incus (Fig.

The second arch contains *Reichert's cartilage*, which gives
to the stapes, the styloid process, the stylohyoid ligament,
lesser cornu of the hyoid bone.

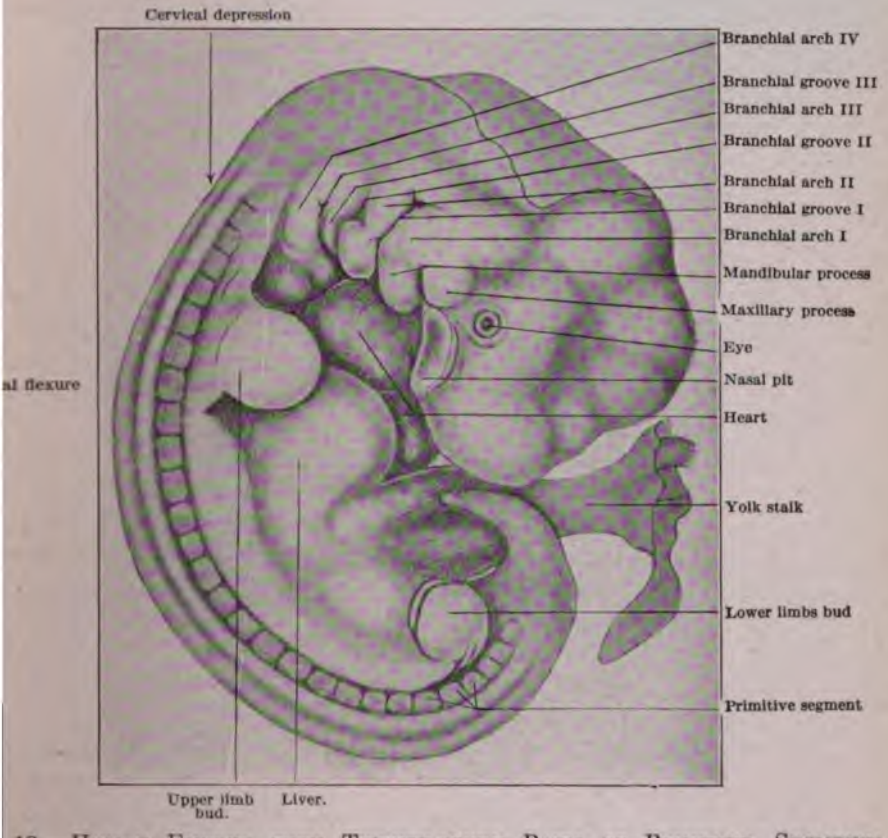
The third arch becomes the body and greater wing of
hyoid bone.

Of the ectodermic clefts, the first, in part, forms the exte
ear. The remaining three clefts disappear. These latter, toge
with the corresponding arches, sink in, to form a deep fossa in
neck, the *sinus præcervicalis*. Occasionally this sinus persists
thin layer forming its bottom ruptures, and so produces wh
known as *cervical fistula*. Such a fistula establishes an ope
into the esophagus.

The inner or entodermic pouches give rise to certain def
structures. The first pharyngeal or entodermic pouch bec
metamorphosed into the middle ear and Eustachian tube; the
ing membrane, which separates it from the outer cleft, forms
tympanic membrane.

The second entodermic pouch gives rise to the posterior t
of the tongue. From the third entodermic cleft develops
thymus, while the fourth gives rise to the thyroid gland.

The first branchial arch plays an important rôle in the d
opment of the face. As already stated, the cephalic flexure
duces the oral pit, situated between the forebrain and the h
This depression at first has no lateral limits, but, subseque



13.—Human Embryo with Twenty-seven Pairs of Primitive Segments (7 mm., 26 days) (Mall).

through the development of the first arch, it acquires the boundaries which determine the mouth cavity. Soon after its appearance the first arch gives rise to two processes, the cephalic, or *maxillary process,* and the caudal, or *mandibular process.* The maxillary process is the anlage of the upper jaw, while the lower

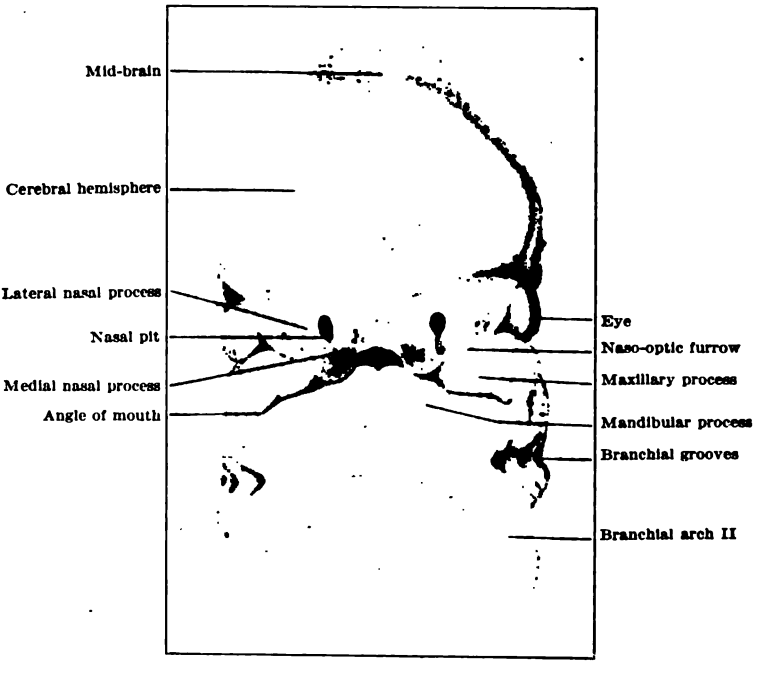


FIG. 14.—VENTRAL VIEW OF HEAD OF 11.3 MM. HUMAN EMBRYO (Rabl).

jaw arises from the mandibular process. The cleft or interval between these two processes is in part closed in by the cheek, while the median portion remains as the orifice of the mouth. The two mandibular processes grow rapidly, and finally fuse with each other across the median line, to form the mandible. While the two maxillary processes approach each other, their fusion across the median line is not as complete as in the case of the mandibular processes, and a process of mesoderm grows ventrally from the medial portion of the forebrain region, the *nasofrontal process* (Fig. 14). This process comes in contact laterally with the maxillary process

of either side. Along this line of contact there is left a furrow extending obliquely to the region of the optic vesicle, known as the *naso-optic furrow.* At this period the oral fossa is a deep depression bounded cranially by the nasofrontal process, caudally by the mandibular processes, and laterally by the maxillary processes. The

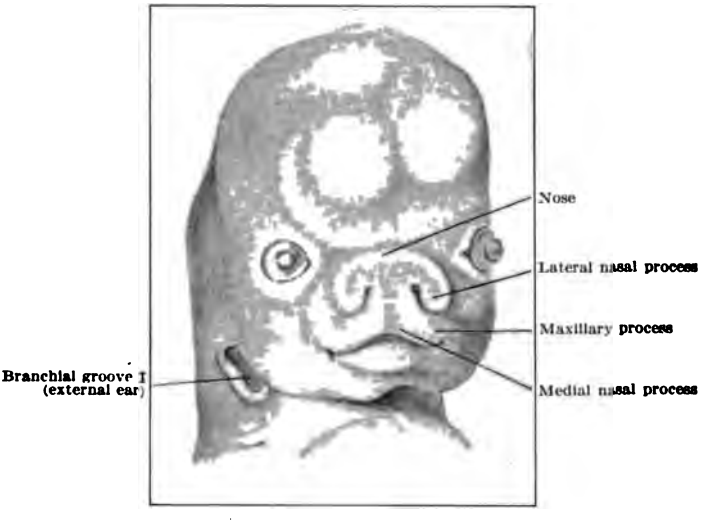


FIG. 15.—VENTRAL VIEW OF HEAD OF HUMAN EMBRYO OF EIGHT WEEKS.

next change of note in the development of the face is the appearance of two secondary projections in the nasofrontal process. One of these projections is lateral in position, the *lateral nasal process,* the other medial, the *medial nasal process* (Fig. 14). Between these two processes is a depression, the *nasal pit.* The maxillary process grows inward and fuses with the lateral and medial nasal processes (Fig. 15). In this region of the face, however, the maxillary processes do not fuse across the median line, since the more medial portion of the nasofrontal process interposes itself as the intermaxillary portion of the maxilla. Failures of fusion may occur between the maxillary, medial, and lateral nasal processes, leading to the malformations known as *hare-lip,* or *cleft palate.* This faulty fusion may only concern the medial nasal and maxillary process, thus causing a hare-lip. It may involve the hard palate, as well, and produce cleft palate, or the entire naso-optic furrow

may persist, and so occasion a cleft extending from the mouth through the nose and into the orbit.

The limb-buds appear in the human embryo at the beginning of the fourth week as small protuberances from the ventrolateral surface of the body. The upper extremities appear earlier than the lower. By the sixth week the upper extremity is divided into

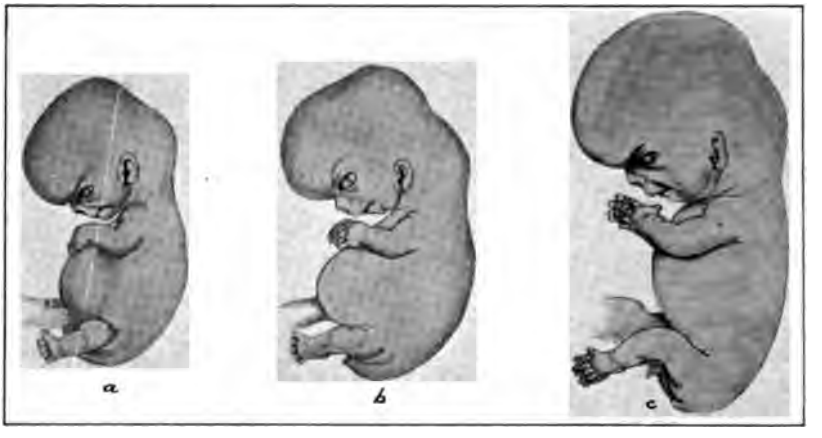


FIG. 16.—HUMAN EMBRYOS OF 47–51 DAYS (a), 52–54 DAYS (b), and 60 DAYS (c) (after His).

an arm, forearm, and hand; the lower extremity is divided into a thigh, leg, and foot (Fig. 16).

During the sixth week the head more nearly assumes its normal position; the anlagen of the eyelids and external ear appear. The fingers become recognizable as separate outgrowths, while in the seventh week the nails make their first appearance. In the third month the face becomes definitely formed; thick lips, a small chin, and a flat, triangular nose are present. The limbs are well formed and in characteristic positions. The fingers and toes are still imperfectly covered by nails. Sexual distinctions may now be observed in the external genital organs. In the fourth month a fine growth of hair, called lanugo, covers the scalp and some parts of the body; the intestines protrude less from the abdomen, and the anus opens. The fifth month is signalized by the inauguration of fetal movements.

THE MATURE OVUM (AFTER RUNGE)

A. Uterine wall	E. Chorion
B. Placenta	F. Amnion
C. Umbilical cord	G. Fetus
D. Decidua	H. Amnial liquor

Other features characteristic of the different periods of gestation will be found tabulated at the end of this chapter.

Normal human embryos in the fresh condition are more or less transparent, so that such structures as the heart and liver may be seen through the skin. This transparency is lost if the embryo has been long dead or is the subject of pathological changes. The average weight of the human fetus is 6 to 7 pounds, males weighing 10 ounces more than females. The average length is 20 inches.

Several methods have been devised to estimate the age of the fetus from its length. The results of the two methods here cited are not absolutely correct in every given case.

According to Haas' method, (a) the length of the fetus in centimeters equals the square of the age in months, up to the fifth month; (b) after the fifth month the length in centimeters equals the age in months multiplied by five.

By Malls' method, for embryos of 1 to 100 mm. in length, the age in days is fairly accurately expressed in the following formula: $100 \sqrt{\text{length in mm.} \times 100}$. In embryos between 100 and 220 mm. the age in days is about the same as the length in millimeters.

ORGANOLOGY

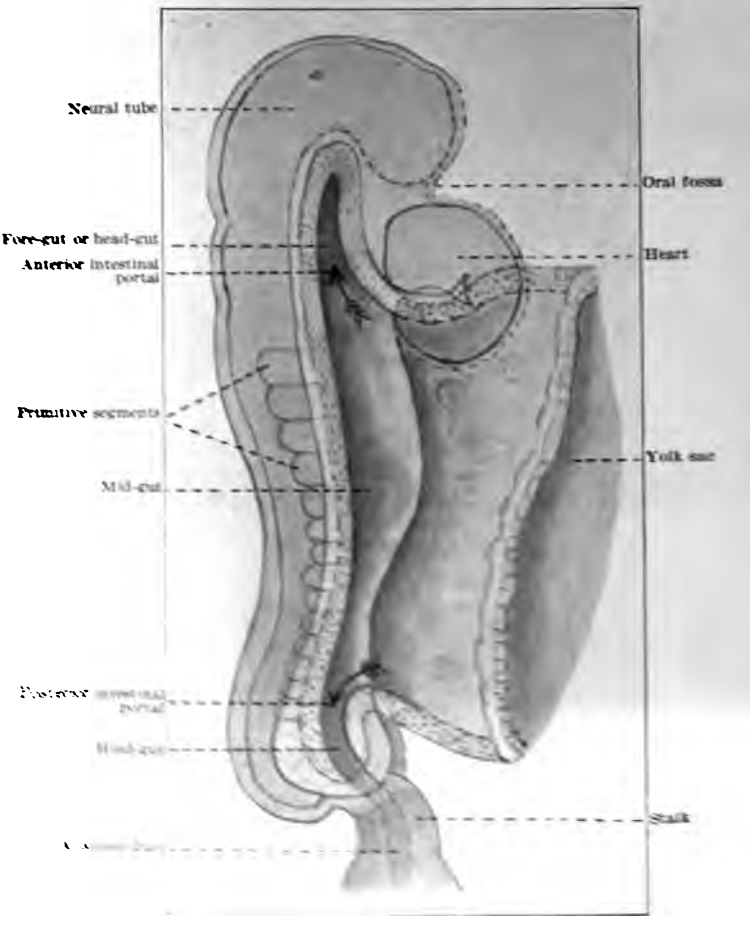
THE GASTROINTESTINAL SYSTEM

The gastrointestinal system in the adult consists of the following divisions: 1. The mouth with its accessory organs, the teeth, tongue, and salivary glands; 2. The pharynx; 3. The esophagus; 4. The stomach; 5. The intestines with their adnexal glands, the liver, and pancreas; 6. The voidance apparatus consisting of the rectum and anus.

Complex as this system appears in the adult, in its primitive condition it has the form of a single, straight tube extending from the head to the tail end of the embryo. It is closed at either end but presents a narrow, slit-like opening which affords communication with the yolk sac.

The development of the alimentary canal depends upon certain modifications in the splanchnopleure, which, as we have already seen, is a thin layer of cells formed by the fusion of the splanchnic mesoderm and entoderm. At first this layer forms a large ovoid

sac whose long axis is parallel with that of the embryonic body. Very early, however, this sac becomes so divided, by the folding



14 PAIRS OF PRIMITIVE

together con-

embryonic tube and

tube is the *gut*

The tube lies dor-

sal of the sac and communicates with the latter by means of a long, slitway opening, the *Vitteline duct.* In the head region the communication between the tube and the sac is gradually lost and the gut tract appears as a simple tube called the *head-gut,* which opens into the yolk sac by what is termed the *anterior intestinal portal.* A similar process of closure goes on in the tail end of the tube to form the *hind-gut,* while this latter opens into the sac by means of the *posterior intestinal portal.* The portion of the tube between the hind and head guts constitutes the *mid-gut,* and this still retains a side communication with the yolk sac (Fig. 17).

We have seen that the cephalic and caudal ends of this gut tract are closed. The cephalic extremity rests against a depression of the surface ectoderm situated immediately below the forebrain. This depression is the *stomodeum* or *mouth pit.* Here ectoderm comes into direct contact with entoderm to form the *pharyngeal membrane,* and it is only after this membrane has ruptured that the gut tract acquires its communication with the mouth. The manner in which the caudal extremity of the gut tube acquires its communication with the exterior is quite similar to that observed at the cephalic end. In this case, also, the ectoderm of the surface comes into direct contact with the entoderm to form a thin plate, the *anal membrane.* This membrane makes its appearance at the third week, and is not situated at the exact caudal end of the tube, so that a considerable portion of the gut tract lies caudal of the membrane. This is called the *postanal gut.* By the fifth week the anal membrane has sunken inward to form the *anal pit* or *proctodeum.* The changes occurring in the gut tract in the region of the anal plate are of the greatest importance and may be summarized as follows: 1. Dilatation of the hind-gut opposite the anal pit to form the *cloaca.* 2. An evagination from the ventral wall of the cloaca to form the allantois. 3. The entrance of the ureters and Wolffian ducts into the dorsal wall of the cloaca. The cloaca has thus become a dilated portion of the hind-gut, serving potentially as a reservoir for the excrements received from the gut, which enters cephalad, and from the ureters, which enter dorsad. In addition to this, the Wolffian ducts provide a communication between the gonads or sex glands and the cloaca, while the ventral evagination giving rise to the allantois indicates an organ which, in some of the lower forms, serves both

emunctory and respiratory purposes, but which, in man, is rudimentary. The postanal gut rapidly disappears and the cloaca then becomes the actual caudal extremity of the gut tract. A transverse septum, called the *urogenital septum*, soon develops in the cloaca, and by the fourteenth week divides this part of the gut into a ventral compartment, the *urogenital sinus*, and a dorsal compartment, the *rectum*. The urogenital septum also divides the anal membrane into two portions. The portion ventrad of the septum is the orifice of the urogenital sinus and that dorsad of it is the anal pit or proctodeum proper. The area of fusion between the anal membrane and urogenital septum rapidly thickens to form the *perineal body* or *perineum*. At the fourth month the anal membrane ruptures; its persistence after birth is called *imperforate anus*.

The Mouth.—The surface ectoderm in the region between the heart and the forebrain sinks inward to form the oral pit. In the third week this pit receives its lateral boundaries by the appearance of the *mandibular arches* and the *maxillary processes*. Its roof is now formed by the *nasofrontal process*. The *pharyngeal membrane*, which separates the mouth from the gut track, ruptures at about the fourth week; prior to this, however, a diverticulum has grown out from the roof of the mouth. This is the hypophyseal pouch which will give rise to the glandular portion of the hypophysis. A ridge appears on the inner side of either maxillary process. As these ridges grow they approach each other and finally join to form the palate, thus separating the nasal from the oral cavity. The partition between these cavities is completed by the development of the intermaxillary bones. The *uvula* appears during the latter half of the third month.

The Teeth.—These structures, which may be regarded as calcified papillæ of the skin, develop from the *dental shelf* or *ridge*. On the oral surface of each ridge a series of protuberances appears corresponding in number to the temporary teeth. Each of these projections is a mass of ectodermic cells which form the *enamel sac* or *primitive enamel organ*. At about this time the dental ridge has become divided into a series of segments, corresponding in number to the enamel sacs. *The eruption of the temporary* teeth usually begins at the fifth or sixth month after

birth. The following table shows the time and order of eruption of the teeth:

Temporary Teeth

Central incisors	5½-7 months.
Lateral incisors	7-10 "
First molars	12-14 "
Canines	14-20 "
Second molars	18-36 "

Permanent Teeth

First molars	6th year.
Central incisors	7th "
Lateral incisors	8th "
First bicuspids	9th "
Second bicuspids	10th "
Canines	11th-12th year.
Third molars	17th-21st year.

THE SALIVARY GLANDS AND TONGUE.—The salivary glands develop as outgrowths from the oral ectoderm. The tongue is formed by the fusion of three elements (a) the *tuberculum impar* situated at the ventral area of the first pharynx arch, and (b) the two lateral processes. Where these three portions meet, they form a small depression, the *foramen cæcum linguæ*. This foramen marks the orifice of the thyroglossal duct which suffers obliteration during development.

The Pharynx.—In the early stages the pharynx presents itself as the dilated cephalic extremity of the gut tube. It is especially characterized by the appearance of four bilateral, symmetrical pouches, the *pharyngeal* pockets. In aquatic animals these pouches participate in the formation of the gills. In most of the air-breathing forms they undergo certain metamorphoses as follows: The first pharyngeal pouch becomes the middle ear (tympanic cavity) and Eustachian tube. From the ventromedian portion of the first pouch the middle lobe of the thyroid gland arises.

The third pouch gives rise to the thymus and the cephalic parathyroids.

The fourth pouch gives rise to the lateral lobes of the thyroid and the caudal parathyroids.

Certain masses of lymphoid tissue develop to form tonsils. The largest of these masses appears at the mouth of the second pharyngeal pouch. Other masses appear in the roof of the pharynx and about the lingual glands. The musculature of the pharynx is formed from the mesoderm surrounding the tube.

Esophagus, Stomach, and Intestines.—During the fourth week certain changes occur in the simple straight tube. The earliest and most important of these changes are: 1, the dilatation in the region of the head gut, which indicates the stomach and demarcates this viscus from the intestine and esophagus; and 2, the elongation and rotation of the intestinal portion of the gut tube. During this process the dorsal mesentery becomes the dorsal mesogastrium and the dorsal mesentery proper. Almost as soon as the stomach dilatation appears, this part of the tract undergoes rotation first on its long axis, so that the left side becomes ventral and the right side dorsal. The second rotation is on a transverse axis and, as a result of this, the caudal end of the stomach is elevated to nearly the same level as the cephalic end, while at the same time the greater and lesser curvatures make their appearance. As a result of these rotations the dorsal mesogastrium begins to grow downward to form the great omentum, and the ventral mesogastrium persists as a connection with the ventral body wall. The intestinal part of the tube is first drawn out into a U loop, which presents a cephalic and caudal limb. The caudal limb, which gives rise to the large intestine, rotates upward and crosses the cephalic limb. By this change the cecal portion of the tube is swung upward toward the stomach, thus giving definition to the following parts of the tract: 1, the cecum; 2, the transverse colon; 3, the descending colon, and 4, the small intestine. The rapid growth of the colon soon carries the cecum down into the right iliac region, while the small intestine, growing even more rapidly, fills in the space bounded on the right by the ascending colon, on the left by the descending colon, and above by the transverse colon. The development of the dorsal mesentery and the subsequent behavior of the large intestine in its relation both to the dorsal body wall and the great omentum constitute one of the most complicated processes in the evolution of the body. The student is therefore

referred to the standard text-books of embryology for a full discussion of this topic.

The Liver and Pancreas.—In the third week an evagination protrudes from the ventral wall of the gut tract in the region of the duodenum. Its cephalic portion, the *pars hepatica,* is solid, and gives rise to the liver. Its caudal portion, the *pars cystica,* is hollow, and gives rise to the gall-bladder. The evagination soon detaches itself from the gut wall with the exception of a narrow strand of cells, the anlage of the *ductus choledochus.* The pars hepatica also tends to separate itself from the pars cystica, retaining connection with it by means of a short cord of cells, the beginning of the hepatic duct. The hepatic portion grows rapidly, and in doing so comes to lie between the two layers of the ventral mesogastrium. In this way the liver, hepatic duct, gall-bladder, the cystic and common bile ducts are formed.

At about the time that the liver evagination appears, several diverticula from the gut tract may be observed which will give rise to the pancreas. Usually there are two of these diverticula, one dorsal and one ventral. Sometimes, however, a second ventral evagination is found. The dorsal diverticulum grows into the dorsal mesentery; it becomes constricted off from the gut except for a thin cord of cells, the anlage of the duct of Santorini. A little later the two ventral diverticula appear, one springing from either side of the common bile duct; the left evagination soon disappears, while the right one becomes constricted off from the ductus choledochus and retains its connection only by means of a small strand of cells, the duct of Wirsung. At the sixth week fusion of the dorsal and ventral anlagen occurs and the duct of Santorini usually disappears, thus leaving the duct of Wirsung as the permanent connecting channel with the common bile duct. The head of the pancreas is formed by the ventral anlage; the dorsal anlage gives rise to the body and tail.

THE RESPIRATORY SYSTEM

The first indication of the respiratory tract appears as a longitudinal groove or gutter extending the entire length of the primitive esophagus along its ventral surface. This is the *pulmonary groove.* It makes its appearance during the third week of develop-

ment. The groove is most pronounced at its caudal extremity. By a process of constriction, which is carried on symmetrically from one extremity to the other, the groove is converted into a long tube situated ventrad of the esophagus. Separation between the esophagus and *pulmonary tube* next occurs, beginning at the caudal extremity of the tube and proceeding cephalad. This separation, however, is not complete, so that the tube remains in communication with the gut tract at the pharyngeal end of the esophagus. Prior to the division the caudal extremity of the pulmonary tube has developed two diverticula, one extending toward the right, the other toward the lef *lung buds* or *pulmonary diverticula* from which the develop. These buds rapidly increase in size, and during th week undergo further division, with the result that the ri ud presents three branches and the left one only two. From this point the development of the lung is accomplished by a process of repeated dichotomous division in the original branches of the lung buds. The pulmonary epithelium is derived from the entoderm, while the cartilages, muscle, connective and vascular tissues have their origin in the splanchnic mesoderm. At first the sprouts appearing upon the lung buds are solid, the lumina being acquired later. The *air sacs* or *pulmonary alveoli* first appear at the sixth month, and from this time until the end of gestation the lung gradually acquires its *alveolar passages* and *infundibula*.

The Larynx.—This is the specialized, cephalic extremity of the pulmonary tube which opens into the pharynx. It serves as the organ of phonation. At the end of the fifth week two ridges make their appearance at the junction of the esophagus and pulmonary tube. These ridges extend ventrodorsad and are closely approximated in front but somewhat separated behind. They are the anlagen of the true vocal cords and the space between them is the *rima glottidis*. At this period the aperture of the larynx is situated dorsad of the three segments of the developing tongue and at about the level of the fourth branchial pouch. The *furcula*, a curved ridge, bounds the laryngeal opening in front and on the sides, at the same time separating it from the tongue. It soon develops a median elevation which becomes the epiglottis, while the extremities of the furcula give rise to *cuneiform tubercles*. The lateral portions of the furcula form the *aryteno-*

epiglottidean folds. The *thyroid cartilage* develops in two lateral halves, and is considered the derivative of the fourth and fifth branchial arches.

THE CARDIOVASCULAR SYSTEM

This system consists of the heart, the arteries and the veins.

The Heart.—According to the recent investigations of Schulte, a common ground-plan underlies the development of the heart and blood vessels. Cells from the mesostroma, between the entoderm and ectoderm, increase in number, both by division and by additions from the mesoderm. Intercellular clefts appear among these cells, while the cells themselves become flattened and thus form small vesicles in loco, which are filled with fluid. This process is observed very early in the formation of the omphalomesenteric plexus. The heart follows the same general course of development. In either lateral plate of the splanchnopleure, before infolding of the body wall has begun, and in the position of the future neck region, there appears a series of separate vesicles similar to those just described. Later these vesicles run together to form two longitudinal tubes on either side. Thus four tubes are formed, two on either side and one above the other, though, as yet, not in communication. The more caudal tubes will ultimately fuse to form the auricular portion of the heart, while the fusion of the more cephalic tubes gives rise to the ventricles. The tubes have not yet acquired a connection with the omphalomesenteric veins caudad, nor with the ventral aortæ cephalad. The two tubes on each side fuse, and then by the infolding of the body wall the right heart tube is brought into contact with the left tube; fusion between them takes place, and a single tube is formed lying practically in the median line. The caudal extremity of the tube so formed represents the auricular portion of the heart and its cephalic extremity the ventricular portion. This tube actually gives rise to the endocardium. A second tube surrounds the endocardium, and rapidly increases in thickness to give rise to the myocardium, while still external to this a third tube forms the pericardium. The further development of the heart depends upon the following changes: 1, the connection of its caudal extremity with the omphalomesenteric veins and the ducts of Cuvier; 2, the con-

nection of its cephalic extremity with the ventral aortæ; 3, the twisting of the tube in an S-shaped curve in such a manner that the auricular portion takes up a dorsal position and the ventricular portion is ventral to it; 4, the partial division of the auricular portion by the *septum primum* into a right and a left auricle—an aperture in this septum determines a communication between the two auricles, the *foramen ovale;* 5, the complete division of the ventricles by the *interventricular septum;* 6, the constriction off of the ventricle from its corresponding auricle with the formation of the auriculoventricular openings; 7, the development of the [illegible]r, the aortic, and pulmonary valves.

The Arteries.—The heart, in [illegible], forces the blood by way of two ventral aortæ into the gills [illegible]re the blood passes through a complex network of capillaries; it is aerated, collected, and finally transmitted to the body by the dorsal aortæ. This simple arrangement of a series of gill vessels arching between the afferent ventral aortæ and the efferent dorsal aortæ serves the purposes of aquatic animals. But with the introduction of air-breathing and a pulmonary system this gill type of respiration became unnecessary. With the general tendency to transform rather than to discard, the process of development makes use of these gill vessels which have been passed on to all air-breathing animals from an aquatic ancestry.

In the early stages the dorsal and ventral aortæ develop by the confluence of independent spaces until two sets of parallel vessels are formed in the head and neck region of the embryo. The ventral aortæ join the heart and presently a series of capillary plexuses begin to connect the dorsal and ventral aortæ. At this period the conditions are not unlike those of the fish. The connecting capillary plexuses have arisen as the result of a confluence of independently formed spaces, such as those described by Schulte in the development of the heart. In the interval between each branchial pouch the plexus becomes pronounced, while in the region of each pouch itself it disappears. A series of six such capillary plexuses appears in man in a more or less regular chronological order. Each one of this series is rapidly reduced to a single discrete vessel called the *branchial arch artery.* Six of these branchial arch arteries develop, and the following changes in them

give rise to the ultimate arrangement of the arterial trunks in upper thorax, neck, and head.

1. The first and second branchial arch arteries atrophy and disappear.

2. The ventral aorta on either side cephalad of the third arch becomes the *external carotid artery,* while the third arch and the dorsal aorta become the internal carotid artery.

3. The ventral aorta on either side, between the third and fourth arches, becomes the *common carotid artery.* The dorsal aorta, between the third and fourth arches, disappears.

4. The fourth arch on the left side becomes the *arch of the aorta,* and on the right side the *subclavian artery.* The ventral aorta on the right side, between the fourth arch and the *truncus arteriosus,* becomes the *innominate artery.*

5. The fifth arch is rudimentary and disappears early.

6. The proximal portion of the sixth arch on the right side is retained as the *right pulmonary artery;* its distal portion disappears. On the left side the proximal portion becomes the *left pulmonary artery,* while its distal portion is retained throughout fetal life as the *ductus arteriosus.*

7. The dorsal aorta on the right side below the third arch disappears while on the left side below the fourth arch it is retained as the *descending aorta.*

8. A spiral septum divides the truncus arteriosus into the *ascending aorta* and *pulmonary artery.*

The development of the other arteries of the body follows the same general course as those already mentioned. Because of the limited space allotted this chapter, the arteries cannot be discussed in detail here.

The Veins.—The first venous channels to appear are the *two omphalomesenteric* veins. Then follow the *two umbilical,* the *two precardinal,* and the *two postcardinal* veins. These vessels, in addition to a plexus surrounding the *mesonephros,* the *perimesonephroic* plexus, constitute the basis from which the definitive veins are evolved. The omphalomesenteric veins empty into the *sinus venosus.* The pre- and postcardinal veins, by their union in the region of the heart, form the *duct of Cuvier,* which also enters the *sinus venosus.* The *perimesonephroic* plexus gives rise to the subcardinal vein.

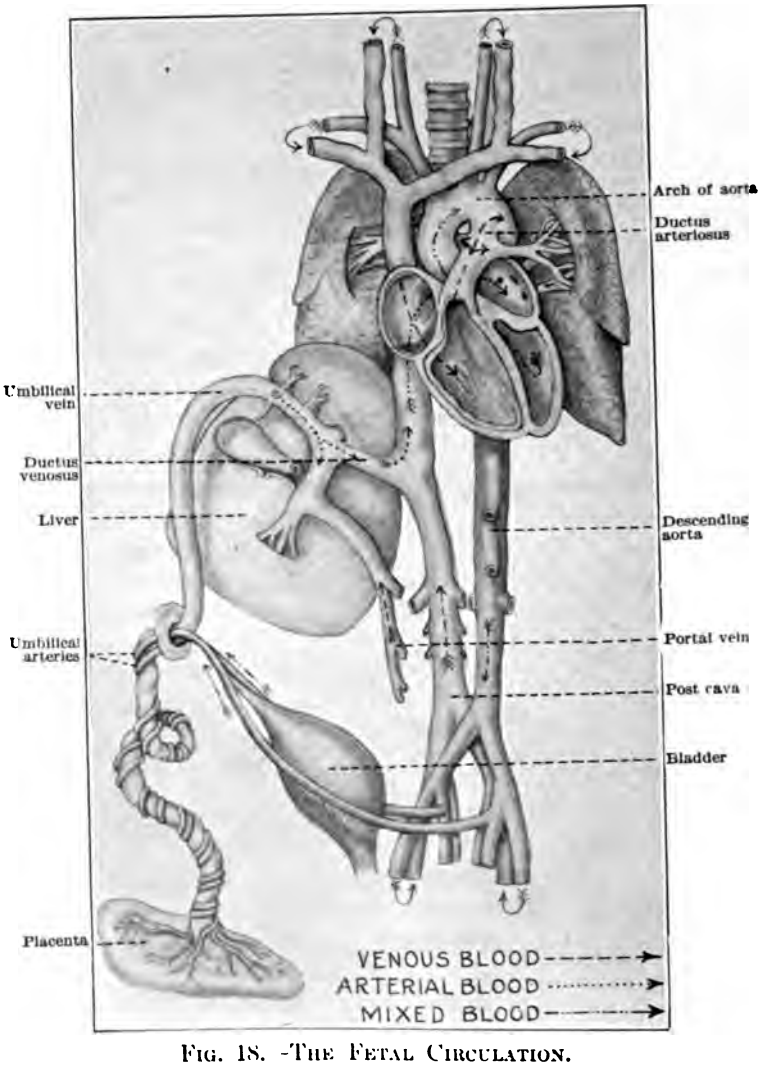


FIG. 18. -THE FETAL CIRCULATION.

In the head and neck region the precardinal veins become modified to form the adult vessels. The right vein forms the right internal jugular and innominate vein, and the superior vena cava. The left vein by a cross anastomosis forms the left innominate and jugular veins.

The postcardinal vein in its cephalic portion becomes, on the right side, the azygos major, and on the left side the hemiazygos vein. The caudal portion of the right postcardinal participates in the formation of the inferior vena cava. The left caudal portion of the postcardinal vein disappears.

The inferior cava is a compound channel consisting of parts of several primitive vessels. Its most cephalic element is the vena communis hepatica; then follow in regular order cephalocaudad, the subcardinal vein, the subcardinopostcardinal anastomosis, and the right postcardinal vein in its caudal portion.

The umbilical veins in the early stages are subequal, but the left vessel soon takes supersedence in returning the blood from the placenta. The left vein distributes the blood to the sinusoids of the liver, except for one large branch which forms an anastomosis with the inferior cava and is called the *ductus venosus.* The *portal vein* is formed by the persisting portion of the omphalomesenteric vessels. The arrangement of the vascular channels in the fetal circulation is shown in Fig. 18.

THE LYMPHATIC SYSTEM

The evolution of the lymphatic vessels, as shown by Huntington in mammals, depends upon the development of two general anlagen, i. e., the *jugular lymph sacs* and the *systemic lymphatics.* The *jugular lymph sacs* are two dilated vessels found one on either side in the neck region during the early stages of development. They are derived from the venous system. Subsequently they lose all connection with the jugular veins, but ultimately establish a secondary connection with them. During these stages they are entirely independent of the systemic lymphatics.

The *systemic lymphatics* develop by the confluence of independent mesenchymal spaces. Such of these spaces as appear along the dorsal aorta give rise to the *axial lymphatic channel* or *thoracic duct,* which develops as three independent segments, namely, the *azygos, preazygos,* and *postazygos* segments. The lymphatic channels of the outlying parts of the body constitute the *peripheral lymphatics.* The final union of the systemic lymphatics and the jugular lymph sacs determines the lymphatic system. In this manner the lymph sac serves as an intermediary in estab-

lishing connection between the systemic lymphatic and venous systems.

THE GENITOURINARY SYSTEM

In discussing a system as complicated as the genitourinary apparatus, it will only be possible to trace the simple outlines of its development in this chapter. Certain primitive organs of a

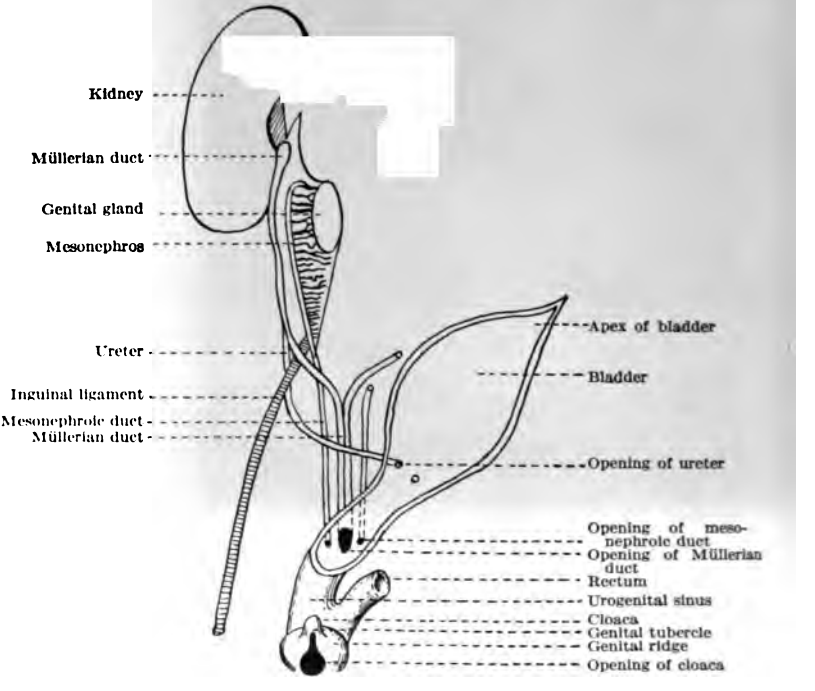


FIG. 19.—DIAGRAMMATIC REPRESENTATION OF THE UROGENITAL ORGANS IN THE "INDIFFERENT" STAGE (Hertwig).

glandular type, together with certain ducts and the genitourinary sinus, establish the foundation of this complex system. The primitive glandular structures are four in number, i. e., the *pronephros;* 2, the *mesonephros;* 3, the *metanephros;* and 4, the *gonad* or *sex gland*. The ducts are three in number, i. e., 1, the *pronephroic* or *mesonephroic duct;* 2, the *ureteric duct;* and 3, the *Müllerian*

duct. The pronephros or head kidney develops as a series of urinary tubules from the nephrotome of the neck region. In order to convey its excretions to the cloaca a long duct is provided, the *pronephroic duct.* The pronephros in mammals rapidly disappears. It is replaced by a larger organ in the abdominal region, which is likewise derived from the nephrotome. This is the *meso-*

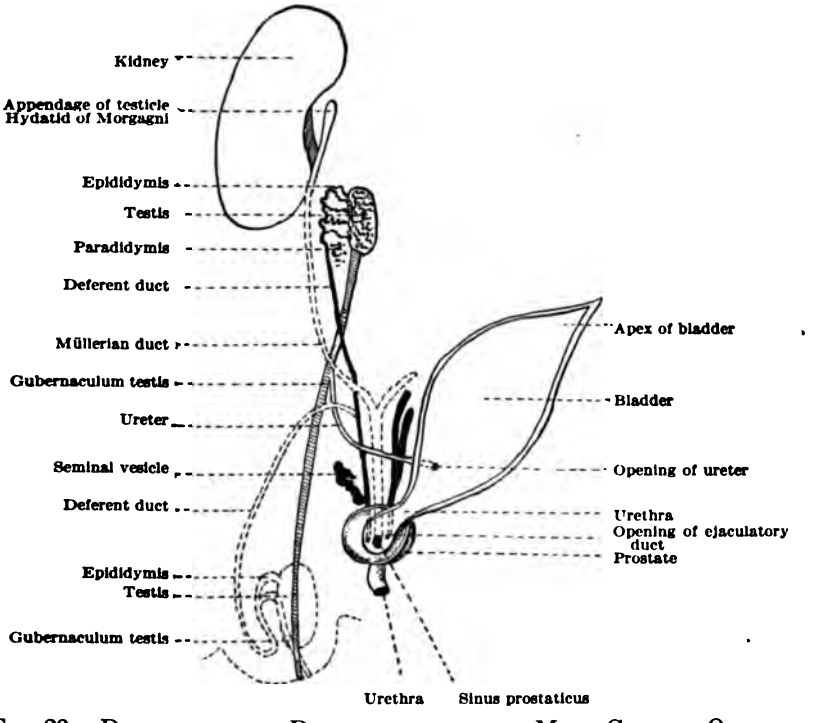


FIG. 20.—DIAGRAM OF THE DEVELOPMENT OF THE MALE GENITAL ORGANS FROM THE "INDIFFERENT" ANLAGEN (Hertwig).

nephros. The pronephroic duct, having by this time ceased to serve the pronephros, now acts as the drainage canal of the mesonephros, and is therefore termed the *mesonephroic duct.* This duct at its caudal extremity and in the region of its entrance into the cloaca develops a small sprout, the ureteric bud, which grows rapidly dorsad until it comes in contact with a mass of mesothelial cells, the *renal blastema.* Fusion occurs between this latter and

pelvis, while from the renal blastema are derived the parenchymatous portions of the kidney. On the mesial surface of the mesonephros a glandular structure develops, which is known as the *gonad* or *sex gland*. Related to this latter structure a third canal or duct appears extending from the gonad to the urogenital sinus. This is the *Müllerian duct*. In the male the gonad becomes the

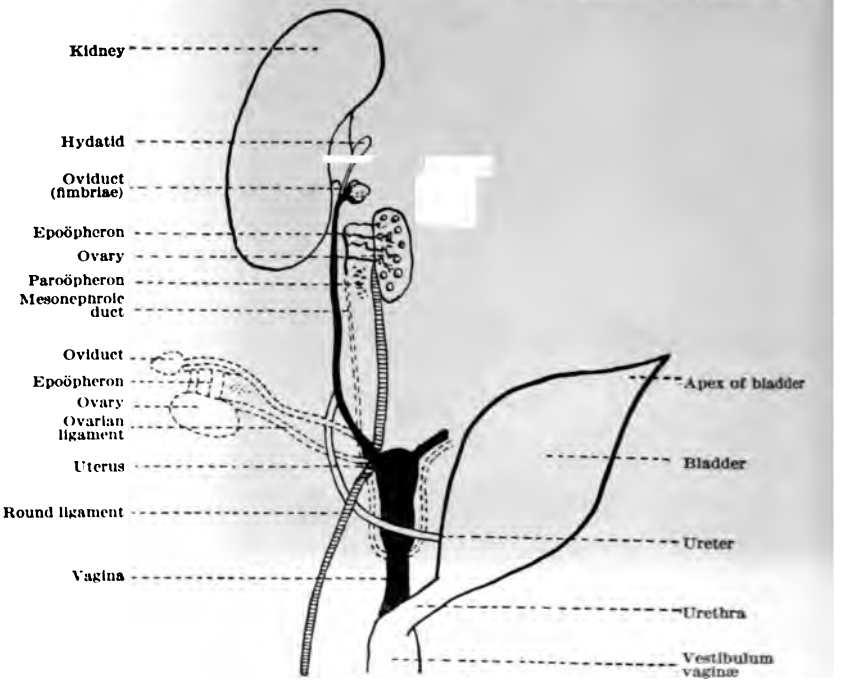


FIG. 21.—DIAGRAM OF THE DEVELOPMENT OF THE FEMALE GENITAL ORGANS FROM THE "INDIFFERENT" ANLAGEN (Hertwig).

testis, the mesonephros, in part, becomes the epididymis, and the Müllerian duct is transformed into certain vestigeal parts. In the female the gonad becomes the ovary, the Müllerian ducts become the Fallopian tubes and uterus, while the mesonephroic duct is reduced to certain vestiges. The accompanying table shows the metamorphosis in passing from the stage of indifferent sex into the conditions characterizing the male and the female (see Figs.

INDIFFERENT	MALE	FEMALE
Germinal epithelium (mesothelium).	Convoluted seminiferous tubules with spermatozoa. Straight seminiferous tubules. Rete testis. Part of stroma of testicle.	Ovarian (Graafian) follicles with ova. *Medullary cords.* Rete cords. Part of stroma of ovary.
Mesonephros: cephalic part	Efferent ductules (vasa efferentia). *Appendage of epididymis.*	*Epoöphoron, transverse ductules.*
Mesonephros: caudal part	*Paradidymis (organo of Giraldes).* *Aberrant ductules (vasa aberrantia).*	*Paroöphoron.*
Mesonephric duct.	Duct of epididymis (vas epididymidis). Deferent duct (vas deferens). Ejaculatory duct. Seminal vesicle.	*Vesicular appendage (of Morgagni).* *Epoöphoron, longitudinal duct.* *Gärtner's Canals.*
Müllerian duct.	*Morgagni's appendage of testicle (hydatid of Morgagni).* Prostatic utricle (uterus-masculinus).	Fimbriae of oviduct. Oviduct. Uterus. Vagina.
Urogenital sinus.	Urethra (prostatic part). (membranous part). Prostate. Bulbo-urethral gland (Cowpers).	Urethra. Vestibule of vagina. Larger vestibular gland (Bartholin's).

The External Genitals.—At about the sixth week the cloacal fossa is surrounded by a ridge, called the *genital ridge.* Near the middle of the fossa there projects a small tubercle, the *genital eminence.* On the under surface of the eminence a groove soon appears, the *genital groove,* which is bounded by two ridges, the *genital folds.* In the female the genital eminence becomes the *clitoris* and the genital folds become the *labia minora.* The ventral portion of the genital ridge develops to form the *mons veneris,* while its lateral portions give rise to the *labia majora.* The hymen begins to form in the fifth month as a small crescentic fold at the posterior margin of the vaginal aperture. The glands of Bartholin develop as evaginations from the wall of the vestibular region of the urogenital sinus.

In the male the genital eminence becomes the penis. The gen-

ital groove deepens and the genital folds, which bound it laterally, increase in size. The folds then proceed to convert the groove into a canal, and in this way form the penile portion of the *male urethra*. The genital ridges give rise to the *scrotum*. The glands of Cowper are developed as evaginations of the terminal part of the urogenital sinus.

THE CENTRAL NERVOUS SYSTEM

The complexity of detail involved in the development of the brain and spinal cord is greater than in any of the other systems of the body, and for this reason only the essential features of this

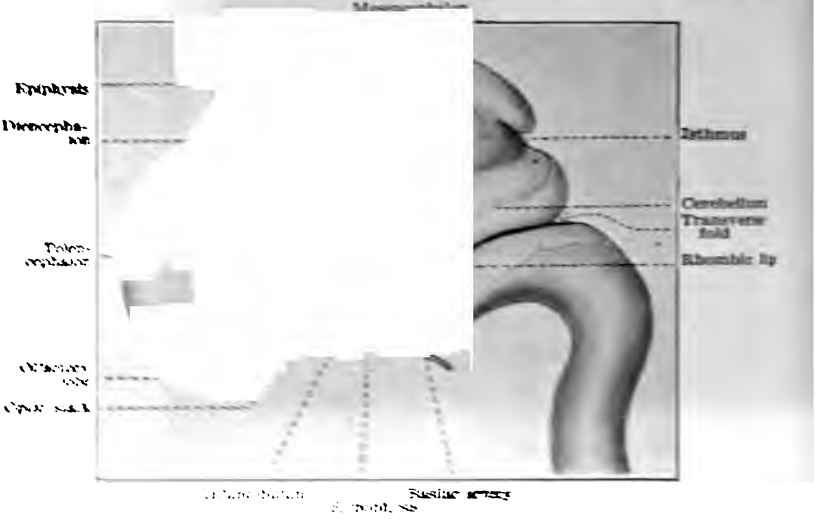


FIG. 21. [illegible] OF THE BRAIN OF A 7½ WEEKS [illegible] HUMAN EMBRYO. ×8.

[illegible] central nervous system [illegible] extending from [illegible] neural plate. At an [illegible] which coincides with [illegible] This groove is [illegible] lateral aspects of the [illegible] Ultimately, [illegible] and thus form

the *neural tube*. The fusion of these folds is not uniform. It is accomplished earliest in the middle regions of the tube. In the head region the failure of fusion gives rise to a slitlike opening in the neural tube, the *neuropore*. This is finally closed in and the whole tube, becoming depressed below the surface, is covered over dorsally by the surface ectoderm. The neural tube is not uniform in size throughout its length. In several places it shows a distinct tendency for dilatations to appear. Such dilatations are noticed in the extreme head end where the *optic vesicles* are developing as a pair of lateral evaginations. Again in the region of the future medulla oblongata and pons a large dilatation appears. Between the cephalic and caudal dilatations is a constricted region which

PRIMARY SEGMENT	SECONDARY SEGMENT	DERIVATIVES	CAVITY
Cephalic vesicle. Prosencephalon or Forebrain.	Telencephalon.	Cerebral hemispheres. Olfactory lobes. Corpora striata.	Lateral ventricles. Foramina of Monroe.
	Diencephalon.	Optic thalami. Optic nerves and tracts. Subthalamic tegmenta. Interpeduncular structures. Pineal and Infundibular process.	Anterior part of third ventricle. Posterior part of third ventricle.
Middle vesicle. Mesencephalon or Mid-brain.	Mesencephalon.	Cerebral peduncles. Corpora quadrigemina.	Aqueduct of Sylvius.
Caudal vesicle or Hind-brain.	Isthmus.	Superior cerebellar peduncles. Superior medullary velum.	
	Metencephalon.	Pons. Cerebellum.	Fourth ventricle.
	Myelencephalon.	Medulla. Inferior medullary velum.	

is more tubular in outline than the rest of the primitive brain, and represents the midbrain. At this stage the central nervous system consists of the *forebrain* (prosencephalon) corresponding to the cephalic dilatation; the hindbrain (metencephalon) corresponding to the caudal dilatation, and the intermediate portion, the midbrain (mesencephalon). Caudad of the metencephalon is the anlage of the spinal cord. By a process of further division the three primitive brain vesicles are converted into five secondary vesicles, namely, the *telencephalon* (end brain), *diencephalon* (interbrain), *mesencephalon* (midbrain), the *metencephalon* (hindbrain), the *myelence*[illegible]). The adult derivatives of these secondary vesicles [illegible] the table on page 73.

[illegible] ANOMALIES OF THE HEAR[illegible] AND VASCULAR SYSTEM

1. [illegible], a condition of a single heart, occurring in twins, which develop but a single chorion. One of the twins has no heart.

2. [illegible] *Heart*: Only one or two cases of double heart have been reported in man.

3. [illegible] *of Heart*:
   a. Dextra cardia, or right-sided heart.
   b. [illegible] heart through ven-[illegible]

[illegible]

7. *Anomalies of the Great Veins:*
   (a) Double superior venæ cavæ, due to persistence of both precardinal veins.
   (b) Inferior cava may be right or left-sided, or even double, depending upon the manner in which the postcardinal veins develop.

II. ANOMALIES OF THE GASTROINTESTINAL CANAL

1. *General Transposition of all the Viscera—Situs viscerum inversus.*
2. *Anomalies of Mouth and Tongue:*
   (a) Defects in boundaries of oral cavity, hare-lip, and cleft palate.
   (b) Defects in anterior portion of tongue.
   (c) Micro- and macroglossia.
3. *Anomalies of the Pharynx:*
   These involve the formation of cysts, fistulæ, and diverticula from the bronchial pouches.
4. *Anomalies of the Thyroid and Thymus Glands:*
   (a) Persistence of thyreoglossal duct.
   (b) Accessory thyroid bodies constituting suprahyoid and prehyoid glands.
   (c) Defective development of thymus may lead to cyst formation in the anterior mediastinum.
5. *Esophagus:*
   Esophagus in rare cases is absent or defective in certain parts.
6. *Stomach:*
   Attenuation or dilatation are about the only unusual occurrences in this organ.
7. *Intestines:*
   (a) Meckel's diverticulum, which may exist as a blood pouch extending from the ileum to the umbilicus, as a fibrous cord or as a patent tube discharging at the umbilicus, in this latter case constituting a *congenital fecal fistula.*
   (b) Stenosis or atresia of the duodenum.
   (c) Atresia of the anus.

(d) Redundancies of the large intestine, especially of the sigmoid portion.

(e) Persistence of the cloaca.

8. *Liver and Pancreas:*

Anomalies of these organs are rare. In one case the gall-bladder has been reported as congenitally absent. The ducts of the pancreas are subject to many variations which are not to be regarded as anomalies.

III. ANOMALIES OF THE CENTRAL NERVOUS SYSTEM

1. *Acrania and hemicrania,* complete or partial absence of the roof of the skull.
2. *Craniorachischisis,* defect in the skull and neural canal.
3. *Cephalocele,* a hernia of the cerebrum, may be of several varieties.
   (a) Encephalocele, hernia of brain substance.
   (b) Meningocele, hernia of the membranes.
   (c) Meningoencephalocele, hernia of membranes and brain substance.
   (d) Hydrencephalocele, brain ventricles distended by accumulation of fluid.
   (e) Hydromeningocele, sac formed by the membranes distended by fluid.
4. *Micrencephaly and microcephaly,* an abnormal smallness of skull and brain.
5. *Spina bifida cystica,* due to a cleft in the vertebral column, generally along its dorsal aspect. Several varieties have been observed.
   (a) Myelomeningocele, if the cyst comprises the cord and membranes.
   (b) Spinal meningocele, if the cyst comprises the membranes alone.
   (c) Myelocystocele, if the cord itself is dilated.
6. *Spina bifida occulta,* in which neither cleft nor tumor is visible externally, but the position of the defect is indicated by a small, depressed cicatrix, covered with a small tuft of hair. This is usually situated in the lumbosacral region.

IV. ANOMALIES OF THE GENITOURINARY SYSTEM

Anomalies of the kidneys:

(a) Congenital aplasia of both kidneys.
(b) Ectopia of one or both kidneys.
(c) Horseshoe kidney.
(d) Single kidney with double ureters.
(e) Lobulated kidney.
(f) Floating or movable kidney.
(g) Congenital cysts of kidney.

Anomalies of the ureters:

(a) Absence of pelvis.
(b) Double or triple ureter.
(c) Atresia of both ureters.
(d) Opening of male ureter may be into seminal vesicles, prostatic urethra, or rectum.

In the female the ureters may open into the urethra, vagina, or terus.

Anomalies of bladder:

(a) Congenital absence, rare.
(b) Urachovesical fistula.
(c) Ectopia of bladder.

Anomalies of urethra:

(a) Hypospadias.
(b) Epispadias.

Anomalies of the testis:

(a) Cryptorchism, testis retained in abdomen. One or both testicles may be so affected.
(b) Cysts and teratoid tumors of testicle.

Anomalies of ovaries:

(a) Congenital absence rare, defective development and malposition not uncommon.
(b) Ovarian cysts and teratoid tumors.

Anomalies of oviducts, uterus, and vagina:

(a) Bicornute or partially divided uterus.
(b) Bipartite or completely divided uterus.
(c) Uterus didelphys which is a complete double utero-vaginal tract.

(d) Unicornute uterus due to the failure of one Müllerian tube to develop.

(e) Infantile uterus and imperforate hymen.

8. *Hermaphroditism:*

In some instances one individual will combine the characteristics of both sexes. If such an individual possesses both ovary and testis, the condition is known as *true hermaphroditism.* If, on the other hand, such an individual possesses ovaries or testes, the condition is then called *false hermaphroditism.*

The types of true hermaphroditism are:

(a) Lateral hermaphroditism in which an ovary is present on one side and a testis on the other.

(b) Unilateral, in which a testicle and ovary are present on one side.

(c) Bilateral, in which ovaries and testicles are present on both sides.

The types of false hermaphroditism are:

(a) Masculine type in which the testicles are present, but the body characteristics are those of the female.

(b) Feminine type in which the ovaries are present, but in which male characteristics predominate in the body.

V. ANOMALIES OF THE RESPIRATORY SYSTEM

1. *Anomalies of the larynx:*

(a) Unusually large or small.

(b) Bifid epiglottic cartilage.

(c) Abnormally large ventricle.

2. *Anomalies of the trachea:*

(a) Absence of trachea, bronchi arising directly from larynx.

TABULATED CHRONOLOGY OF DEVELOPMENT

First Week.

Segmentation of fertilized ovum to form morula while passing along oviduct to uterus.
Cleavage-cavity present, marking stage of blastula.
Great increase in size.
Cells of inner cell-mass rearranged to form entoderm and ectoderm.
Embryonal area.
Primitive streak.
Amnion completed at fourth or fifth day.

Second Week.

Ovum in uterus imbedded in mucosa.
Chorion and its villi. Vascularization of chorion and its villi.
Heart indicated as two tubes.
Oral pit. Gut-tract partly separated from yolk sac.
Medullary plate. Nasal areas.

Fourth Week.

Marked flexion of body. Cephalic flexures.
Pancreas begun. Liver-diverticulum divides. Bile-ducts acquire lumina.
Pulmonary anlage bifurcates, the two pouches being connected by a pedicle, the primitive trachea, with the pharynx.
Anterior lobe of hypophysis begins.
Optic vesicle stalked and transformed into optic cup.
Limb-buds apparent.

Sixth Week.

Nasofrontal, lateral nasal, and maxillary processes unite.
First indication of teeth in the form of the dental shelf. Submaxillary gland indicated by epithelial outgrowth.
Thyroid and thymus bodies begun.
Genital tubercle, genital folds, and genital ridge (external genitals).
Semicircular canals.
Concha of external ear.
Fingers as separate outgrowths.

Eighth Week.

Head more elevated.
Parotid gland begins.
Anlage of spleen recognizable.
Suprarenal bodies recognizable.
Lens-capsule.
Palpebral conjunctiva separates from cornea.
Fingers perfectly formed. Toes begin to separate (fifty-third day).

Third Month.

Weight (end of n... ; length, 2¾ inches. At first chorion læve and ch... frondosum present; formation of placenta.
Union of testis with canals of wolffian body complete. Testes in false pelvis. Ovaries descend.
Eyes nearly in normal position. Eyelids begin to adhere to each other.
Limbs have definite shape, nails almost perfectly formed.

Fourth Month.

Weight, 7¾ ounces; length, 5 inches.
Anal membrane disappears.
Sexual distinctions of external organs well marked. Closure of genital furrow. Scrotum. Prepuce. Prostate well formed.
Eyelids and nostrils closed.

Fifth Month.

Weight, 1 lb.; length, 8 inches. Active fetal movements begin. Two layers of decidua coalesce, obliterating the space between vera and reflexa.
Distinction between uterus and vagina. Hymen begins.
Differentiation of muscular tissue of arms.

Sixth Month.

Weight, 2 pounds; length, 12 inches. Vernix caseosa begins

Seventh Month.

Weight, 3 pounds; length, 14 inches. Surface less wrinkled, owing to increase of fat.
Meconium in large intestine.
Testes at internal rings or in inguinal canals.
Lanugo over entire body.
Lens-capsule begins to acquire transparency. Eyelids permanently open.
Differentiation of muscular tissue of lower extremities.

Eighth Month.

Weight, 4 to 5 pounds; length, 16 inches.
Testes in inguinal canals.
Vernix caseosa covers entire body.
Lanugo begins to disappear. Nails project beyond finger-tips.

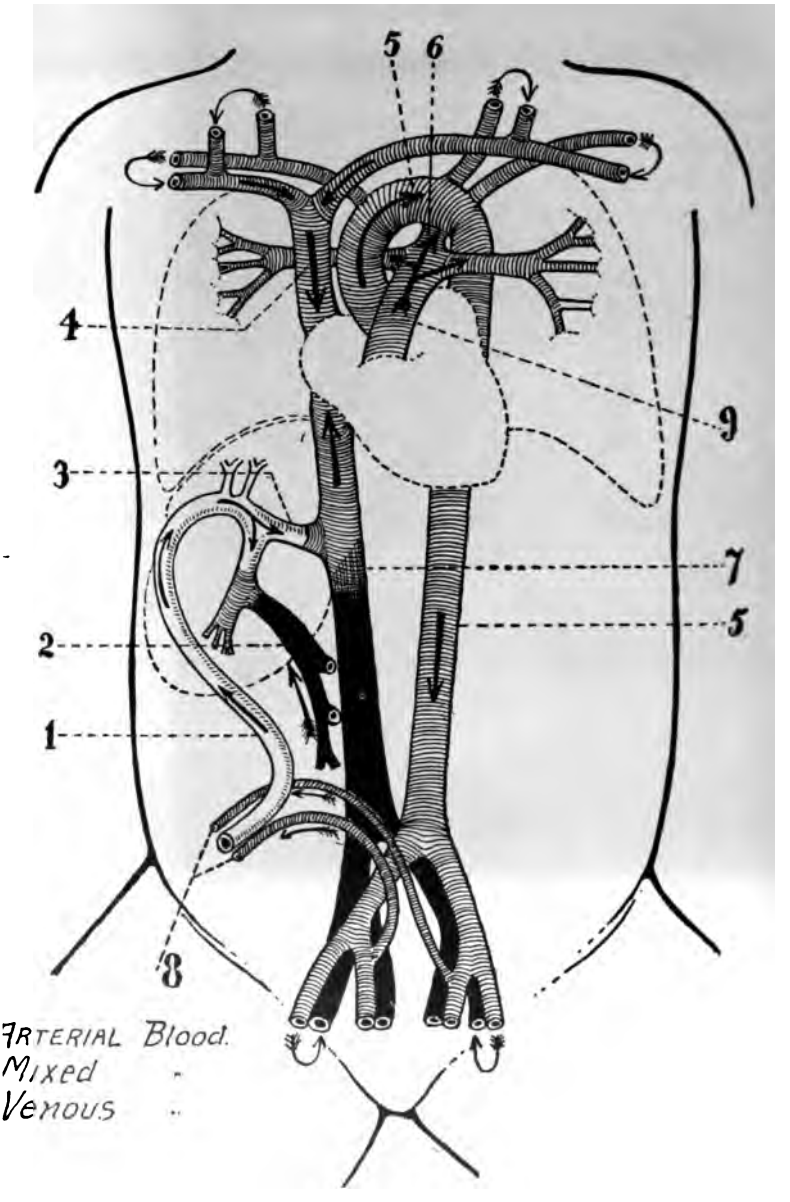
Ninth Month.

Weight, 6 to 7 pounds; length, 20 inches. Umbilicus almost exactly in middle of body.
Meconium dark greenish.
Testes in scrotum. Labia majora in contact.
Lanugo almost entirely absent. Galactopherous ducts of milk-glands acquire lumina.

FETAL CIRCULATION

During intrauterine life the *respiratory blood changes* are *accomplished in the placenta.* There is no pulmonary respiration, consequently only so much blood goes to the lungs as is needed for their nutrition.

From the placenta, the blood which has been oxygenated in the placenta passes to the umbilical vein, from which a part goes directly to the ascending vena cava, by the ductus venosus, while a part goes to the liver, and, after passing through it, reaches the vena cava through the hepatic vein. Together with the blood from the lower extremities, it then goes to the right auricles, and thence is deflected, through the *foramen ovale,* into the *left auricle, by the Eustachian valve,* whence it passes through the *left ventri-*



23.—Diagram of the Fetal Circulation.—1. Umbilical vein; 2. rtal vein; 3. Ductus venosus; 4. Vena cava descendens; 5. Aorta; Ductus arteriosus and pulmonary arteries; 7. Vena cava ascendens; 8.

cle into the aorta. The larger part goes to the head and arms. *Returning* by the *descending vena cava* to the *right auricle,* it goes to the *right ventricle,* a very small part passing to the lungs by the pulmonary artery, the larger part reaching the aorta through the ductus arteriosus; a small portion of this mixed blood goes to the lower extremities via the iliacs; the greater part, however, is returned again to the placenta by the hypogastric arteries.

THE EFFECTS OF PREGNANCY ON THE MATERNAL ORGANISM

Changes in the Uterus.—The first effects of pregnancy are to be observed in the uterus. The *most notable,* clinically, are the alterations in *size, shape,* and *structure* of the uterus.

Size.—The growth of the uterus begins immediately on the fixation of the ovum, and its enlargement is continuous and progressive until the development of the ovum is complete. In the first two months the enlargement is chiefly in the lateral and anteroposterior directions. Subsequently the growth is nearly symmetrical. In the early months the development of the uterus is mainly due to hypertrophy and to hyperplasia of its muscular fibers, while in later months the enlargement is due to the growth of the ovum and dilation of the uterine body. The thickness of the uterine walls at term is usually less than 5 cm., never more than 10 cm. The internal surface is expanded between conception and full term from 32 to 39 square cm. (5 or 6 square inches) to 2,256 square cm. (350 square inches). The cubic capacity of the uterus is enlarged more than 500 times, to 4,000 c. c., or more, while the weight increases from 43 grams (1½ ounces) in the pregravid state, to 904 or 1,133 grams (or 2 to 2½ pounds) at term.

DIMENSIONS OF THE GRAVID UTERUS

Stage of Gestation.	*Total Length.*	*Width.*
12 weeks	12.5 cm. (5 in.)	10 cm. (4 in.)
16 weeks	15 cm. (6 in.)	12.5 cm. (5 in.)
20 weeks	17.5 cm. (7 in.)	15 cm. (6 in.)
24 weeks	21.5 cm. (8½ in.)	16.5 cm. (6½ in.)
28 weeks	25 cm. (10 in.)	17.5 cm. (7 in.)
32 weeks	29 cm. (11½ in.)	20 cm. (8 in.)
36 weeks	33 cm. (13 in.)	22.5 cm. (9 in.)
40 weeks	35.5 cm. (14 in.)	25 cm. (10 in.)

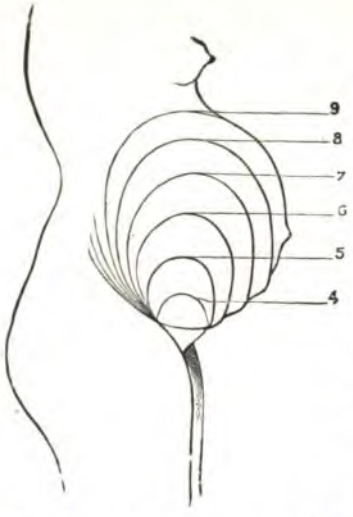


FIG. 24.—HEIGHT OF THE FUNDUS AT DIFFERENT PERIODS OF PREGNANCY.

Shape.—In the first three months the shape of the uterus is irregularly pyriform, the irregularity depending on the position of the ovum. At the second month the body of the uterus is a flattened spheroid—its anteroposterior diameter being the smallest, while it is widened from side to side. In the later months it is generally egg-shaped, the fundal being the larger end. Yet the form of the uterus in the later months is not altogether constant.

Structure.—The changes which take place in the mucosa have already been described in a previous chapter. The muscular fibers grow 7 to 11 times in length, 2 to 7 times in thickness; there is also some hyperplasia of muscular tissue in the first three or four months.

At the internal os there is a preponderance of circular fibers in all the layers. The peritoneal coat develops by tissue growth in proportion to the increasing size of the uterus.

The arteries increase in number, length, and caliber. By the later months of pregnancy the ovarian arteries attain the size of goose quills, and the uterine arteries are still larger. The size of the lateral branches which connect the ovarian and the uterine arteries on each side exceeds that of the radial artery. The uterine venous plexus develops into a system of huge sinuses in the middle coat of the muscularis and in the subplacental portion of the inner coat. Some of these vessels attain a diameter of 12 mm. (⅛ inch). The ovarian and uterine veins are proportionately enlarged. The lymphatic tubes reach the size of goose quills and the lymph spaces are expanded. Underneath the peritoneum the lymph vessels form a plexus continuous with the general lymphatic system.

Hypertrophy of the nervous structures within the uterus keeps pace with the general uterine development.

Changes in the Cervix Uteri.—*Size.*—The apparent shortening

of the cervix during pregnancy is due partly to the softening of its structure and partly to swelling of the vaginal mucosa and the loose cellular tissue about the cervix at the vaginal junction. The cervical enlargement is partly hypertrophic, but is mainly due to loosening of its structure in consequence of serous infiltration; it is progressive to about the end of the eighth month.

Structure.—The softening extends progressively from the lower border upward; it involves the entire cervix by the end of the eighth month.

By this time generally the cervical canal has become sufficiently expanded in multiparæ to admit the finger, and the head of the child may be felt through the membranes.

In women pregnant for the first time the os externum is seldom as large as the finger, even in the later weeks of gestation.

Changes in the Other Pelvic Structures.—The *broad ligaments* adapt themselves to the expansion of the uterus partly by the separation of their layers and partly by the growth in the number and size of their tissue elements.

The *ovaries* and the *Fallopian tubes* lie in contact with the sides of the uterus by the time it rises out of the lesser pelvis. Their vascularity is greatly increased.

The *vagina* undergoes hypertrophy during pregnancy. The width and length of its walls are increased, and it becomes more vascular. The papillæ of the mucosa undergo marked development.

GENERAL CHANGES CONSEQUENT ON PREGNANCY

The Heart.—Most authorities claim that there is a *physiological hypertrophy* of the *left ventricle* of the heart during gestation, which is designed to meet the increased resistance in the systemic circulation brought about by the superadded uteroplacental circulation.

The Blood.—*Extreme changes* of the blood *do not occur* in normal pregnancy. The number of *red cells* and the proportion of *hemoglobin* are *slightly increased.* The number of white cells is greater, most so in the last weeks of gestation; the *alkalinity* is *increased* and the same is true of the *fibrin-forming ferment.*

The Nervous System.—In most gravidæ there is some increase

in the irritability of the nervous system. Psychic disturbances, neuralgias, and other nervous disorders are sometimes observed.

The Body Weight.—As a rule a considerable gain in body weight occurs in the later months, due mainly to an increased adipose deposit.

The Thyroid.—The thyroid gland is more or less hypertrophied during pregnancy in a small proportion of cases. The enlargement is not constant.

CHAPTER III

DIAGNOSIS OF PREGNANCY

The diagnosis of pregnancy is made upon:

(1) The history.
(2) The mammary signs.
(3) The abdominal signs.
(4) The pelvic signs.

History.—CESSATION OF MENSTRUATION.—The cessation of menstruation in a woman whose previous menstrual history has been regular is the most valuable of the subjective symptoms of pregnancy. Amenorrhea, however, may depend on many other conditions, which must be excluded before the arrest of the catamenia is to be considered as presumptive evidence of pregnancy. Among the causes which may produce amenorrhea are change of climate, mental and nervous disorders, chronic nephritis, exposure to cold, anemia, chlorosis, tuberculosis, tardy menstruation, acquired atresia of the vagina or cervix, the menopause, and the growth of pelvic and abdominal tumors. Amenorrhea is not always available as a symptom of pregnancy, as it is possible for the woman to become pregnant during the lactation period, after the menopause, or before the menstruation is regularly established. There are cases in which a bloody vaginal discharge may recur with regularity during the first half or even throughout the whole of gestation. This flow, however, differs in character from the usual bleeding of the individual woman. Its occurrence at the end of the menstrual month results from the influence of the menstrual molimen. When bleeding occurs in the later months, examination generally shows it to proceed from polypi or lesions of the cervix, or chronic decidual endometritis, or placenta prævia. It may usually be distinguished from true menstruation by irregularity in the amount or the duration of the flow.

NAUSEA AND VOMITING.—Some degree of nausea is usually pres-

ent in the majority of pregnancies. This symptom depends either upon a reflex due to the distention of the gravid uterus, in the beginning of pregnancy, or upon a mild toxemia. It usually begins about the end of the first month, although many notice it within the first weeks after fruitful coitus. It usually ceases by the end of the third month. It generally manifests itself as a morning sickness, or repulsion for food, or by actual vomiting.

The causes which may produce nausea and vomiting are irritations of the uterus, congestion or inflammation of the tubes and ovaries, and the growth of pelvic tumors. Functional and organic disease of the stomach must be excluded.

Some degree of *ptyalism* is usually associated with the nausea and vomiting of pregnancy. While excessive salivation is exceptional, hypersecretion of mucus in the mouth and throat is common. This mucus is characterized by its tenacity and is expectorated with difficulty. The symptom of nausea and vomiting is absent in a small proportion of pregnant women.

Quickening.—Quickening is the sensation of the active fetal movements as first felt by the mother. This subjective symptom is usually apparent by the end of the fourth month. It is noticed in some cases earlier, and in some later, while some women do not experience the sensation at all, and others overlook its presence.

Other symptoms ascertainable from the history may be the sensation of increased weight, fullness and tenderness in the breasts, and gradual enlargement and pigmentation of the abdomen.

Mammary Signs.—The mammary signs available at the second month are:

(1) Increased size and fullness of the glands.

(2) The primary areola.

(3) Montgomery's follicles.

(4) Enlargement of the mammary glands.

In addition to these are the later signs:

(5) Colostrum, appearing in the breasts at the *third* month.

(6) The secondary areola, which may be demonstrated at the *fifth* month.

Increased Size and Fullness of the Glands.—During pregnancy the milk glands become enlarged by the growth of the acini, swelling of the interglandular connective tissues and an inter-

lobular deposit of fat. About the second month the glands become distended and stand out prominently from the chest, and the veins are enlarged and plainly seen coursing under the skin. Rarely there may be no material enlargement of the glands, though slender cords (hypertrophic acini) may always be demonstrated running from the nipple toward the periphery.

PRIMARY AREOLA.—The primary areola about the nipple becomes elevated, edematous and pigmented during the second month of

FIG. 25.—BREAST SIGNS OF PREGNANCY.

pregnancy. The pigmentation varies in blondes and brunettes, being more marked in the latter. In the negroes the pigmentation is black. The areola becomes soft and velvety to the touch, and elevated above the level of the surrounding skin. The pigmentation is the most constant of these changes.

MONTGOMERY'S FOLLICLES.—Within the pigmented area of the primary areola may be found sebaceous follicles, 5 to 20 in number, which appear as papular elevations, projecting conspicuously

from the surface of the skin. There may be an entire absence of these follicles. They can be best demonstrated while the skin is held gently on the stretch.

Veins.—Owing to the enlargement of the glandular structure of the breast, the superficial veins become fuller and more prominent, and may be seen coursing across the gland and into the areola or encircling the margin of the primary areola.

Colostrum (Milk Secretion).—By manipulation over the

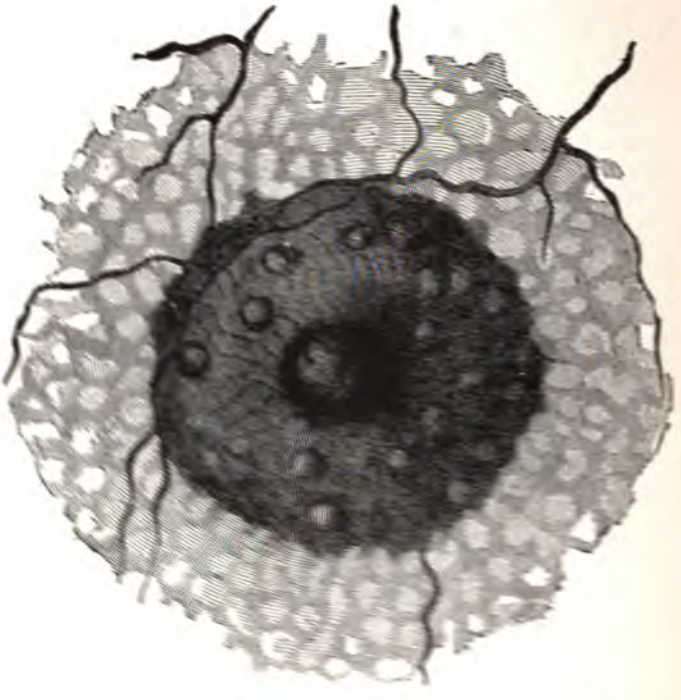


Fig. 26.—The Primary and Secondary Areolæ of Pregnancy.

acinulæ of the milk ducts at the base of the nipple, colostrum may be expressed from the breast by the end of the third month. In women who have never been previously pregnant this sign is of presumptive value. Previous pregnancy diminishes its importance, as milk is usually found in the breasts of parous women. It may be occasionally found in the breasts of women, virgins, and males.

THE SECONDARY AREOLA.—The secondary areola appears at the fifth month of pregnancy. It is characterized by a series of washed-out spots surrounding the primary areola, due to the presence of non-pigmented sebaceous follicles. This sign is of diagnostic value in the woman who has never been pregnant. All of these mammary signs may be observed independently in the non-pregnant woman, or may be absent in that condition, but *when present collectively in the primipara,* the mammary signs make one of the *positive signs of pregnancy.*

Abdominal Signs.—INSPECTION.—The abdominal signs to be noted on inspection are:

(a) Flattening.
(b) Enlargement.
(c) Umbilical changes.
(d) Pigmentation.
(e) Striæ gravidarum.

Flattening.—Hypogastric flattening, due to the sinking of the enlarging uterus deeper into the pelvis, may possibly be noted in the first few weeks of pregnancy. This descent of the womb may be associated with irritability of the bladder, which is complained of by the patient.

Enlargement.—The enlargement of the abdomen is apparent after the third month; when the uterus rises by its increased growth out of the true pelvis, this enlargement is steady and progressive until the last month of gestation. The fundus reaches the pubes at the third month, the umbilicus at the sixth month, and the ensiform at eight and one-half months. During the last two weeks of gestation the uterus usually sinks deeper in the pelvis and falls forward. This is more apparent in primiparæ than in multiparæ, and is known as "lightening."

Umbilical Changes.—In the first three months, owing to the uterus sinking deeper into the true pelvis, the bladder is carried downward, making traction on the urachus, which retracts the umbilicus. At the sixth month the umbilicus is level with the surface of the abdomen, while during the last trimester it becomes protruded and surrounded by a ring of pigmentation.

Pigmentation (*Linea nigra*).—Pigmentation of the linea alba or median line is limited to a narrow band about 3 mm. (⅛ inch) wide, extending from the pubes to the umbilicus, which may be

observed from the end of the second month. It progresses with the growth of the uterus. It is more marked in brunettes, and is frequently absent in blondes. The linea nigra may rise proportionately to the height of the fundus or stop in its abdominal ascent at the umbilicus. The pigmentation remains after the pregnancy has terminated. In brunettes a dark circle appears about the umbilicus, and pigmented patches are observed over other parts of the abdomen.

Striæ Gravidarum (*Linea albicantes*).—These are irregular, whitish, pinkish, or bluish lines over the lower part of the abdomen, appearing during the last trimester of pregnancy. These striæ extend to the hips and thighs, and are due to a partial atrophy of the skin from tension, and separation of the superficial layers of epidermis, exposing the glistening corium. These striæ may be found in conditions, other than pregnancy, which cause rapid abdominal enlargement, as ascites, ovarian cysts, etc. They persist after the pregnancy has terminated.

PALPATION.—The signs of pregnancy on palpation are:

(a) The size of the tumor.
(b) The character of the tumor.
(c) Intermittent contractions.
(d) Active fetal movements.
(e) Passive fetal movements.

Size of the Tumor.—The increase in the size of the pregnant uterus is progressive. The fundus lies, at the third month, in the plane of the brim, and reaches the umbilicus at the sixth month and the ensiform cartilage at the thirty-eighth week.

The length of the gravid uterus is 12.5 cm. at 12 weeks, 15 cm. at 16 weeks, 17.5 at 20 weeks, 21.5 at 24 weeks, 25 at 28 weeks, 29 at 32 weeks, 33 at 36 weeks and 35.5 cm. at term. The height of the fundus increases 3.5 cm. for each lunar month after the 20th week.

month, and may be appreciated by abdominal palpation in the intervals between contraction as early as the fifth.

Intermittent Uterine Contractions.—By placing the hand on the fundus, intermittent uterine contractions may be detected as early as the fourth month. These contractions occur throughout pregnancy at intervals of about ten minutes; the whole uterine muscle contracts as it does in a labor pain. Contractions may be demonstrated by bimanual palpation as early as the eighth week. They cease with the death of the fetus; they occur occasionally when the uterine enlargement is due to causes other than pregnancy, as hematometra, hydrometra, soft fibroids, and occasionally in the distended bladder. This sign is of no positive diagnostic value.

Active Fetal Movements.—Fetal movements, as an objective sign, may be felt as pregnancy advances. The detection of fetal movements may be considered as a *positive sign of pregnancy.* They may be excited by suddenly placing the cold hand upon the woman's abdomen, or by tossing the fetus from side to side. The movements of the fetus begin as early as the tenth week, and may be demonstrated by bimanual palpation at the end of the third month. As an abdominal sign they can seldom be elicited prior to the sixteenth week. In excessive liquor amnii, the movements of the fetus may be masked, occasionally they may cease for days or weeks without apparent reason.

Passive Fetal Movements (or External Ballottement).—Passive fetal movements are elicited by placing the hands upon the sides of the abdomen with their palmar surfaces facing each other; the fetus is then tossed from side to side, the movement and contact being transmitted to the palpating hands. Pathological growths floating in ascitic or other fluid must be excluded.

AUSCULTATION.—Auscultation gives the following signs of pregnancy:

(a) Fetal heart sounds.

(b) Choc fœtal.

(c) Uterine souffle.

(d) Funic or umbilical souffle.

Fetal Heart Sounds.—The fetal heart tones, when heard, are a *positive sign of pregnancy.* This sign is generally available by abdominal auscultation between the fourth and fifth month. It consists of a rhythmical succession of sounds, which can be counted,

similar to the heart-beat of the new-born child, heard with the stethoscope directly over the anterior shoulder of the fetus. The rate varies from 120 to 150 per minute. The fetal heart sounds are usually audible over an area of three inches or more in diameter, known as the *focus of auscultation;* exceptionally, there may be a second focus even in a single fetation, due to the conduction of sound through some remote point of fetal contact with the uterine wall.

The heart sounds may be for a time inaudible, owing to a change in the position of the fetus, as in certain occipitoposterior positions or in the pr[illegible] liquor amnii, or in a very fat abdomen or great pen[illegible]

When the heart tones remain p[illegible]ntly absent upon repeated examination, after they have o[illegible]een distinctly heard and counted, it may be presumed that the child is dead. To auscultate the fetal heart, the patient should be in the horizontal position. The location of the anterior scapula of the fetus must be previously determined by abdominal palpation. In head-first cases the heart may be heard over the anterior scapula, which is usually within one to three inches to the right or left of the median line below the umbilicus. In breech cases the heart is heard above the umbilicus.

Choc Fœtal.—The choc fœtal is a sound produced by the impact of the fetal movement, as heard by auscultation of the abdomen over the uterus. It is elicited by abdominal stethoscopy during the fourth, fifth, and six months, by placing the stethoscope directly over the uterus and causing the fetus to make a sudden movement by placing the cold hand over the uterus. It resembles the sound produced by gently tapping the back of the hand placed over the ear

[illegible] [illegible] souffle or bruit is a sound [illegible] through the uterine artery [illegible] side of the abdomen [illegible] pronounced on the [illegible] towards the right. It [illegible] is generally available [illegible] Other conditions, [illegible] blood current in [illegible]

Funic or Umbilical Souffle.—The funic or umbilical souffle is a soft bruit, synchronous with the fetal pulse. It results from some obstruction to the flow of blood through the umbilical veins, from torsion, knotting or coiling of the cord. It is seldom available as a sign of pregnancy, but can usually be elicited in the later months.

Pelvic Signs.—The pelvic signs by which pregnancy may be recognized are:

(a) Purplish hue of the cervix and vagina.
(b) Softening of the cervix.
(c) Changes in the uterine tumor in shape, size and consistency.
(d) Excessive flexibility of the cervix.
(e) The pulsation of the uterine artery.
(f) The increased temperature of the cervix.
(g) Internal ballottement.

PURPLISH HUE OF THE CERVIX AND VAGINA.—The purple color of the cervix is due to the marked congestion of pregnancy. The lividity of the vaginal portion of the cervix may be observed from the first month after conception. This dusky hue of the cervix is more constantly present and develops earlier than the change in color of the vagina.

As pregnancy advances, the vagina takes on a purplish hue. This is apparent, at first, along the anterior wall, immediately below the meatus, due to the hypertrophy of the corpus cavernosum of the vestibule and of the vaginal venous plexuses. This sign is present in about 80 per cent. of pregnancies at the end of the third month. A condition which very closely simulates the dusky hue of the cervix and vagina may be produced by pelvic congestion due to other causes, as incarcerated tumors in the pelvis.

SOFTENING OF THE CERVIX.—The softening of the cervix is a progressive sign and can usually be made out in the primipara by vaginal touch as early as the sixth week. It begins at the lower border of the cervix and feels like a thin, velvety layer covering a firm body.

As the gestation advances, the softening progresses from below upward, until it involves the entire cervix by the end of the eighth month. The cervical canal participates in this change and becomes more patulous as the softening extends.

Goodell has described this sign as giving a sensation to the finger similar to that produced by palpating the lip.

Changes in the Uterine Tumor.—The changes in the *shape, size,* and *consistency of the uterus* make one of the positive signs of pregnancy. This sign is available as early as the sixth or eighth week. These changes are detected by bimanual examination. *The body of the uterus enlarges with the growing ovum. It takes on an irregular globular shape and becomes soft and elastic.*

The changes in the character of the tumor vary with relaxation and contraction of the uterus. *In relaxation the uterus is soft, elastic, flattened from before backward, wider from side to side, and asymmetrical in shape.* The elasticity is most marked in the anterior wall just above the isthmus.

The cornua are of unequal size and density, owing to the fact that the ovum in the second month is usually situated in or near one horn of the uterus. During the contraction which develops under the stimulation of bimanual palpation of the fingers, the uterus loses its asymmetry and becomes symmetrical, and somewhat globular or ovoid in shape.

The enlargement of the uterus due to pregnancy must be differentiated from chronic metritis or subinvolution by the history, by the greater density of the uterine tumor, and by the absence of progressive growth. A soft submucous fibroid or myoma can generally be differentiated from pregnancy by the history, by the slower growth of the tumor, and by the absence of the changes in consistency, as are demonstrated in the pregnant uterus during relaxation.

Hegar's sign properly belongs under the changes in consistency, which take place in the pregnant uterus. It is available about the second month of gestation and consists in the *extreme compressibility of the median portion of the isthmus uteri.* This point in the non-gravid uterus is the most dense.

In order to elicit Hegar's sign, the patient should be placed in the lithotomy position, and the uterus be drawn down with a sella caught in the cervix, while the thumb is carried int vagina and pressed against the lower uterine segment at its tion with the cervix, and the index finger of the same passed into the rectum to a point just above the uterosa de-sac; the lower segment or isthmus of the uterus is

FIG. 27.—HEGAR'S SIGN BY RECTO-VAGINAL TOUCH.

FIG. 28.—HEGAR'S SIGN (COMPRESSIBILITY OF THE UTERINE ISTHMUS). Obtained by the vagino-abdominal method; available in thin women.

tween the thumb and finger, and may be compressed to almost the thinness of a visiting card (Fig. 27).

This sign may also be demonstrated in thin women with lax abdominal walls by bimanual palpation. Two fingers are introduced into the vagina against the lower segment of the uterus just above the cervix, while the external hand depresses the abdominal wall behind the fundus and the fingers of each hand are made to meet over the thinned out lower segment (Fig. 28).

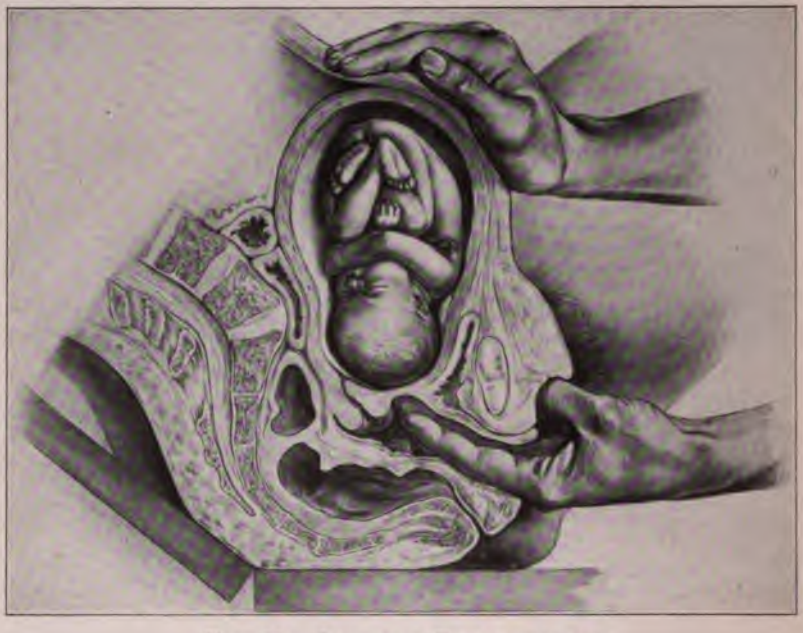


FIG. 29.—INTERNAL BALLOTTEMENT.

Thinning under pressure to less than one-half a centimeter establishes a positive diagnosis of pregnancy. Examination under anesthesia facilitates the detection of this sign.

EXCESSIVE FLEXIBILITY OF THE CERVIX.—Excessive flexibility of the cervix is due to the thinning of the isthmus, and may be elicited by bimanual palpation at the second month.

PULSATION OF THE UTERINE ARTERY.—Pulsation of the uterine artery is due to hypertrophy of the artery consequent upon pregnancy, and may be detected by vaginal touch during the second

and third months of gestation. The examining finger is held against the vaginal vault at one side of the cervix, and the pulsation noted.

THE TEMPERATURE OF THE CERVIX.—The temperature of the cervix of the pregnant uterus is from ½ to ¾ of a degree Fahrenheit above that of the vagina or the rectum. Both of these signs have only contributory importance, as they may be found associated with pathological growths or local inflammatory lesions.

INTERNAL BALLOTTEMENT.—Internal ballottement—or passive fetal movements—as an objective sign, consists in tossing the fetus upward in the amniotic sac, with two fingers in the vagina, against the anterior uterine wall above the cervix, while the other hand steadies the fundus, and feeling it fall and repercuss the fingers, thus demonstrating the presence of a movable solid content. Ballottement is available during the fifth and sixth months. Earlier

TABLE OF THE SIGNS OF PREGNANCY

Mo.	History	Mammary	Abdominal	Pelvic
1st	Cessation of menses.	None.	None.	None.
2nd	Cessation of menses. Nausea, ptyalism.	1. Increased size and fullness of the glands. 2. Primary areola. 3. Montgomery's follicles. 4. Enlargement of veins.	None.	1. Purplish hue of vagina and cervix. 2. Softening of the cervix. 3. Changes in shape, size and consistency of the uterus. 4. Hegar's sign. 5. Increased flexibility of cervix.
3rd	Same history as above except nausea and ptyalism may cease.	All mammary signs increased. Colostrum may be expressed from nipples.	None.	Pelvic signs as above. All increased, except flexibility of cervix.
5th & 6th	Cessation of menses continues. Quickening.	All mammary signs increased. Secondary areolæ.	1. Enlargement. 2. Pigmentation. 3. Intermittent contractions. 4. Active fetal movements. 5. Uterine souffle. 6. Choc fœtal. 7. Fetal heart (not constant).	Purplish hue, softening of cervix, and changes in uterine tumor more marked. Internal ballottement.
8th & 9th	Continued amenorrhea. Active fetal movements. Progressive abdominal enlargement.	All of the mammary signs more pronounced.	1. Tumor nearly at ensiform cartilage. 2. Pigmentation. 3. Lineæ albicantes. 4. Detection of fetal parts. 5. Active fetal movements. 6. Fetal heart sounds. 7. External ballottement.	The entire cervix is softened. Cervical caral patulous. Detection of presenting part.

the weight of the fetus is too small, while later its mobility is too limited to permit of its being tossed upward and rebounding against the vaginal fingers (Fig. 29).

To elicit this sign, the patient should be placed in the half sitting posture, the bladder and rectum emptied, the constricting waist bands loosened. Two fingers are then introduced into the vagina, and held against the anterior uterine wall above the cervix, the external hand steadying the fundus; the fetus is then tossed up by the vaginal fingers, which are held against the anterior wall, until it falls again and taps the fingers.

It may be impossible to demonstrate ballottement owing to scanty liquor amnii, multiple fetation, transverse position of the fetus, or a placenta prævia. The sensation imparted to the vaginal fingers by the rebound of the fetus in ballottement may be confounded with an anteflexed uterus, a large stone in a full bladder, a floating kidney, or a pedunculated tumor of the uterus or ovary.

DIFFERENTIAL DIAGNOSIS

The differential diagnosis of pregnancy covers a wide field, for gestation may be confounded with enlargement of the abdomen from other causes, such as ovarian cysts, fibroid tumors, obesity, distended bladder, ascites, tympanitis, etc. *The most important point in the differential diagnosis of an abdominal enlargement is the presence or the absence of the distinctive signs of pregnancy,* which may be enumerated as follows:

(a) The mammary signs collectively (in the primipara).
(b) The detection of the fetal parts.
(c) The demonstration of the active fetal movements.
(d) Changes in the character of the uterine tumor, in its size, in its shape, and in its consistency.
(e) Internal ballottement.
(f) The detection of the fetal heart.

Pregnancy is the most frequent cause of abdominal enlargement. It is during the first half of pregnancy, before the fetal heart, the fetal parts, and the fetal movements can be definitely recognized, that the greatest difficulties are encountered in making a positive diagnosis.

In the early months gestation must be distinguished from fibro-

myoma, hematometra, hydrometra, pyometra, chronic metritis, small cystic and solid tumors of the broad ligaments, inflammatory swelling of the broad ligaments and of the ovaries, and exudates, while in the later months large myomata, obesity, ascites, distended bladder and ovarian cysts are the conditions from which uterine gestation must be distinguished. Pregnancy may coexist with any of the conditions from which it must be differentiated. All women presenting an abdominal tumor between the ages of nine and sixty-one should be regarded as possibly pregnant until proven not to be.

Patients presenting an abdominal enlargement should be catheterized before proceeding with the examination. Having excluded a distended bladder, our next step is to establish the presence or the absence of the diagnostic signs of pregnancy, particularly those which pertain to the uterus, i.e., the changes in the shape, size, and consistency of the uterine tumor.

Obesity.—Fat in the abdominal wall gravitates when the patient is in the erect posture, and lies in folds and broadens the abdomen when she is recumbent. The fat may be caught up in folds with the hand and moved over the underlying muscle, when the patient is in the recumbent position. On pelvic examination the uterus may be found unchanged.

Tympanites.—Tympanites is a cause of abdominal enlargement; the intestinal movement may be mistaken for the movements of the fetus. It can be excluded, first, by the absence of the positive signs of pregnancy; second, by palpation of the abdomen, with the patient in the recumbent position. By maintaining firm pressure with the hand on the abdomen at the level of the umbilicus during each expiration, the walls may be depressed until the vertebral column is reached. Percussion over the entire abdomen will give a resonant note. Tympanites usually subsides in the morning.

Ascites.—In ascites, which is a collection of fluid within the peritoneal sac, when the patient takes the horizontal position the abdomen flattens at the umbilicus and bulges in the flanks. The percussion note from the pubes to the ensiform is tympanitic at the summit of the tumor, while dullness may be elicited in the flanks. Change in the position of the patient changes the location of the fluid level, which is mapped out by its flatness to percussion. A fluctuation wave may be transmitted to all parts of the tumor

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CHAPTER IV

MULTIPLE PREGNANCY AND THE ESTIMATION OF THE DURATION OF PREGNANCY

Multiple Fetation.—Multiple fetation may properly be considered as bordering on the pathological, for the viability of the children is lower than in single pregnancies. The fetuses are usually undersized and of unequal development, malpresentations are more common, monstrosities more frequent, and anomalies in the liquor amnii not exceptional. Hydraminos is common. One fetus or both may die in utero at different periods of gestation. Labor comes on prematurely in one-fourth of the cases. Twins, or two fetuses within the uterus, occur once in one hundred pregnancies. Triplets are found once out of 7,900, quadruplets once in 371,000 births, while quintuple pregnancies and sextuplets have been recorded.

Multiple fetation may result, first, from the *impregnation* of a *single ovum* that contains *two or more germinal vesicles;* second, from the *impregnation* of *two or more ova from one Graaffian follicle*, or *from separate follicles*, from *one or from both ovaries.* Children developed from the same ovum with a double germ are always of the same sex, when from different ova they may be of the same or of different sex.

The origin of the twin pregnancy may be determined by examination of the arrangements of the membranes and placentas.

When the fetation is from separate ovules there are two amnions, two chorions, and two placentas with independent circulations. The placentas may be separate or fused at their margins.

When the twins are from a single ovum having a double germ, there is one chorion containing two amnions, and one placenta.

Superfecundation is the fertilization of two ova, expelled at the same ovulation, within a short period of one another, but not at the same coitus; the fertilization may be by the same or by different males.

Superfetation is the fertilization of two separate ova thrown off at different periods of ovulation. Several months may intervene between the birth of the two fetuses.

The authenticity of superfetation is doubtful, and it is believed by many observers that these supposed cases are in reality twin pregnancies, in which one fetus is blighted and cast off, while the other survives and goes to term.

The Duration of Pregnancy.—The duration of pregnancy is not a fixed term, as we have no means of ascertaining the exact date at which fertilization takes place. Conception usually occurs either soon after the last appearance of the menses, or shortly before the first period which is missed. This explains the apparent variation in the duration of pregnancy within normal limits.

The average interval between the first day of the last menstruation and labor is two hundred and eighty days, or practically ten lunar months, while the interval between fruitful coitus and the birth of the child is approximately two hundred and seventy-three days. This rule, however, is subject to many exceptions, as normal pregnancy may be shortened to two hundred and forty days or prolonged to more than three hundred days, with nothing in the character of the labor or the appearance of the child which would suggest premature birth or overgrowth. The attachment of the ovum in the last week or two of gestation is so insecure that there is little doubt that delivery occurs prematurely in a large number of instances. Prolongation of pregnancy beyond the average time is associated with increase in the weight of the child. Winckel has shown that increase in the length of gestation bears a definite ratio to the increase in the size of the child.

Rules and Methods for Predicting the Date of Labor.—No reliable means for estimating the exact date at which the particular pregnancy will terminate has been suggested. The method proposed by Naegele, and known as "Naegele's rule," is to count forward nine calendar months from the first day of the last menstruation and add seven days, which, as will be seen, is approximately two hundred and eighty days from the beginning of the last menstruation; for example, if the last period began on October
we count forward nine months to July 10th and add seven
which makes July 17th the probable date of confinement
method for estimating the date of labor is generally ac

within a week or ten days, but occasionally a period of several weeks may elapse before labor occurs. This difference is probably due to the fact that in one case conception occurred soon after the last period, while in the other instance impregnation has taken place just before the missed period. The period of quickening, or the recognition by the patient of active fetal movements, is not constant. It occurs in different individuals from the 16th to the 20th week, and even varies in the same individual in different pregnancies; hence, reckoning from the date of quickening is also unreliable.

We may measure the length of the uterus or estimate the actual size of the child as a check to the menstrual history. The former depends on the quantity of liquor amnii present in a given case, while the size of the fetus is not constant at any given period of gestation.

MENSURATION OF THE UTERUS.—The duration of pregnancy in lunar months is equal to the height of the uterus in centimeters, divided by 3.5 cm. This rule is based on the average size of the fetus at full term, being 3,300 grammes, and depends on the more or less regular growth, in the uterus, of 3.5 cm. for each lunar month, after the fifth month of pregnancy. This estimation is made with the patient in the horizontal position; one end of the tape is placed at the upper border of the symphysis, while the other is held by the thumb in the palm of the upper hand, the fingers of which are held at right angles to the fundus of the uterus; the tape follows the contour of the uterus, save at the last dip; this gives the height of the fundus in centimeters, which, when divided by 3.5, gives the duration of pregnancy in lunar months.

In order to take this measurement the head must not have sunk into the lesser pelvis, hence it will be seen that this method of estimation is limited in its application.

MENSURATION OF THE FETUS.—The total length of the fetus is about double that of the fetal ovoid. The length of the fetal ovoid may be measured by applying one end of a pelvimeter in contact with the lower fetal pole through the vagina, and the other end upon the abdomen over the upper fetal pole. The length of the fetus during the latter months of gestation is approximately as follows:

Sixth calendar month, 30 to 35 cm. (12 to 14 inches).

Seventh calendar month, 35 to 40 cm. (14 to 16 inches).

Eighth calendar month, 40 to 45 cm. (16 to 18 inches).

Ninth calendar month, 45 to 50 cm. (18 to 20 inches).

Unfortunately the rate of fetal development is not uniform, and accuracy of measurement presents many difficulties, so that data from these measurements are subject to correction.

Haase's Rule.—For the first four months the length of the fetus in centimeters equals the square of the age in lunar months. After the end of the fifth month, the length in centimeters equals five times the age in months.

ENLARGEMENT OF THE ABDOMEN (*Situation of the Fundus*).—The height to which the uterus has risen gives a rough estimate of the length of the gestation. The fundus is found in the plane of the brim at the third month; midway between the symphysis and the umbilicus at the fifth month; at the level of the umbilicus at the sixth month; three fingers' breadth above the umbilicus at the seventh, and reaches the ensiform cartilage at eight and one-half months, whereas in the last month, particularly in the primipara, when "lightening" has occurred, the fundus sinks downward and assumes almost the position it occupied at the eighth month.

CHAPTER V

THE MANAGEMENT OF NORMAL PREGNANCY

Pregnancy and labor should be normal processes in the healthy woman, but civilization has wrought changes in the maternal organism, and the border line between health and disease is so easily passed in pregnancy that serious conditions may develop and go undetected until grave pathological changes have already taken place, unless the woman is under the observation of a competent physician from the early months of gestation.

The practitioner who engages to take care of an obstetric case should give the patient specific directions as to the hygiene of pregnancy and its proper management. The points upon which the woman needs special information are:

I. Exercise.
II. Teeth.
III. Bowels.
IV. Sleep.
V. Vaginal discharges.
VI. Diet.
VII. Clothing.
VIII. Care of the nipples.
IX. Urine.
X. Blood pressure.
XI. Marital relations.
XII. Danger symptoms (which should cause the patient to seek the advice of the physician).

Exercise.—The pregnant patient should be encouraged to take moderate muscular exercise daily in the open air, and instructed to avoid over-exertion or exhaustion. Daily walks, driving, or motoring afford the necessary fresh air and sunlight; golf, in moderation, and sea bathing are safe out-of-door employments

during the first and second trimester. When out-of-door exercise is impossible, massage may help to keep up the muscular tone. In the later months, exercise to fatigue, violent muscular strain, long journeys, driving over rough roads, etc., should be avoided, as well as unpleasant mental influences. Tepid or cold sponge baths, daily, do much toward improving the action of the skin.

Teeth.—The teeth of the pregnant woman are especially prone to decay. They should be cleansed on rising, before retiring, and after each meal, by brushing with a solution of milk of magnesia. The gums are subject to some hypertrophy. A mouth wash of diluted listerine or borolyptol may be used with advantage in completing the mouth toilet. Occasional inspection by a competent dentist should be the rule. Cavities should be filled, at least with temporary fillings. Pregnancy offers no contraindication to the extraction of teeth when such is necessary.

Bowels.—Pregnant patients, owing to the pressure of the growing uterus and frequent disturbance of the digestive functions, are prone to constipation. Daily bowel movements are necessary. For this purpose, cascara sagrada, phenolthalin and mild saline laxatives should be the choice.

Sleep.—The pregnant woman needs eight hours daily of undisturbed sleep; an extra hour of repose in the afternoon may well be added. It is advisable for her to sleep with the windows open, so that she may have an abundance of oxygen. During the last trimester, owing to the enlargement of the abdomen; it is difficult for the patient to rest comfortably. Sleeping alone adds much to her comfort.

Vaginal Discharges.—Irritating leucorrheal secretions may result from a chronic endocervicitis aggravated by pregnancy. Cleansing alkaline douches of a borax and soda solution (1 oz. of each to the quart) at a temperature of 100° Fahrenheit may be taken night and morning. The patient should be in the recumbent position, and the bag or reservoir at low elevation, lest the irritation of the douche provoke abortion.

Diet.—The diet of the pregnant woman should be sim nourishing and easily digestible. She should observe regular for her meals. Meats should not be taken oftener than once Fried dishes, pastry, highly seasoned and rich foods sho avoided. Excessive eating is injurious, as overeating may r

increasing the toxemia of pregnancy. Diet has a decided influence on the size of the child.

Women who have given birth to large children, or who are the subjects of slight contraction of the pelvis, can lessen the weight of the child by strict adherence to a special diet during the last six or eight weeks of pregnancy. Prochownick has shown us that a diet free from sugar and starches, and in which the amount of fluid taken is restricted, will lessen the weight of the child. This diet consists of a breakfast of coffee and a roll; lunch of lean meat, salad, crackers, and a small glass of Moselle wine with seltzer; supper, of an egg, green vegetable, salad, and fruit. The adherence to such a diet will result in a small fetus, in which the plasticity of the cranial vault is increased. Functionally incompetent kidneys will contraindicate the employment of so much proteid.

Clothing.—The clothing should not be tight, especially about the breasts and abdomen. Garments should be hung from the shoulders. The underclothing should be of thin flannel or linen mesh of light weight. No heavier underwear is necessary in winter than in summer. A properly fitting corset may be worn in the early months, while in the latter months a specially constructed maternity corset or an abdominal supporter will add much to the comfort of the patient. Outer clothing may be changed to suit the changing temperature, wraps being added as necessary.

Care of the Nipples.—Proper attention to the nipples during the last few weeks of pregnancy will obviate many of the difficulties of nursing. The nipples should be washed with Castile soap and warm water each night before retiring and thoroughly dried; then, after the patient's hands have been carefully scrubbed with soap and running water, the nipple may be drawn out with the thumb and finger and anointed with sterile lanolin. The following morning the nipple may be bathed with a boroglycerid solution, of the strength of one ounce of boroglycerid to seven ounces of sterile water. This method of treatment prevents cracking and keeps the surface of the nipple smooth and supple. Astringent applications, as solutions of tannin, alcohol, etc., with a view to hardening the surface, have proven ineffectual in our hands. Small or shrunken nipples may be drawn out with the thumb and finger, and a small cupping glass or the breast pump applied for a few minutes each day during the last half of pregnancy.

Urine.—The urine should be examined at regular intervals throughout pregnancy. This examination should be both chemical and microscopical, and made at least once a month for the first six months, and once a week during the last four. The presence of albuminuria, the evidences of toxemia, edema, renal insufficiency, or nephritis, demand daily examinations. This examination should determine the amount of urine passed in twenty-four hours, its specific gravity, the total amount of urinary solids, the percentage of urea, the presence or absence of albumin or sugar and of tube casts.

The amount of u[illegible] must be kept up to about sixty ounces. When it is [illegible] amount a greater quantity of pure water should be taken. W[illegible] albumin is detected or the patient shows signs of toxemia, a t[illegible]y-four-hour specimen should be saved and sent to a competent pathologist or chemist, for the determination of the total amount of urea, the total nitrogen, and the nitrogen partition. The quantity of urea and the nitrogen partition afford evidence of the functional activity of the kidneys, while urea alone will vary with the amount of exercise and the quantity of nitrogenous food taken. The average normal quantity of urea excreted daily is from 20 to 30 grammes (500 grains), while the total solids amount to about 66 grammes (1,000 grains). The total solids may be roughly estimated by multiplying the last two figures of the specific gravity by the number of ounces of urine passed in twenty-four hours, and the product by 1.10. For example, if the specific gravity is 1,020, and the number of ounces of urine passed 50, we multiply 20 x 50, which equals 1,000, and this product x 1.10 = 1,100 grains total solids. The urea is approximately one-half the total solids.

Blood Pressure.—The blood pressure of the pregnant woman in the early months seldom rises above 130 millimeters, but in the later months, and at the beginning of labor, the blood pressure is markedly increased. A persistently increased blood pressure of 150 millimeters or over may be considered as one of the earliest evidences of toxemia.

Marital Relations.—Marital relations are to be restricted, particularly near the menstrual dates, and strictly interdicted where there is a tendency to abortion.

The early nausea and vomiting of pregnancy are often aggra-

vated by sexual intercourse. *All relations should be positively forbidden during the last month of gestation.* Non-observance of these rules may cause abortion, premature labor, and puerperal infection.

Symptoms Which Should Cause the Patient to Seek the Advice of the Physician.—The pregnant woman should be instructed that the occurrence of any of the following symptoms may be *the danger signal* of an *obstetric complication,* and should be communicated at once to her physician.

A. Diminution in the amount of the urinary secretion (scanty urine) to below 50 ounces.
B. Persistent frontal headache.
C. Disturbance of vision.
D. Appearance of edema about the face or swelling of the feet.
E. The presence of persistent constipation.
F. Blood losses from the vagina, however slight.

CHAPTER VI

THE PHYSIOLOGY OF LABOR

The mechanism of labor depends on three factors, i. e., (1) the expelling powers; (2) the passages, and (3) the passenger. A normal relation between these three factors, acting jointly, produces what is known as a normal labor.

EXPELLING FORCES

The expelling forces are: First, the contractions of the uterus; second, the expelling and contractile powers of the abdominal muscles; third, the action of the pelvic floor and its influence on the mechanism of normal labor.

Contractions of the Uterus and Abdominal Muscles.—The contractions of the uterus begin in the cornua at the fundus, and extend over the entire contractile segment. The uterine contractions are involuntary, being largely under the control of the sympathetic nervous system.

The contraction of the muscular walls of the body of the uterus is the chief expelling power. These contractions are intermittent and recur at intervals of from thirty minutes to one minute; the intervals shorten as labor progresses, while their duration is from thirty seconds to a minute or more.

During contraction the uterus assumes a more or less cylindrical form, the fundus is steadied by the round and broad ligaments, and held forward against the abdominal wall, and the entire organ is forced down so that the axis of the uterus is brought into line with the axis of the bony inlet. Dilation of the lower uterine segment is accomplished by these uterine contractions, which open the cervix to permit the expulsion of the fetus. At the height of the contraction the woman holds her breath, which fixes the diaphragm and increases the intraabdominal pressure, and the simul-

taneous contraction of the abdominal muscles, which action is partly voluntary and partly an involuntary reflex, and helps to reinforce the uterine contraction and expel the fetus. It will be seen, therefore, that the chief expelling force is the contraction of the uterus, which power has been estimated by Duncan at from 50 to 80 pounds, and by Schatz from 17 to 55.

Action of the Pelvic Floor.—The pelvic floor offers a resistance to the advancing head or presenting part until the moment of expulsion, when the muscular action of the posterior segment helps to carry it upward and forward in the direction of the pelvic outlet. The pelvic floor has a further influence in completing rotation.

THE PASSAGES

The passages through which the fetus must pass in its exit from the uterus include the hard parts or bony pelvis, which is made up of the two ossa innominata, the sacrum and the coccyx, and the pelvic soft parts, which consist of the uterus, the vagina, the pelvic floor, and the several structures which line the bony birth canal.

The Anatomy of the Bony Pelvis.—The pelvis is a bony basin, which, from the obstetric standpoint, is the most important part of the parturient canal. It is made up of the two ossa innominata, the sacrum and the coccyx. It has four joints, the symphysis pubis, the two sacroiliac joints, and the sacrococcygeal. A slight mobility of the pubic and sacroiliac joints is present in the latter months of gestation. The capacity of the pelvis is slightly larger in the gravid woman, owing to the softening of these joints.

The posture of the patient has some influence on the diameters of the bony pelvis. When the thighs are extended, as in the Walcher position, the upper end of the sacrum moves backward, while the symphysis is lowered and the brim is slightly increased in its anterior posterior diameter. Flexion of the thighs upon the abdomen increases the anterior posterior diameter at the outlet, as by forward flexing of the thighs against the abdominal wall the lower portion of the sacrum recedes and the anterior posterior diameter of the outlet is increased. Flexion in an exaggerated latero-prone posture further increases this diameter.

Recession of the coccyx to the extent of from twelve to twenty-

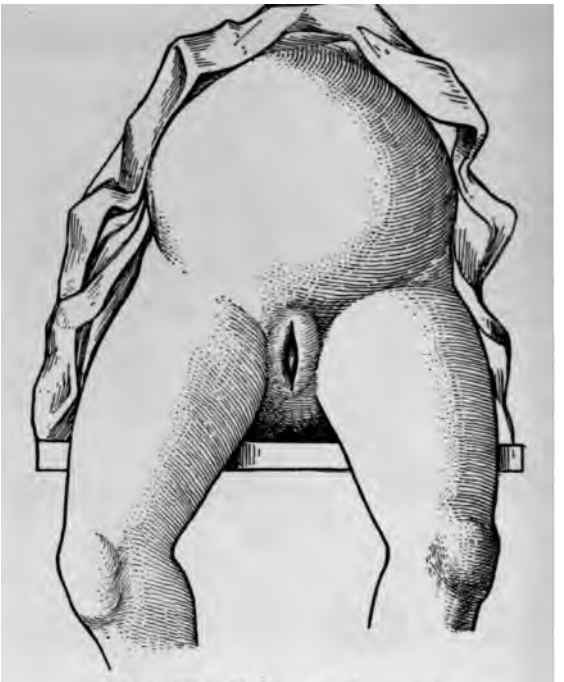
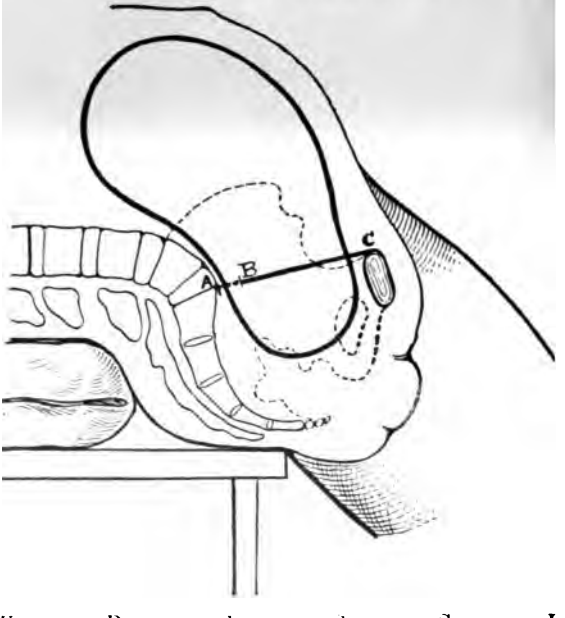


FIG. 30.—WALCHER POSITION.



WALCHER POSITION, SAGITTAL SECTION, SHOWING I

five millimeters (½ to 1 inch) occurs at the moment of expulsion, as the fetal head passes through the vulva outlet.

The Obstetric Pelvis.—The obstetric pelvis is divided into the *false pelvis,* or that portion of the pelvis lying above the iliopectineal line which, with the lateral and anterior abdominal walls, makes a funnel-shaped approach to the *true pelvis* and the *true pelvis,* which is that part of the pelvic basin lying below the iliopectineal line. This line divides the false pelvis from the true pelvis, and marks the inlet or entrance to the true pelvis, which is *the part of the bony structures which concerns the obstetrician in the mechanism of labor.*

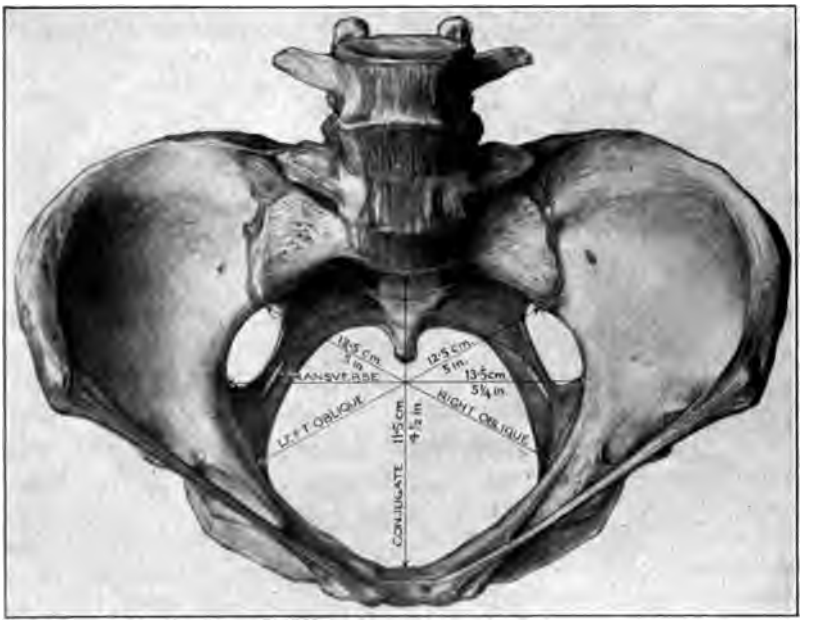


FIG. 32.—THE PELVIC BRIM, SHOWING LANDMARKS AND DIAMETERS.

The Pelvic Brim or Superior Strait.—Several names are applied to *the brim,* which is marked by the iliopectineal line and the upper margin of the sacrum. It is known as *the inlet, the superior strait, the isthmus, or the margin.* It is approximately heart-shaped, though it may be oval or round.

On the brim are *located* the *several obstetric landmarks, six in number*, (1) the symphysis pubis; (2) the promontory of the sacrum; (3 and 4) the right and left sacroiliac joints; and (5 and 6) the right and left iliopectineal eminences. These six landmarks mark the terminals of the principle diameters at the brim.

The pelvic outlet or *inferior strait* is described as lozenge-shaped and bounded in front by the summit of the subpubic arch; posteriorly, by the tip of the sacrum or coccyx; and laterally, by the two ischial tuberosities. It presents two obtuse-angled triangles

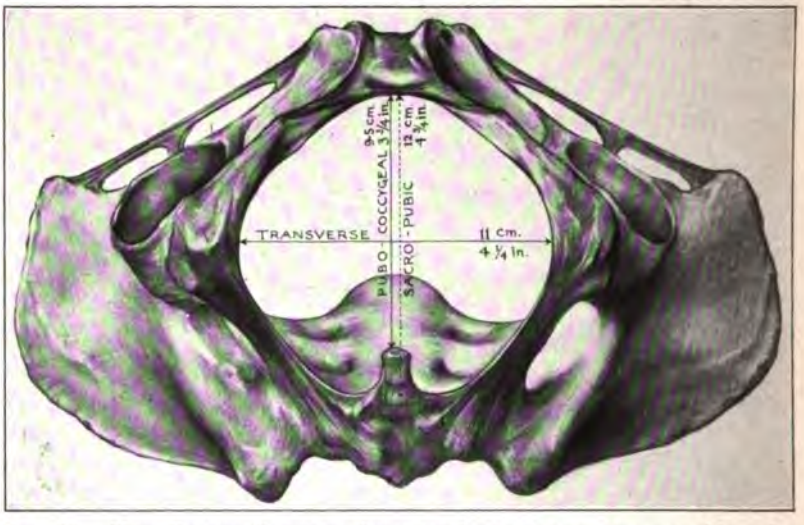


FIG. 33.—THE PELVIC OUTLET, SHOWING LANDMARKS AND THE TWO IMPORTANT DIAMETERS.

with a common base, the bisischial line; one apex is at the subpubic angle and the other at the tip of the sacrum; the lateral boundaries of the anterior triangle are made by the pubic rami, while the lateral borders of the posterior triangle are made by the sacrosciatic ligaments, which, owing to their distensibility, allow of a change in the contour of the outlet, making it more oval than angular during the expulsion of the head.

The Obstetric Landmarks at the Outlet.—The anatomical landmarks at the outlet are: (1) the tip of the coccyx, or more properly the tip of the sacrum, as the coccyx is a movable point; (2) the summit of the subpubic arch or the subpubic angle; (3) the

two ischial tuberosities; (4) the two ischial spines; (5) the obturator foramina (two).

These landmarks are, as at the brim, the terminals of the diameters of the outlet.

In addition to these bony landmarks at the outlet, the greater and the lesser sacrosciatic ligaments complete the circumference of the inferior strait.

The greater sacrosciatic ligament arises from the posterior-inferior spine of the ilium and from the side of the sacrum and coccyx, and is inserted into the inner surface of the ischial tuberosity.

The lesser sacrosciatic ligament takes its origin from the side of the sacrum and of the coccyx and passes in front of the greater, and is inserted into the spine of the ischium. The spaces formed by the greater and lesser sciatic notches of the ilium and ischium and the ligaments are known as the greater and lesser sciatic foramina. The pyriformus muscle, the gluteal, sciatic, and pubic vessels and nerves pass through the greater sacrosciatic foramen, while the tendon of the obturator internus muscle and the internal pubic vessels and nerves are transmitted through the lesser sacrosciatic foramen.

The Cavity of the Pelvic Basin, or True Pelvis.—The true pelvis is bounded posteriorly by the sacrum and coccyx, anteriorly by the pubic bones and their rami, and laterally by the lower portions of the ilia and the bodies, tuberosities, spines, and rami of the ischial bones.

The brim or entrance to the cavity offers its transverse diameter as the widest, while the greatest diameter at the outlet is the anterior posterior. The cavity itself is irregularly cylindrical in shape. The posterior wall is smooth and concave from above downward, which favors the descent of the presenting part.

The depth of the posterior wall is from 11.5 to 14 centimeters (4½ to 6 inches), depending on whether it is measured on the straight or on the curve of the sacrum and coccyx. The anterior wall is concave from side to side; its depth at the symphysis is four centimeters (1⅝ inches). This concavity from side to side favors the lateral rotation of the head in its screw-like descent, as it adjusts itself to the several diameters of the pelvis. The lateral wall of the cavity of the pelvis is nine centimeters (3½ inches) in depth.

The obturator foramen is bounded by the bodies and rami of the ischium and pubis, and closed by the obturator membrane except at one point, the obturator canal, through which pass the obturator nerves and vessels. One foramen is situated in each anterior lateral wall of the pelvis.

The Planes of the Pelvis.—There are three obstetric planes in the pelvis. The plane of the brim is coincident with the obstetric

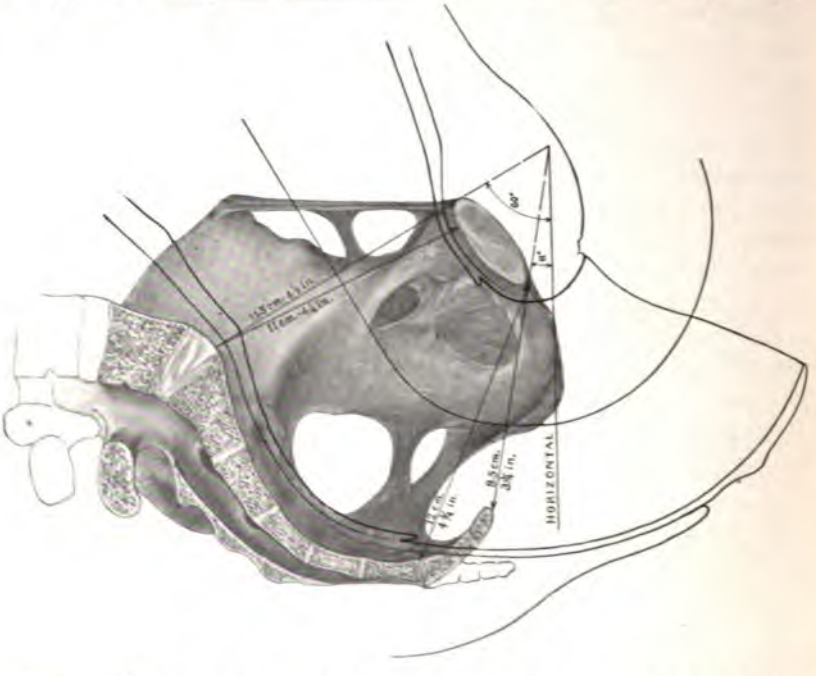


FIG. 34.—PLANES OF THE BRIM AND OUTLET SHOWING THE PELVIC AXES.

inlet. It is an imaginary surface which cuts the iliopectineal line, the upper margin of the sacrum, and the top of the symphysis, where it is crossed by the iliopectineal line. In the erect posture the inclination of the plane of the brim in the normal pelvis forms an angle of sixty degrees with the horizon. Faulty inclination disturbs the normal mechanism.

The plane of the cavity, or middle plane, cuts the upper border of the third piece of the sacrum, the middle of the posterior surface of the symphysis pubis, and points opposite to the centers of the

The plane of the outlet cuts the tip of the coccyx, the ischial tuberosities, and the lower end of the symphysis pubis. Practically the plane at which the head escapes from the grasp of the bony pelvis is a plane cutting the tip of the sacrum and a point just above the lower end of the symphysis. The sacrosciatic ligaments, which form the posterior anatomical boundaries of the outlet, yield somewhat under pressure of the advancing head, so that practically the outlet becomes ovoid.

At the expulsion of the head from the bony outlet, the shape of this plane becomes ovoid, with its greatest expansion posteriorly. The inclination of the plane of the outlet to the horizon is eleven degrees, the coccyx being two centimeters above the level of the subpubic arch. In addition to these planes of the bony pelvis, there is the plane of the dilated soft parts, or the distended vulvovaginal girdle, the axis of which looks forward.

The pelvic axis represents the course which the fetal head follows in its descent through the pelvis in a normal labor. This axis is made up of the axes of the several cardinal planes, and the planes between them. The axis of the inlet, if prolonged, would pass through the tip of the coccyx and the umbilicus. The axis of the outlet would pass immediately in front of the sacral promontory. The parturient axis practically conforms to the shape of the sacral curve.

The Pelvic Diameters and Their Numerical Equivalents.—DIAMETERS OF THE BRIM.—The diameters of the brim are:

1. The conjugata vera.
2. The diagonal conjugate.
3. The transverse.
4. The two obliques.

The *conjugata vera*, or true conjugate, is measured from the center of the promontory of the sacrum to that point on the posterior surface of the upper end of the symphysis pubis which is crossed by the iliopectineal line. This is the shortest diameter at the brim through which the head must pass. It cannot be accurately measured, but is estimated in the normal pelvis at 10.5 to 11 centimeters (4¼ to 4½ inches).

The *diagonal conjugate* is measured from the summit of the subpubic arch, or the subpubic ligament, to the promontory of the sacrum; it is from this diameter that we estimate the true conjugate.

To estimate the true conjugate from the diagonal, we deduct from ½ to ¾ of an inch (1.5 to 2 centimeters). The amount to be deducted depends (a) on the depth of the symphysis pubis—the greater the depth the greater must be the allowance; (b) on the thickness of the pubic symphysis, for increase in the thickness increases the allowance to be subtracted; (c) on the inclination of the symphysis and the inclination of the brim of the pelvis, for when the promontory is high a greater deduction must be made.

The Transverse Diameter.—The greatest transverse diameter at the pelvic brim is the transverse diameter of the pelvis. It begins at a point on the brim midway between the sacroiliac joint and the iliopectineal eminence on one side, and terminates at a corresponding point on the opposite side. It measures 13.5 centimeters in the dried or static pelvis; this diameter is actually shortened by ¼ of an inch (.5 or .7 cm.) in the dynamic pelvis by the psoas and iliacus muscles.

The Oblique Diameters of the Pelvic Brim.—The right oblique diameter begins at the right sacroiliac joint on one side and terminates at the left iliopectineal eminence on the opposite side, while the left oblique takes its origin at the left sacroiliac joint, and ends at the right iliopectineal eminence. These diameters cannot be accurately measured in the dynamic pelvis. In the static pelvis they measure 12.7 centimeters (4½ to 5 inches). The left is shortened by the presence of the rectum and the more or less filled sigmoid, for constipation is commonly present in pregnancy. This makes the right oblique the pelvic diameter of election, which is demonstrated by the large percentage of vertex presentations in which the occiput occupies a left anterior position engaging in the right oblique diameter.

Diameters of the Middle Plane.—The diameters of the middle plane are:

1. The anterior posterior.
2. The transverse.
3. The two obliques.

The *anterior posterior* begins at the upper margin of the third sacral vertebra and ends at the middle of the posterior surface of the symphysis pubis.

The *transverse* terminates at two points in the cavity of the pelvis, corresponding to the lower margins of the acetabula. The

oblique is measured from the center of the greater sacrosciatic foramen to the center of the obturator membrane of the opposite side. These diameters average 11 centimeters (4½ in.) in the static pelvis. The numerical equivalents of these diameters are only approximate.

DIAMETERS OF THE OUTLET.—The diameters of the outlet are:

1. The anterior posterior.
2. The transverse.
3. The two obliques.

The *anterior posterior* extends from the lower margin of the symphysis pubis to the tip of the coccyx. Owing to the mobility of the coccyx, this diameter should properly be measured from the summit of the subpubic arch to the tip of the sacrum, which is about 12.5 centimeters or five inches.

The *transverse diameter* or *bisischial* is the diameter between the inner margins of the ischial tuberosities. This distance, to permit the exit of the head, should average 10 centimeters or 4 inches. The *oblique diameters* of the outlet are measured from the middle of the lower edge of the greater sacrosciatic ligament, on one side, to the point of junction of the ischial and pubic rami on the opposite. These diameters are of little practical significance, owing to the distensibility of the sacrosciatic ligaments.

EXTERNAL DIAMETERS AND CIRCUMFERENCE OF THE PELVIS.—These are:

1. The iliospinal (interspinal).
2. The iliocristal (intercristal).
3. The external conjugate (Baudelocque diameter).
4. The external oblique diameter.
5. The pelvic circumference.

The *iliospinal* or *interspinal* diameter is the distance between the anterior superior spines of the crest of the ilium measured from the outer borders of the sartorius muscles at their origins. The measurement is approximately 25-26 centimeters (10-10¼ inches).

The *iliocristal* or *intercristal* diameter is the distance between the widest points of the outer ridge of the iliac crests, and is from 28 to 29 centimeters (about 11-11⅜ inches).

The *external conjugate* is a prolongation of the true conjugate. It was first described by Baudelocque, and is frequently called the

Baudelocque diameter. It is measured, with the patient standing, from the depression or sulcus just below the spinal process of the last lumbar vertebra to the most prominent point on the front of the symphysis pubis. The posterior terminal is found by drawing an imaginary line between the two depressions which correspond to the posterior superior spines of the crest of the ilium, which are the lateral borders of the Michaelis rhomboid, and placing one tip of the pelvimeter ½ inch above the center of this line, while the other tip is placed over the most prominent point on the anterior surface of the symphysis pubis. The distance between these points averages 21 centimet[illegible]

The *external oblique* [illegible] om the posterior superior spine of the crest of the ilium on [illegible] le to the anterior superior spine of the opposite side. The [illegible] external oblique diameters should be of equal lengths.

The average external *circumference of the pelvis*, measured over the symphysis pubis and rami, just below the iliac crests and across the middle of the sacrum, is about a meter (37 inches).

The external diameters in the normal pelvis should bear a constant relation to one another. The iliospinal is always less than the iliocristal, but should not be below nine inches when the iliocristal is ten. The external conjugate should be over seven inches, or 17.5 cm. Changes in the relative values of these diameters suggest pelvic distortion.

Sexual Differences in the Adult Pelvis.—The male pelvis is heavier, higher, more funnel-shaped and less graceful than the female. The pubis is deeper, the pubic arch narrower, and the pubic angle sharper. The female pelvis is larger and shallower, the cavity and outlet diameters are larger, the bones lighter, and the pelvic inclination greater. The brim is more heart-shaped. The [illegible] anterior superior [illegible] The cavity is not as funnel- [illegible] and broader. The [illegible] from ninety [illegible] from seventy to [illegible] tuberosities are [illegible] greater.

[illegible] *Cavity and* [illegible] is somewhat

diminished by the iliacus and psoas muscles. They encroach upon the lateral margins of the inlet to the extent of a quarter of an inch or more on each side. The external iliac vessels run along the inner borders of these muscles.

In the cavity no muscular structures overlie the median portion of either the anterior or posterior pelvic wall. On either side of the median section are the pyriformis muscle posteriorly and the obturator internus anteriorly and laterally; these muscles are too thin to affect the pelvic diameters.

The outlet of the pelvis is closed by the pelvic floor or pelvic diaphragm, which is made up chiefly of muscles and fascial sheets. These structures have already been described in the chapter on anatomy.

The Parturient Axis.—The parturient axis is made up of the axis of the uterus at term, the axes of the several planes of the bony pelvis, and the axis of the outlet of the soft part or vulvovaginal ring.

The axis of the brim is a line erected perpendicular to the plane of the inlet at its center. If prolonged, it would pass through the umbilicus and the coccyx. The axis of the brim is coincident with the axis of the uterus at term. The axis of the outlet is a line erected perpendicular to the plane of the outlet at its central point, which, if prolonged, would cut the lower border of the first piece of the sacrum. The axis of the outlet of the soft parts, or the vulvovaginal ring, looks directly forward. The child, in its passage from the uterus through the pelvis and outlet of the pelvic soft parts, follows, more or less perfectly, the parturient axis, which is described as an irregular parabola.

THE PASSENGER

The passenger or fetus is the third factor in labor upon which the normality or abnormality of the particular labor depends. The fetal head, being the largest part of the fetus, is the part which concerns the obstetrician. The fetal head is divided into the cranial vault and the cranial base with the face.

The cranial vault is made up of the two parietal, the two frontal, and the squamous portions of the occipital and temporal bones. Their semicartilaginous character, their plasticity, and the mem-

branous fontanelles and sutures which unite them make the cranial vault malleable. This facilitates the passage of the head through the pelvis, and allows it to be molded by the pressure of the walls of the birth canal.

The cranial base comprises the basilar portion of the occipital, the petrous portion of the temporal, and the entire sphenoid and ethmoid bones. The base is unyielding, highly ossified, and the bones are firmly united.

The Sutures of the Cranial Vault.—The sutures, which are membranous interspaces between the cranial bones, allow of a cer-

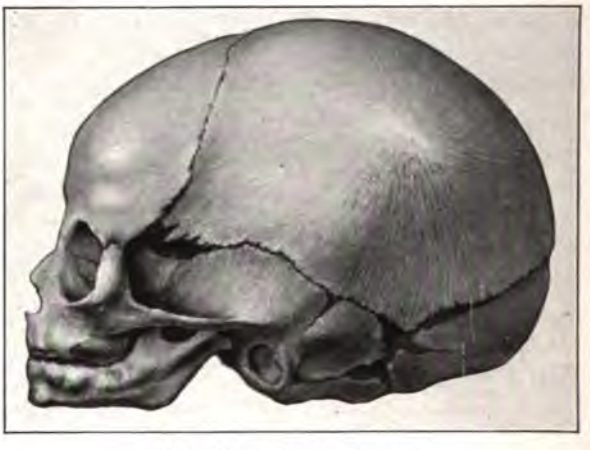


FIG. 35.—FETAL SKULL.

tain degree of mobility. The following are of obstetrical importance:

(1) The frontal or the interfrontal, between the two frontal bones.

(2) The interparietal or sagittal, between the two parietal bones.

(3) The coronal or frontal-parietal, between the frontal and parietal bones.

(4) The lamboidal or occipito-parietal, between the occ and parietal bones.

(5) The temporal-parietal, between the squamous the temporal an

At each end of the sagittal suture there is formed a *membranous space between the angles of the adjacent bones*, which is known as a *fontanelle*. The one at the *anterior end* is known as the *bregma* or *anterior fontanelle*, the one at the *occipital end* of the sagittal suture is known as the *posterior fontanelle*. Each of these has distinguishing characteristics, which are of obstetrical importance in determining position and posture.

The *anterior fontanelle or bregma*, first, is quadrangular in shape, with the most acute angle pointing forward. This angle becomes continuous with the interfrontal suture.

Second, *it has four sutures running into it.*

Third, it is a distinct membranous space, the transverse diameter of which is about one inch.

The posterior fontanelle is found at the occipital end of the sagittal suture. It is distinguished by having, first, *three lines of suture running into it;* second, it is characterized by the depressibility of the squamous portion of the occipital bone, which is triangular, and is hinged on the basilar portion and can be depressed so that the examining finger comes into the acute angle formed by the parietal bones.

The cranial vault is divided into three regions, i. e., the *vertex*, the *occiput*, and the *sinciput*.

The *vertex* or crown is that portion of the cranial vault lying between the anterior and posterior fontanelles, and extending laterally to the parietal protuberances.

The *occiput* is that portion of the cranium which lies behind the posterior fontanelle, while the *sinciput* includes the forehead and is bounded posteriorly by the coronal suture, anteriorly by the orbital ridges and root of the nose.

The cranial bones present five protuberances which are important as landmarks: the parietal eminences, or protuberances at the center of each parietal bone, which mark the lateral limits of the vertex; the occipital protuberance, which is located about one inch behind the posterior fontanelle, and is of importance because it is a terminal of the occipito-frontal and occipito-mental diameters; the frontal eminences or protuberances, which are elevations found in the center of each frontal bone and mark the summit of the forehead.

The Diameters and Circumferences of the Fetal Head.—The

diameters of the fetal head are of importance because of their relation to the diameters of the pelvis during the passage of the head through the birth canal.

The *biparietal diameter* is the greatest transverse diameter of the cranial vault. It is the distance between the parietal eminences. Its average numerical equivalent is 9.5 cm. (3½ inches).

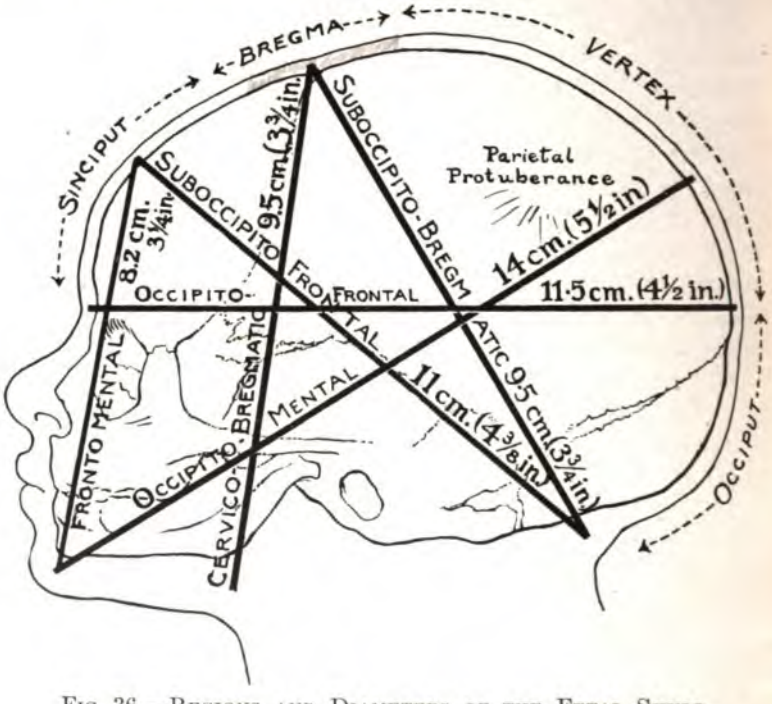


FIG. 36.—REGIONS AND DIAMETERS OF THE FETAL SKULL.

The *fronto-mental diameter* is the distance from the center of the lower margin of the chin to the summit of the forehead—9.5 cm. (3½ inches).

The *occipito-frontal diameter* extends from the occipital protuberance to the root of the nose, and is 12 cm. (4¾ inches).

The *occipito-mental diameter* is the longest diameter of the fetal head and terminates at the occipital protuberance and the center of the lower margin of the chin. Its numerical value is 13.5 cm. (5¼ inches).

The *suboccipito-bregmatic diameter* is the distance from the junction of the nucha and the occiput, which is found just behind and below the occipital protuberance to the center of the bregma. Its value is 9.5 cm. (3½ inches).

The *bitemporal diameter* is the distance between the lower extremities of the coronal suture. Its average value is 8 cm. (3⅛ inches).

The *bimastoid diameter* is the greatest distance between the mastoid apophyses. Its length is 7 cm. (2¾ inches).

There are three *circumferences* to the fetal head. The *suboccipito-bregmatic* passes through the terminals of the biparietal and suboccipito-bregmatic diameters, and is the greatest circumference of the flexed head. Its value is 33 cm. (13 inches), being somewhat less in female children.

The *trachelo-bregmatic* circumference is the greatest circumference of the extended head. This circumference passes through the bregma and the front of the neck just above the larynx, and has approximately the same value as that of the suboccipito-bregmatic.

The *occipito-frontal* circumference is the greatest circumference of the vault, which is 34.5 cm. (13½ inches).

SUMMARY OF THE HEAD DIAMETERS

Diameters of approximately 9.5 cm. or 3½ inches:
- Biparietal.
- Suboccipito-bregmatic.
- Trachelo-bregmatic.
- Fronto-mental.

Diameters above 9.5 centimeters:
- Occipito-frontal 12
- Occipito-mental 13.5

Diameters below 9.5 centimeters:
- Biparietal 8
- Bimastoid 7

Trunk Diameters.—The diameters of the fetal body are compressible, and hence relatively smaller than those of the cranium. Two are of obstetric importance.

The *bisacromial*, which is the greatest transverse diameter of the shoulders, has a value of 12 cm. (4¾ inches).

The *bistrochanteric*, or the distance between the trochanters, is 8.8 cm. (3½ inches).

THE PRESENTATION AND POSTURE OF THE FETUS

(a) Presentation.
(b) Posture.
(c) Position.

Presentation.—Presentation *is the relation of the long axis of the fetal ovoid to the longitudinal axis of the uterus.* When the long axis of the fetal ovoid is coident with, or parallel to, the uterine axis, the presentation is spoken of as a longitudinal presentation. On the other hand, when the axis of the fetus bears a transverse or oblique relation to the axis of the uterus, it is called a transverse presentation. Longitudinal presentations are subdivided into podalic and cephalic: *podalic* when the breech presents: *cephalic* when the head presents.

The *presenting part* is that portion of the fetal ovoid which offers itself to the examining finger, and is felt through the cervical ring on vaginal examination. Consequently, when we have a longitudinal presentation, there may be two varieties: (a) Cephalic, in which the presenting part may be either the vertex, the brow, or the face; (b) podalic, in which the presenting part may be the breech, the knee, or the foot.

When the fetus lies with its *longitudinal axis transverse or oblique to that of the uterus, the presentation is transverse,* while the presenting part may be either the shoulder, the elbow, or the hand.

At term the fetus presents by the head in about 96 per cent. of the cases, by the breech in 3 per cent., while it is found lying transversely in only about 1 per cent. The face or the brow is the presenting part in a little less than 5–10 per cent. of cephalic births. The large preponderance of cephalic presentations is due to adaptation, as the fetal mass attempts to accommodate itself to the shape of the uterus.

Posture.—Posture may be defined as the *relation which the fetal*

parts bear to one another. In order that the fetus may adapt itself to the ovoid shape of the uterine cavity the head becomes flexed on the body, the thighs on the abdomen, the legs on the thighs, while the arms are usually carried over the thorax, and the back shows a marked convexity. The normal posture of the fetus in utero is one of flexion.

The posture of the fetus is determined by the posture of the head as shown by the presenting part. When the vertex is the presenting part, the posture is one of flexion. When the face presents, the posture is that of extension. When the brow is the presenting part the head is in semi-extension. *Complete flexion is present when, on vaginal examination, the posterior fontanelle is found on a lower plane in the pelvis than the anterior.* When the anterior and posterior fontanelles are on the same level, the head is semi-flexed.

Position.—Position may be defined as the *relation of the presenting part to the quadrants of the pelvic brim.* These quadrants are designated, anterior left, anterior right, posterior right, posterior left. They correspond to the terminals of the two oblique diameters at the brim, which are the diameters by which the presenting part enters the pelvic cavity.

Positions are *named according to the particular quadrant which is occupied by the leading anatomical landmark on the presenting part,* or from the relation which this anatomical landmark on the presenting part bears to the terminal of the oblique diameter by which it enters. In illustration, when the occiput, which is the leading pole of the flexed head, occupies the left anterior quadrant or confronts the left acetabulum, it is called a first position or left occipito-anterior; left, because it is to the mother's left; anterior, because it points to the mother's front; occipito, because this is the anatomical landmark which occupies this quadrant and confronts the landmark on the pelvic brim.

When the occiput occupies the right anterior quadrant or looks toward the right anterior landmark, it is a right occipito-anterior. In the same way it may be a right occipito-posterior, or a left occipito-posterior. Right and left, anterior and posterior refer to the mother.

When the face is the presenting part, the chin is the leading pole or anatomical landmark. Face positions are named from the

relation which the chin bears to the quadrant of the pelvis which it occupies.

Breech positions are named with reference to the direction of the sacrum. When the sacrum of the child confronts or occupies the left anterior quadrant, it is called a left sacro-anterior; when it looks toward, or occupies, the right anterior quadrant, it is named a right sacro-anterior, etc. Shoulder positions are named from the relation which the scapula has to the quadrant at the mother's brim.

We have, therefor sitions with their relative frequency.

s

Left occipito-anteri per cent.
Right occipito-ante. 10 per cent.
Right occipito-posterior, 17 per cent.
Left occipito-posterior, 3 per cent.

From this it will be seen that the head selects the right oblique diameter in 87 per cent. of all vertex cases.

FACE POSITIONS

Left mento-anterior
Right mento-anterior
Right mento-posterior
Left mento-posterior

SACRAL POSITIONS

Frequently in shoulder positions there is by vaginal examination no presenting part available until labor is well advanced, or the membranes have ruptured, hence we must diagnose shoulder cases by our abdominal findings, i. e., by the location of the head and the location of the fetal dorsum. A shoulder case is designated as right or left, depending on whether the head occupies the right or the left iliac fossa; anterior or posterior depending on the relation which the dorsum of the fetus bears to the mother—anterior when it faces the mother's front, posterior when it lies to the mother's back.

CHAPTER VII

THE MECHANISM AND MANAGEMENT OF NORMAL LABOR

Normal labor may be defined as a labor in which the mechanical factors, i. e., the powers, the passages, and the passenger, are normal or relatively normal. Any defect in these mechanical factors, which offers obstruction to the progress of labor, whether it be inertia or inefficiency on the part of the uterine muscle, an anomaly in the pelvis, or a malposition of the fetus, producing dystocia, makes the labor pathological; al labor must have no element of dystocia. It ider as normal only vertex births, in the first p ipito-anterior cases.

Labor is a natural pro he woman expels from her uterus the matured ovum. It is d into three stages:

The *first stage* (or stage of *dil*) begins with the first labor pain and ends with the complete canalization of the cervix.

The *second stage* (or stage of *expulsion*) begins when the cervix is completely dilated and terminates with the expulsion of the child.

The *third* or *placental stage* includes the delivery of the remainder of the ovum, i. e., the placenta and its membranes and the persistent retraction of the uterus.

The Causes of the Onset of Labor.—Why labor usually begins [illegible] eighty days after the first day of the last menstruation is not definitely known. The probable causes are: the [illegible] of the ovum in the later weeks of gestation; the [illegible] of the menstrual period; the influence of period- [illegible] the distention of the [illegible] uterine muscle; the [illegible] muscle; the in- [illegible] excess of car- [illegible] the sep- [illegible] and the fatty [illegible] uterus; and

the intermittent contractions of the uterus in their preparation of the cervical zone.

The growth of the ovum, which becomes a foreign body, furnishes a sufficient stimulus for continued muscular efforts, and, finally, the unconscious memory of tissue transmitted from generation to generation plays an important rôle in the causation of labor.

Signs of the Onset of Labor.—The signs of the onset of labor are:

(1) Lightening.
(2) The irritability of the bladder and rectum.
(3) The increased flow of the vaginal and cervical mucus.
(4) The show (a bloody discharge from the vagina).
(5) The expulsion of the cervical plug.
(6) The occurrence of rhythmic uterine contractions.

Three of these signs indicate that labor has actually begun, i. e., (1) The regular recurrence of uterine contractions; (2) the escape of blood-tinged mucus from the vagina; and (3) the dilation of the cervical os.

By lightening we understand the sinking of the uterus into the pelvis, which takes place from ten to fourteen days before labor actually begins, provided there is no defect in the powers or disproportion between the passage and the passenger. The uterus, with the presenting part, sinks more deeply into the pelvis; the waistline becomes smaller. As the uterus settles lower in the pelvis the pressure on the bladder and rectum is increased, and these viscera become irritable, and are evacuated oftener than is the habit of the individual.

In the primipara the presenting part actually engages in the pelvic brim as a result of lightening, while in the multiparous woman the uterus falls forward, the fundus becomes lower as the uterus assumes the axis of the brim.

With the onset of actual labor urination and defecation become still more frequent, and there is a profuse secretion of vaginal and cervical mucus. As the cervix begins to dilate, the ovum separates from the lower segment, blood escapes, becomes mixed with this cervical mucus, and produces what is known as the *show* (blood-stained mucus).

As referred to above, the most reliable evidence of beginning labor is the occurrence of rhythmic uterine contractions, found by

placing the examining hand upon the abdomen of the woman and feeling the uterus contract. These gradually increase in severity until they become actual *labor pains, which are painful uterine contractions, due to pressure of the uterine muscle on the nerve filaments in the uterus and the nerves in the pelvic cavity.* These contractions occur at regular intervals, which, at the beginning of labor, may be twenty or thirty minutes apart. The interval shortens as labor progresses, until the contractions recur at minute intervals at the acme of expulsion. The duration of the labor pain is from thirty to sixty seconds, the intensity progressively increasing until the maximum is reached, as the head is expelled from the vaginal outlet.

THE STAGE OF DILATION OF THE CERVIX

The first stage of labor includes the dilation of the cervix, and is not complete until the external os is sufficiently dilated to admit of the passage of the child. During labor, as the result of the uterine contractions, there are developed two distinct portions of the uterus, which are separated from one another by the *retraction ring.* The upper segment is the active contractile portion and thickens as the labor advances, while the lower segment becomes thinned out and opens to allow the passage of the child.

The agencies which are concerned in this dilation of the cervix and thinning of the lower segment are:

(1) The traction of the longitudinal fibers of the upper uterine or contractile segment.

(2) The hydrostatic action of the bag of waters.

(3) The softening of the cervical structures by serous infiltration.

(4) The dilation of the cervix, which may be divided into two parts:

(a) The obliteration of the canal, which effaces the internal os and shortens the vaginal portion of the cervix.

(b) The dilation of the external os.

Action of the Longitudinal Muscular Fibers.—The traction of the longitudinal fibers of the upper segment of the uterus draws the lower segment upward over the presenting portion of the ovum. The obliteration occurs from above downward, beginning at the os

internum. With the first occurrence of active labor pains, the ovum is partially detached from the lower uterine segment. The internal os expands, and the detached bag of waters protrudes into the cervical zone, making the cervical canal funnel-shaped and increasing its depth and width during the pains. In the intervals between pains the cervical canal partially regains its cylindrical form until the internal os has been permanently effaced.

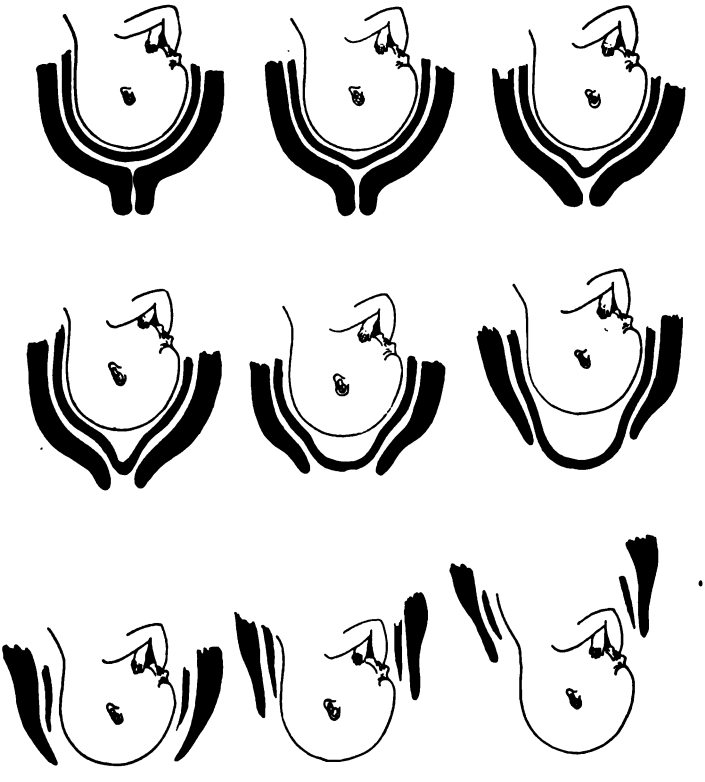


FIG. 37.—DILATION OF THE CERVIX.

After the cervical canal has become obliterated, dilation of the external os occurs, and the progress of labor is indicated by the degree of canalization. This process differs, depending on whether the woman is a primipara or has already borne children. In the multipara the dilation is nearly uniform throughout its extent, while in the primipara the obliteration takes place as has already

been described, and complete dilation of the external os usually follows.

When the entire os and vaginal portion of the cervix have been completely effaced the second stage begins.

The Bag of Waters.—The bag of waters is that portion of the fetal sac, the membranous envelope, which in the course of labor protrudes downward into the cervical canal and acts as a dilating fluid wedge during each labor pain.

The contained liquor amnii is divided into the "fore waters" and "hind waters" by the ball valve action of the fetal head. The "fore waters" is that ained liquor amnii in front of the head or presenting artly cut off from the hind waters as the head is driven i er uterine segment during a pain. By the "ball valve" action of the head the force of each uterine contraction, which is transmitted to the liquor amnii, is lessened as it reaches the fore waters, and the protruding bag is not only urged downward, but exerts an expansive force upon the walls of the passive cervical canal. The fore waters are "watch glass" in shape when the vertex is the presenting part; "glove finger" in case there is malposition. Malpositions and malpresentations favor early rupture of the membranes, as the full force of the general uterine pressure is applied to the apex of the dilating wedge during a pain, un-

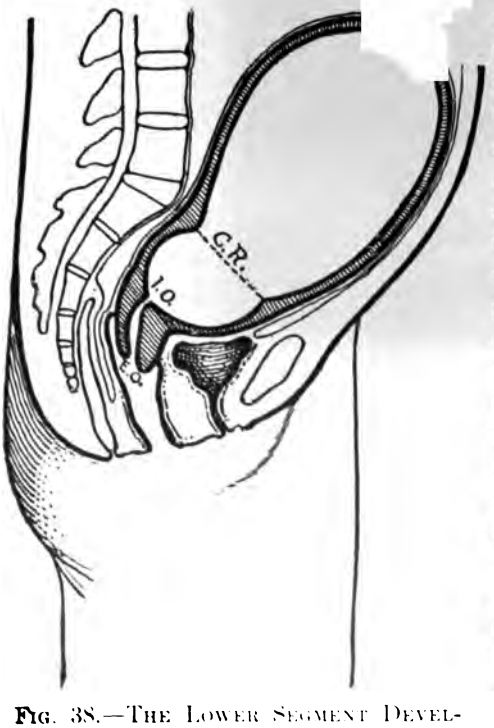


FIG. 38.—THE LOWER SEGMENT DEVELOPED PARTLY FROM THE CERVIX AND PARTLY FROM THE LOWER POSITION OF THE BODY.

less the pelvis is blocked and the force lessened by the "ball valve" action of the head. When the membranes rupture prematurely dilation of the cervix goes on more slowly and is more painful, for the fetal head is not as good a dilator as the elastic fluid wedge, the bag of waters, with its equable pressure. The dilation is yet more tedious when there are malpresentations or malpositions, by reason of the greater inequality of pressure on the different parts of the girdle of resistance.

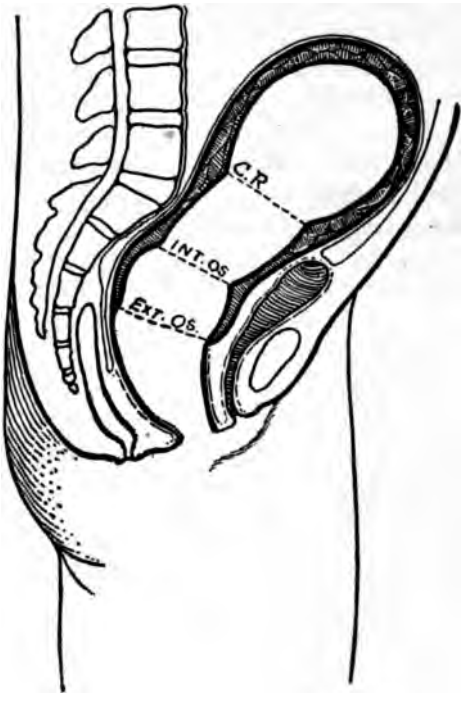


FIG. 39.—COMPLETE CANALIZATION OF THE UTEROCERVICAL ZONE.

Complete canalization of the cervix is obtained by the careful preservation of the membranes until they protrude at the vulvar orifice. The membranes rupture usually by the time they reach the pelvic floor, though occasionally only after the head has escaped.

Cervical disease, such as chronic endocervicitis, malpresentations or frequent and indelicate vaginal examinations, favor early rupture, which is termed "breaking the waters."

Softening of the Cervix.—The softening of the cervix is a progressive process beginning early in pregnancy. Near term the development of the uterus increases the size of the blood vessels of the cervix, especially the veins, which, during a pain, when the walls of the uterus are everywhere compressed by contraction upon its contents, are unsupported by pressure, and become markedly engorged. A serous transudation takes place into the cellular tissues, loosening its structure, making it more dilatable.

Dilation of the Cervix.—The retraction ring, or ring of Bandl, is the line of demarcation between the thickened upper segment of the uterus and the thinned out lower segment, which becomes defined during a pain. It is developed during the first stage of labor, as during each contraction of the uterus there is a retraction of the circular muscular fibers into the upper segment of the uterus, causing it to become thickened, while the lower segment becomes correspondingly thinned. The retraction or contraction ring rises higher on the uterus in proportion to the number and the strength of the pains. While it is demonstrable in every labor during a pain, near the end of the first stage it becomes more apparent, and its presence has more significance in connection with fetal or pelvic dystociæ. According to Schroeder and others, the lower uterine segment is developed in part from the cervix, in part from the lower portion of the corpus uteri.

During the latter part of the first stage of labor the posterior wall of the bladder and the anterior or pubic segment of the pelvic floor are drawn up as the presenting part descends lower in the pelvis and dilation progresses. The elevation of these structures is more marked as the head escapes from the uterus. The bladder is thus lifted partly out of the lesser pelvis away from injurious pressure; only a small portion of the organ rises above the level of the pubic bones; the length of the urethra remains unchanged.

The duration of the stage of dilation is from two or three hours to several days. The average length of this stage in the primipara is sixteen hours; in the multipara eleven hours.

STAGE OF EXPULSION

The second stage of labor, or the stage of expulsion, begins when the head passes through the dilated cervix and terminates with the expulsion of the child. It is during this stage that the fetus undergoes a series of passive movements, in the course of its passage through the bony birth canal, which are described as the mechanism of labor. These passive movements are necessitated by the fact that the engaging diameters of the head are larger than those of any other part of the fetal mass. Therefore, the essential mechanical phenomena of the stage of expulsion are those pertaining to the birth of the head.

The Birth of the Head.—The fetal head is an irregular ovoid body, with two leading poles, an occipital and mental process, whose long axis is greater than any of the inlet diameters of the pelvis, while its transverse diameter is about equal to those of the pelvic-brim cavity and outlet and, in typical labor, tightly fits the birth canal. To enter the brim the head must flex upon the body in order that the occipital pole may pass into the superior strait.

The essential cause of the head movements is the adaptation of the head to the varying shape and course of the birth canal. The movements which the head describes in its course are *descent, flexion, rotation, extension, restitution, and external rotation.* Restitution and external rotation are additional movements which the head takes after it escapes from the vulva in consequence of the spiral motion of the trunk and consequent twisting of the neck in the course of its descent.

Descent does not actually take place until the stage of expulsion, as before this time, when the waters are intact, the expellent force of the uterine contraction is transmitted to the head through the entire uterine contents. When dilation is complete and the membranes have ruptured, allowing the escape of more or less fluid, the propelling force of the uterine contraction, supplemented by the action of the abdominal muscles, acts directly upon the fetus, propelling it along in the direction of least resistance, through the course of the birth canal. The descent is a progressive process and is coincident with the other steps of the mechanism. The head advances with the pains and recedes in the intervals. Under normal conditions, i. e., a proper relation between the size of the head and the pelvis, the advance and recession continue till the head is well in the grasp of the vulvar ring. It is partly due to this phenomenon that sufficient dilation of the soft passages is attained to allow of the passage of the child without extensive laceration.

Flexion.—During pregnancy, in order to conform to the shape of the uterus and bring the long diameter of the cephalic ellipsoid into conformity with the long diameter of the uterus, the fetus assumes a posture of flexion, which is the normal posture of the fetus in utero. This primary flexion is increased as the descent begins. The head is so hinged upon the trunk that the occipitofrontal diameter of the skull corresponds to a lever of unequal arms, the frontal arm being the longer. When labor pains occur,

and the head is forced down into the uterocervical zone, equal resistance is met with at both ends of the lever, but owing to the frontal arm being the longer the upward resistance acts with greater effect and the chin is forced up against the sternum. The flexion is still more increased when the head encounters the greater

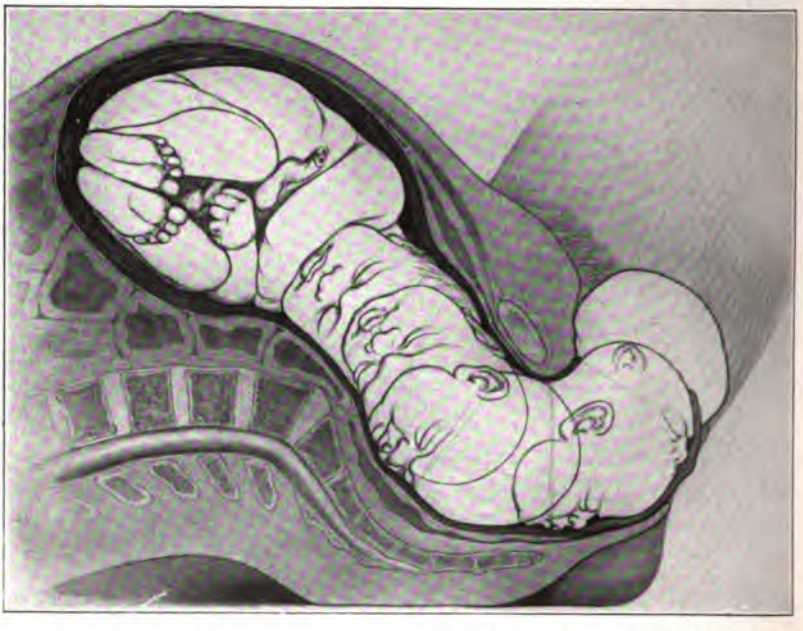


FIG. 40.—SUCCESSIVE STEPS IN THE NORMAL MECHANISM IN A LEFT OCCIPITO-ANTERIOR POSITION OF THE VERTEX.

resistance of the bony canal. By the attainment of complete flexion, which is only possible when all of the factors of labor are acting harmoniously, the suboccipito-bregmatic diameter of 9.5 cm., is substituted for the occipito-frontal of 12 cm., which makes it possible for the head to pass into the pelvic inlet and become engaged, which means that the suboccipito-bregmatic circumference, the largest circumference of the flexed head, has passed into the brim. The head undergoes still further accommodation to the passages by the process of molding, due to the malleability of the cranial vault

in the longest diameter which is available for its passage, i. e., the right or left oblique. At the outlet, however, the longest diameter available for its exit is the antero posterior. The head, therefore, as it descends, must rotate about the axis of the birth canal to keep its longest engaging diameter constantly in the longest diameter of the pelvis during its passage through it.

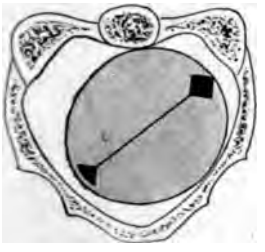


FIG. 41.—RELATION OF THE SAGITTAL SUTURE IN RIGHT OCCIPITO-ANTERIOR AT THE BRIM.

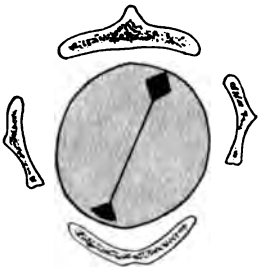


FIG. 42.—RELATION OF THE SAGITTAL SUTURE IN RIGHT OCCIPITO-ANTERIOR IN CAVITY.

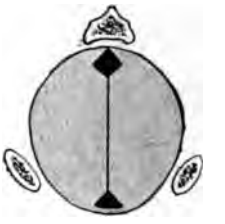


FIG. 43.—COMPLETE ANTERIOR ROTATION, SAGITTAL SUTURE AT OUTLET.

The lateral halves of the pelvic floor shunt downward and inward toward the median line. In normal labor, as the head passes the brim in complete flexion, the occipital pole of the cephalic ellipsoid first strikes the lateral half of the pelvic floor, and, as it descends, it is guided forward and inward beneath the subpubic arch. *It will be seen, therefore, that perfect flexion, a firm pelvic floor, and efficient labor pains are essential to the completion of forward rotation of the occiput.* The relation which the sagittal suture bears to the diameters of the pelvis during the descent of the head from the brim to the vulvar outlet is the obstetric index of the degree of rotation, *for rotation has not been completed until the sagittal suture of the fetal head is approximately parallel with the anteroposterior diameter of the pelvic outlet.* Clinically, however, complete rotation is seldom observed, as the head is usually expelled in a position slightly oblique to the median anteroposterior plane of the parturient outlet.

In addition to complete flexion, molding of the head and the development of the caput succedaneum (an edematous swelling de-

veloped upon the presenting part of the fetus after rupture of the membranes) tend to promote rotation by increasing the dip of the occipital pole. When the occiput has sunk below the level of the pubic arch, its further forward rotation is due partly to the fact that it follows the direction of least resistance.

Extension.—After the occiput has escaped beneath the pubic arch, and the suboccipito-bregmatic circumference is in the grasp of the vulvar ring, further advance in flexion becomes impossible, owing to the arrest of the shoulders by the pubic rami and the contour of the soft p[illegible] birth canal. The nape of the neck rests against the [illegible]nent, and the head rotates upon the nucha as a pivotal [illegible] is born by a movement of extension, the vertex (suboc[illegible]gmatic circumference), the forehead (suboccipito-frontal [illegible]ference), and the face (suboccipito-mental circumference) successively passing through the vulvar ring and sweeping over the perineum. The chin does not leave the sternum until the moment of expulsion. There is usually a brief pause following the birth of the head, during which *restitution* takes place.

Restitution.—Restitution is the untwisting of the neck which takes place after the head is born, which allows the head to take a position corresponding to that in which it entered the pelvis. This step of the mechanism is brought about by the shoulders descending into the pelvis and engaging in the oblique diameter opposite to that in which the head engages. This results in a certain degree of torsion of the neck, as the forward rotation of the head takes place in its descent through the pelvis. Therefore, *when the head is born, the neck untwists*, and the movement is termed restitution. The position which the head takes after its birth, if left to itself, confirms the diagnosis of its position as made by vaginal examination prior to delivery.

External rotation is a still further rotation of the head after its delivery, which is observed during the expulsion of the body. It occurs in consequence of the spiral movement of the trunk as it follows the course of the pelvic canal in the several steps of the mechanism, which are less perfect than those followed by the head.

The Birth of the Trunk.—The shoulders and the breech suc-

cessively engage in the oblique diameter of the brim and rotate into the anteroposterior diameter of the outlet, but they descend through the pelvis with a less perfect mechanism than that followed by the head.

Since the shoulders and breech enter the brim of the pelvis in the opposite oblique diameter to that taken by the head, the rotation, imperfect as it is, takes place in a direction opposite to that taken by the head. The anterior shoulder is usually expelled first, or it lodges behind the pubic bone and acts as a pivotal point about which the posterior shoulder rotates. In which case the posterior shoulder first appears at the ostium vaginæ and escapes over the perineum.

A gush of bloody water, the discharge of the "hind waters," generally accompanies the birth of the trunk.

Other phenomena having to do with mechanism are the formation of the caput succedaneum and the molding of the head, which takes place under the pressure of the pelvic walls.

As referred to above, the caput succedaneum is an edematous swelling developed upon the presenting part of the fetus after the membranes have ruptured.

In a cephalic presentation the caput forms on the part of the head below the girdle of resistance (the dilating cervix). The vessels, which at this point are unsupported by pressure during the uterine contractions, become engorged, a serous infiltration of the unsupported tissues takes place, and an edematous tumor develops. The size of the tumor depends on the strength of the pains and the length of the labor. Early rupture of the membranes in primiparæ is always complicated by large caput formations. Its location differs with the position in which the head has entered the pelvis, and, therefore, has a value in confirming the interpartal diagnosis.

In left occipito-anterior positions the caput forms on the right posterior parietal region, while when the occiput has entered in a right anterior position the caput will be found on the left posterior parietal region. On the other hand, when the head has entered as a right occipito-posterior, the edematous tumor appears upon the left anterior, and in the left occipito-posterior upon the right anterior parietal region. A long delayed second stage, in which the head has rested for several hours in the lower portion of the birth

canal without completing its rotation, tends to modify the location at which the caput is found.

Molding of the head is due to the plasticity of the cranial vault. The head adapts itself to the pelvic bones by molding, during which process the ovoid under the pressure of the pelvic walls may diminish in its engaging circumference, while the long axis of the ovoid is correspondingly increased and the head is elongated in the direction of the birth canal. This is particularly marked when there is a slight disproportion between a malleable head and the pelvis it has to pass through.

The last step in the perineal stage. As the occiput escapes from the ... approaches the outlet of the soft parts, the posterior or ...gment of the pelvic floor is stretched and pushed downw... forward in front of the advancing head. Its length, fro... ...coccyx to the posterior commissure, becomes markedly increased, so that at the moment of expulsion it measures 13 cm. (5 or 6 inches). The sphincter ani is relaxed, the anal orifice becomes D-shaped and gapes widely, and feces are expelled from the rectum as the head is pushed out over the stretched pelvic floor. The head escapes from the vulvovaginal orifice by the suboccipito-bregmatic, suboccipito-frontal, and suboccipito-mental circumferences, and, as it escapes the posterior segment of the floor, promptly retracts over the face.

Close attention should be given to the fetal heart and the maternal pulse and temperature during the second stage of labor. It will be noted that normally the maternal pulse rate is somewhat accelerated during the pains, but in the intervals between the pains it should reassume the normal. A progressively quickened pulse, when the woman is at rest, shows fatigue. The maternal temperature is generally raised a degree or more during labor; the elevation is greater the more tedious the delivery.

The fetal pulse rate is retarded at the height of the pain, owing to increased arterial tension in the fetus. Prolonged labor or early rupture of the membranes exposes the fetus to greater circulatory changes from interference with the placental circulation.

The length of the second stage averages about two hours in primiparae and about one hour in multiparae, though it may be as

THE PLACENTAL STAGE OR THIRD STAGE OF LABOR

Three distinct physiological events take place in the third stage of labor:

I. The separation of the placenta.
II. The expulsion of the placenta, the membranes, and blood clots.
III. The retraction of the uterus.

The placenta is separated from its uterine attachment in the meshy layer of the decidua by the sudden contraction of the placental site due to the *retraction* of the uterus, which takes place on the expulsion of the fetus and liquor amnii. Further contraction

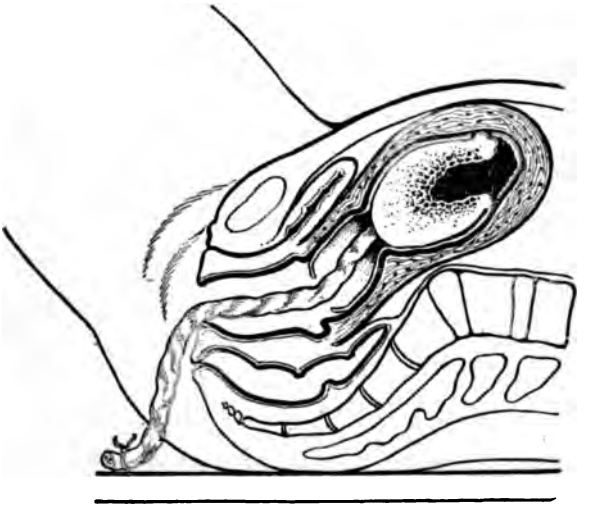


FIG. 44.—DIAGRAM ILLUSTRATING SEPARATION OF PLACENTA. EXTRUSION BY FETAL SURFACE. Schultze's Mechanism.

of the placental site continues as the uterus retracts. Its loosening is also partly due to the extruding force of the uterine contractions. There is a moderate bleeding in the intervals between contractions until the separation is complete. After the placenta is completely separated, its expulsion is effected by the expelling force of the uterine contractions, which recur at three to five-minute intervals.

The placenta is expelled through the rent in the membranes, through which the child has already escaped, like an inverted umbrella, dragging the membranes after it and peeling them off from the uterine wall. It may present by its amniotic or fetal surface

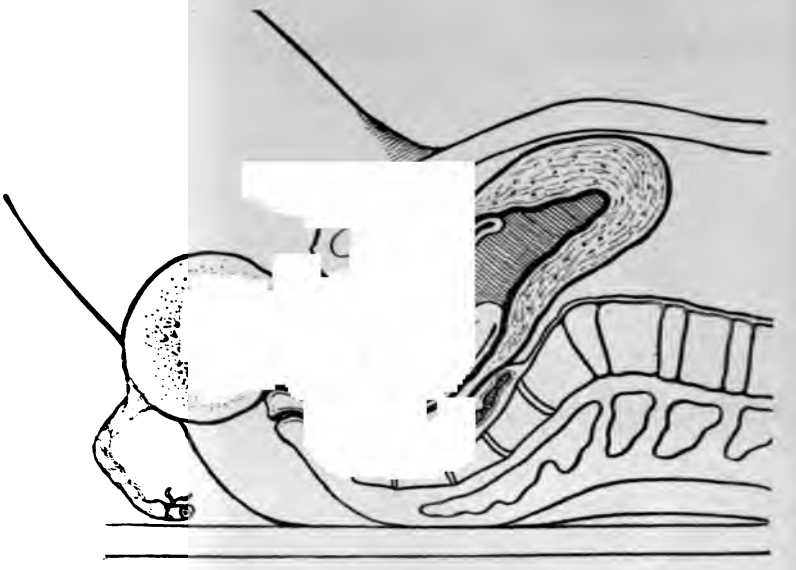


FIG. 45.—EXPULSION BY FETAL SURFACE. Schultze's Mechanism.

(Schultze's mechanism), or it may be folded on itself and be expelled edge first (Duncan's mechanism). It is probable that the extrusive force of the uterine contraction is sufficient to propel it through the vagina, acting in conjunction with the tonicity of the muscular structures in the posterior segment of the pelvic floor.

Retraction of the uterus is the most important physiological step of the placental stage. It consists of a thickening and shortening of the walls of the uterus, due, first, to a rearrangement of the muscular fibers; second, to the thickening and shortening of the fibers themselves. Only the upper segment participates in these changes, the body and fundus become hard and firm and the muscle fibers by their retraction ligate the uterine vessels which have been torn across by the separation of the placenta.

The cervix and lower uterine segment remain passive and hang

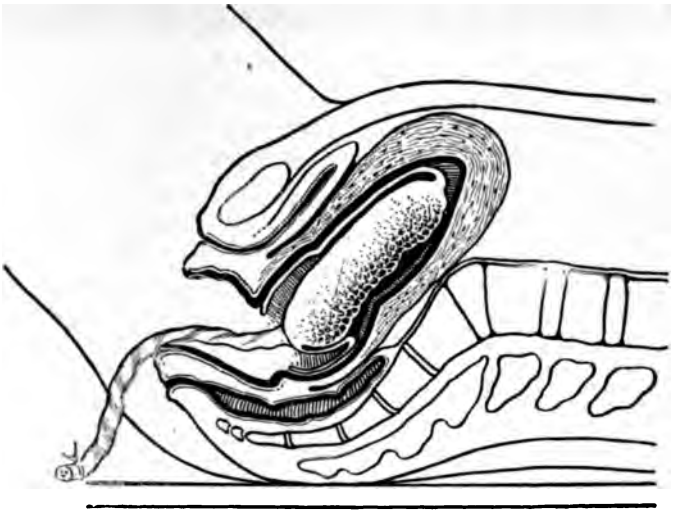
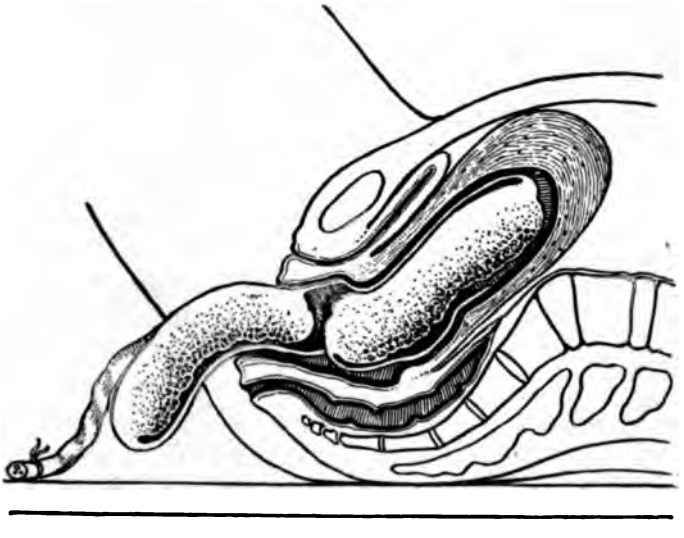


FIG. 46.



FIGS. 46 AND 47.—EXTRUSION OF THE PLACENTA EDGEWISE. Duncan's Mechanism.

in the vagina as a bruised curtain, flaccid and without form for several hours.

The duration of the third stage varies from a few minutes to two hours. Its average length is twenty to thirty minutes.

The average length of normal labor is, in a primipara, eighteen hours, in a multipara, twelve hours. Variations from two to twenty-four hours are not uncommon.

THE MANAGEMENT OF LABOR

The obstetrician's obligation to his patient are often underestima... antepartum, interpartum, and postpartum complications... he child-bearing woman is liable may be prevented or cor... proper and intelligent medical supervision during mid-p... and in the later months. The pregnant woman should be taught the simple rules of hygiene; urged to give attention to her general health, and instructed as to her diet, the amount of exercise to be taken, the care of the breasts, the nipples, the genitalia, and her marital relations. The physician should acquaint himself with the urinary output of his patient, by frequent qualitative and quantitative examinations of the urine at regular intervals throughout the pregnancy, and with the state of her metabolism and the degree of nitrogenous oxidation by repeated examinations of her blood pressure during the last trimester. Every patient at least a month before the expected date of labor should be subjected to a systematic examination, which should include ...

finally a computation should be made of the probable date of labor.

Important data concerning the present pregnancy, such as the occurrence of hemorrhages, leucorrhea, unusual abdominal enlargement, abdominal pain, fetal movements, etc., should be noted, as should the character of the vaginal discharges.

The mammary examination should include inspection of the breasts, their shape and development, the condition of the nipples, their form, size, and development.

The abdominal examination should determine the presence or absence of complicating abnormalities, as:

(1) The presence of a pendulous abdomen, hydramnios, complicating tumors, or twins.
(2) The development of the pregnancy, as shown by the height of the fundus and the length of the fetal ovoid.
(3) The location of the placenta.
(4) The presentation, position, and posture of the fetus.
(5) The size and hardness of the fetal head.
(6) The location, rate, and rhythm of the fetal heart.
(7) The external measurements of the pelvis, including the diameters of the outlet in all primiparæ and in multiparæ with a history of previous difficult labors.

Vaginal Examination.—The birth canal should be examined for *former injuries* to the pudendum and vulvovaginal orifice, the vagina, the cervix (including scars from previous operations), and for tumors and inflammations in these locations.

The *lower uterine segment* should be examined for *placenta prævia* and the pelvic cavity explored to determine the relation of the head to the pelvis, and for obstructing tumors, as incarcerated dermoids, ovarian cysts, cervical myomata or osteomata.

Finally the numerical equivalent of the internal measurements should be noted: (1) of the diagonal conjugate; (2) of the depth of the symphysis pubis; (3) of the bisischial, and (4) of the anterior posterior at the outlet. The determination of these measurements should be a routine procedure in every primipara and in multiparæ whose history excites suspicion of pelvic contraction.[1]

[1] It is advised that the student or practitioner familiarize himself with the routine of the foregoing examination, which may be applied to the woman seen for the first time, already in labor, as well as to the patient who has placed herself under the care of the physician early in her pregnancy.

METHOD OF ABDOMINAL EXAMINATION FOR DETERMINING THE PRESENTATION AND POSITION OF THE FETUS

Position of the Patient.—The woman is placed in the horizontal posture, preferably on the left side of the bed or on a couch, with her thighs and legs extended. The abdomen is fully exposed, the limbs may be covered with a sheet reaching to the pubes, and the upper part of the body protected by the nightdress, which is rolled up to about the level of the ensiform, or by a second sheet over the chest. The abdomen is then inspected, and the height, shape, and position of [illegible] noted. The next step is to proceed with the palpa[illegible] g this, however, it is well to bathe the hands in warm wa[illegible] er the sense of touch more acute and obviate the reflex co[illegible] of the abdominal and uterine muscles, which are apt t[illegible] ed by the contact of cold hands. Abdominal or uterine tension interferes with the examination.

The succession of steps in abdominal examination, which will most easily determine the presentation and position of the fetus and its relation to the pelvis, are as follows, i. e.:

1. Locate the dorsal plane.
2. Locate the small parts (these are always found on the opposite side to that on which the dorsal plane lies).
3. Examine the lower fetal pole.
4. Locate the cephalic prominence.
5. Examine the upper fetal pole.
6. Locate the position of the anterior shoulder.
7. Locate the fetal heart.
8. External and internal pelvimetry and cephalometry.

Location of the Dorsal Plane and Small Parts.—To locate the dorsal plane and small parts the examiner faces the patient and places the palmar surface of one hand flat on the median section of the uterine tumor at about the level of the umbilicus. He then presses firmly backward toward the spinal column and the child will be displaced to the side toward which its *back lies* and the fluid content to the other. The child may be felt to slip from under the hand, and palpation with the other hand will readily distinguish the dorsum from the fluid part of the tumor by its greater resistance. Having located the dorsum to be on the left or right side of

e mother, one hand is placed on the fundus or upper pole, mak-
g downward pressure in the direction of the fetal axis. This
eadies and arches the dorsum and brings it nearer to the abdom-

G. 48.—THE HAND IN THE MEDIAN SECTION, DISPLACING THE CHILD TO THE SIDE TOWARD WHICH ITS BACK LIES.

al wall, where it may be palpated with the other hand and identi-
ed by the length and breadth of the resisting plane, and dis-
nguished from the lateral plane by its greater width and con-
xity of the dorsum and the absence of a sulcus between it and
e head. When the location of the dorsal plane is determined the
nall parts should be felt on the opposite side; they give to the

palpating hand the sensation of nodules, which glide freely about under the touch. Occasionally their outlines may be fully traced, and a knee, thigh, or leg recognized. Light palpation, by the use of circular rubbing movements with the finger tips, favors their detection.

FIG. 49.—THE HAND ON THE FUNDUS, ARCHING AND STEADYING THE DORSAL PLANE, BRINGING IT OUT FOR EASIER PALPATION.

In anterior positions the dorsal plane is prominent and in front, while the small parts are felt on the opposite side and more or less masked.

In posterior positions the lateral plane of the fetal body, with the sulcus between the body and head, is most accessible, and the small parts are easily appreciable and in the median section of the abdomen.

Examination of the Lower Fetal Pole.—To examine the lower fetal pole, the examiner faces the patient's feet and with both hands placed over the lower uterine segment just above and to the inner side of Poupart's ligament, finger tips toward the mother's feet, and palmar surfaces nearly facing each other, grasps the lower fetal pole between the hands, and by manipulation finds the presenting part. When the head is in the lower uterine segment, it is recognized by its *hard globular feel*, and there is a lateral sulcus between it and the trunk. *The head is always found sunk into the pelvic excavation before labor in the primipara when the relations*

between the size of the head and the size of the pelvis are normal. This is not so in the multipara unless *lightening* has occurred, when the head will be found in the excavation before labor in one-third of *multiparous women.*

FIG. 50.—EXAMINATION OF THE LOWER FETAL POLE.

The breech alone is smaller, though with all of its component elements it is larger than the head. It lacks, however, the hard and globular feel of the head, presents no sulcus between the presenting part and the trunk, and is *never found* in the *excavation before labor.*

When the small parts can be felt just beyond either fetal po that pole is almost surely the breech.

When the head is located in either iliac fossa it suggests a cro birth or transverse presentation.

FIG. 51.—LOCATING THE CEPHALIC PROMINENCE IN THIN WOMEN I GRASPING THE FETAL HEAD WITH ONE HAND HELD TRANSVERSE ACROSS THE SUPRAPUBIC REGION.

Location of the Cephalic Prominence.—When the head, perfect flexion, has entered the brim, the cephalic prominence greater on the side of the sinciput. This may be recognized b placing the hands as when examining the lower fetal pole, ar

noting that the hand opposite to the cephalic prominence sinks more deeply into the excavation, or in women with thin, lax abdominal walls the head may be grasped with one hand held transversely across the suprapubic region and the cephalic prominence palpated. Its location affords some aid in deciding whether the child's back lies to the right or the left.

Examination of the Upper Fetal Pole.—To examine the upper

FIG. 52.—EXAMINING THE UPPER FETAL POLE.

fetal pole the operator stands facing the mother and places both hands over the upper uterine segment, the palmar surfaces nearly facing each other, and grasps the content of the upper segment and attempts to ballott it from side to side. The hard globular head may be tossed from side to side, while the breech, which lacks the flexible attachment of the head to the trunk, is less mobile and is of greater bulk. In the intervals of uterine relaxation the breech may be broken up into its component parts by deep circular movements of the flat hand. The ease of palpation is largely dependent upon the amount of liquor amnii present and the laxness of the abdominal wall.

Location of the Anterior Shoulder.—The location of the anterior shoulder indicates the position of the child's back and serves as a check in the abdominal *diagnosis* of *position*. When the an-

terior shoulder is found within one or two inches of the medi line, an anterior position of the child's back may be assume When, however, the anterior shoulder is far from the median li in the region of the anterior superior spine of the ilium, a posteri position of the dorsum is indicated.

FIG. 53.—LOCATING THE ANTERIOR SHOULDER.

The anterior shoulder may be located by placing the hand up the head and moving it upward toward the breech (Fig. 53) the side of the abdomen on which the dorsum has been found. T first obstacle encountered after passing over the sulcus formed b the neck is the anterior shoulder. More careful palpation ma identify its anatomical characters.

Location of the Fetal Heart.—The point at which the fetal heart tones are heard loudest is called the *focus of auscultation.* The heart is usually heard in its maximum intensity over an area of about 7.5 cm., or three inches, in diameter. The location of this area is of importance in distinguishing between right and left, and anterior and posterior positions of the child's back. When the heart sounds are heard on the left side of the abdomen, it indicates a left position, while when the heart tones are on the right side the dorsum is to the right. The relation of the heart tones to the median line, whether near to it or far from it, indicates respectively an anterior or posterior position of the back. In right dorsal positions *too* much dependence must not be placed on the location of the heart sounds for diagnostic purposes, as the trunk may be in a right dorsal-anterior position and the head in a right occipito-posterior, owing to the fact that the right oblique diameter at the inlet is larger than the left and the head elects it, while the normal obliquity of the uterus is to the right, and the whole organ is slightly rotated in its long axis toward the left.

The heart sounds are best transmitted through a solid medium. Therefore, they should be heard at a point where the uterine wall can be firmly depressed into contact with the fetus. *Such a point is over the lower angle of the left scapula of the fetus, or the upper part of the fetal dorsum, which offers a surface for firm contact.*

Heart sounds in the upper uterine segment above the umbilicus indicate a breech, in the lower portion of the abdomen a cephalic, presentation. The position of the heart tones is only of positive diagnostic value in determining presentation in primiparæ, in whom the presenting part sinks into the lesser pelvis, for it must be remembered that the heart is situated nearly midway between the ends of the fetal ellipse, and, therefore, in multiparæ, in whom neither pole sinks into the pelvis before lightening, the heart may be heard either above or below the umbilicus without having a definite diagnostic significance.

External Pelvimetry.—External pelvimetry should be practiced on every woman, pregnant for the first time, who places herself in care of a physician, and on all multiparæ who have experienced difficulty in previous deliveries, as the suggestive value of the external measurements cannot be overestimated.

In order to measure the external diameters of the pelvis we use

a pelvimeter, a large pair of calipers with *blunted tips* having a centimeter scale attached which indicates the distance between the tips. The simplest form of instrument is the one devised by Colyer (Fig. 54).

Marked pelvic contraction is commonly associated with evidences of body asymmetry elsewhere, such as the rachitic rosary, large joints, lameness, small stature, spinal kyphosis, etc., which are usually apparent. On the other hand, the minor degrees of contraction, which are comparatively common and cause a large proportion of the difficult labors, can only be recognized by the adoption of routine pelvimetry.

FIG. 54.—COLYER'S PELVIMETER.

When the *interspinal* and *intercristal* diameters are both decreased in length, general pelvic contraction is suggested. When, however, the length of the interspinal is equal to or greater than that of the intercristal, some degree of anteroposterior flattening may be assumed. The length of the external conjugate confirms or disproves this assumption. An external conjugate of 18 cm., or seven inches, may be taken as the average lower limit in a normal pelvis. When the external conjugate is below 16 cm., or six inches, the pelvis is surely contracted; when above 20 cm., or eight inches, the pelvic inlet is almost always ample. External mensuration should always be supplemented by an examination of the outlet measurements; the bisischial, the anteroposterior, and the depth of the symphysis should be estimated as routine, as the frequency of funnel pelvis as a cause of second stage dystocia has shown their importance.

When the *subpubic* arch is narrowed, the effect on labor is seri-

ous unless there is a compensating space posteriorly, as it prevents the occiput from emerging directly under the symphysis pubis, and causes it to slide down upon the ischiopubic rami before it can escape. The distance between the ischial tuberosities is normally about four inches, or 10 cm., while the antero-posterior, measured from the summit of the subpubic arch to the sacral tip, is about five inches, or 12.5 cm. From the obstetric standpoint this diam-

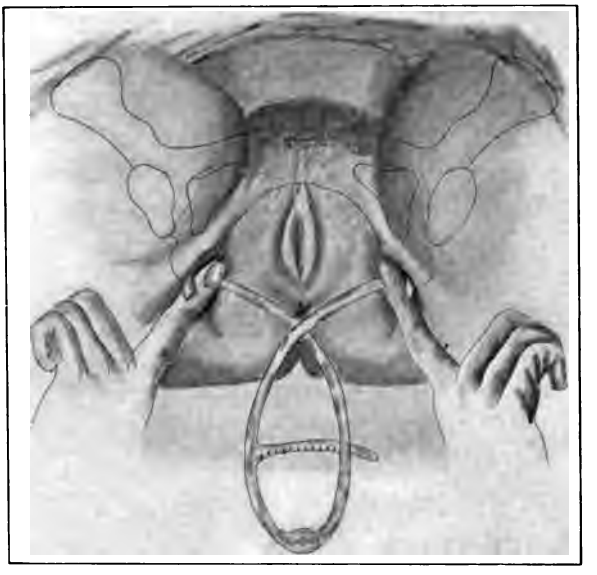


FIG. 55.—MEASURING THE DISTANCE BETWEEN THE ISCHIAL TUBEROSITIES (THE BISISCHIAL DIAMETER).

eter has two sections, an anterior sagittal, which is measured from the center of the bisischial line to the subpubic ligament, and a posterior sagittal taken from the center of the bisischial line to the sacral tip; it is this latter section which must be ample in order to accommodate the head as it emerges from a pelvis with a deep symphysis, narrow arch, or contracted transverse. When the posterior sagittal is below 8.5 cm., and the bisischial is contracted, spontaneous delivery of the average size child is impossible. A material increase in the length of the anteroposterior outlet diameter may be secured by turning the patient in the extreme lateroprone posture.

Method of Vaginal Examination and Internal Pelvimetry.—Preliminary to a vaginal examination during pregnancy or labor the bladder and rectum must be emptied and antiseptic precautions in the preparation of the external genitals and of the *obstetrician's hands* should be strictly observed. We then proceed with the inspection of the introitus for former injuries, scars, edema, rigidity, and inflammations. We also look for injuries and inflammation of

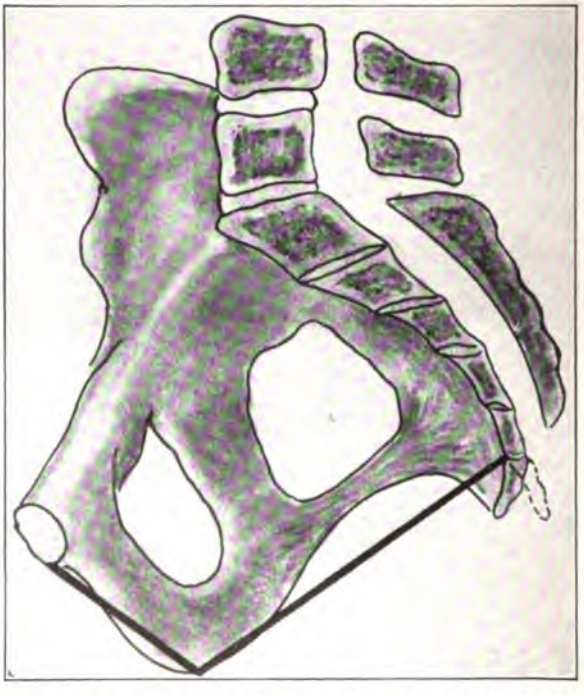


FIG. 56.—THE ANTERIOR AND POSTERIOR SAGITTAL DIAMETERS AT THE OUTLET.

the mucous membrane of the vagina. We then measure the depth of the symphysis, the width of the subpubic angle, the sacropubic (anteroposterior), the bisischial, and the diagonal conjugate diameters, and note the size and general contour of the sacrum.

The depth of the pubes may be readily ascertained by placing the tips of the pelvimeter at the upper and lower margins of the symphysis. The average depth should be about 4.5 cm., or one and three-quarter inches.

The width of the subpubic angle is usually estimated from the lepth of the symphysis, and the length of the bisischial diameter, 'or when the symphysis measures more than 5.5 cm., or the bis-schial is 8 cm., or less, the angle is always less than 90°.

The transverse at the outlet has already been referred to under :xternal pelvimetry. It may be measured externally by placing he woman in the exaggerated lithotomy position with the thighs 'orcibly flexed on the abdomen, and taking the distance between he inner aspects of the ischial tuberosities on a line drawn through he anterior margin of the anus.

The bisischial (or transverse) may be approximately estimated vith the hand by placing the half hand in the vagina and turning t at right angles, so that its greatest width is between the ischial uberosities, which shows that there is sufficient space for the pas-age of the normal head.

The diagonal conjugate is measured as follows: The index and econd finger of one hand are passed into the vagina (the patient)eing in the dorsal recumbent position with the thighs flexed on he abdomen, legs flexed on the thighs, and the thighs abducted) ınd the tip of the sec-)nd finger is placed ıgainst the center of :he summit of the prom-)ntory of the sacrum, vhile the radial edge of :he hand is brought up ıgainst the subpubic ligament, and the point)f contact marked with :he fingernail of the in-lex finger of the other ıand, and the hand withdrawn. The dis-:ance between the two points of contact is neasured, and this neasurement is the .ength of the diagonal :onjugate (Fig. 57),

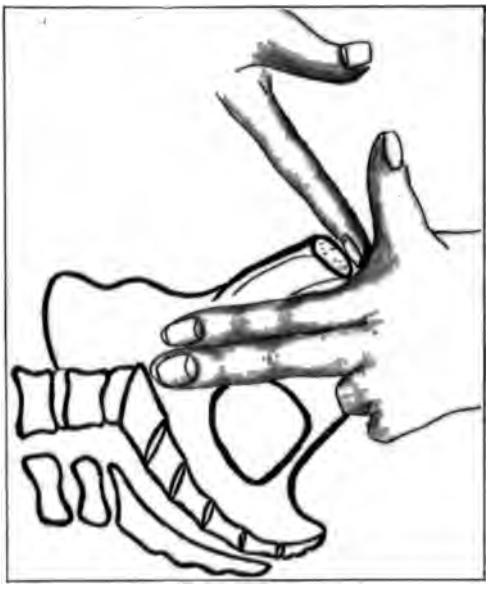


FIG. 57.—TAKING THE DIAGONAL CONJUGATE.

from which we estimate the true conjugate or conjugata vera.

The true conjugate is found by deducting 1.3 to 2 cm. (½-¾ inch) from the diagonal, according to the depth and inclination of the pubes, 1.3 cm. when the depth of the symphysis is 4.5 cm. or less, and 2 cm. when the interpubic joint is more than 4.5 cm. The deeper the symphysis the greater is its inclination. Before removing the hand from the pelvis the other diameters, as the trans-

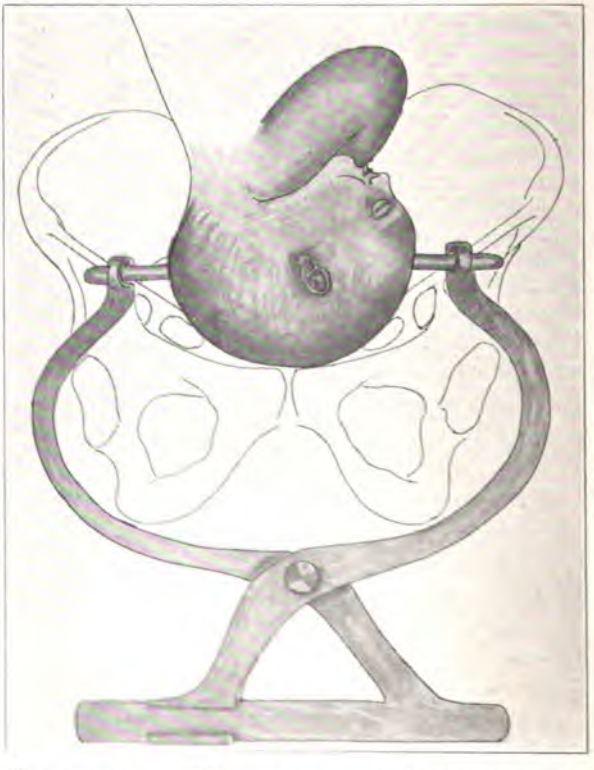


FIG. 58.—MEASURING THE OCCIPITO-FRONTAL DIAMETER, FROM WHICH IS ESTIMATED THE LENGTH OF THE BIPARIETAL IN UNENGAGED CASES.

verse and oblique, and the contour of the pelvic walls may be estimated by palpation.

Cephalometry.—In the foregoing chapter we have called at-

tention to the mechanical factors in labor, the powers, the passage, and the passenger. At present we have no way of estimating the actual dynamic force of the labor pains in the individual woman. We can, however, with comparative accuracy, record the pelvic measurements, but the estimation of relative size of the head to the particular pelvis presents a difficulty not easily surmounted, owing to the fact that what the particular head will do in its relation to the particular pelvis depends not only upon its measurements, but upon its malleability or molding power, which is again largely dependent upon the force and character of the labor pains. *Therefore the best cephalometer in borderline cases is the test of labor.*

However, the size of the fetal head may be determined with approximate accuracy by measurements taken through the abdominal wall before the head has entered the pelvis and is perfectly flexed. The hands are placed upon the abdomen as for palpating the lower fetal pole, and the head is caught between them. The poles of the pelvimeter are held against the abdomen between the middle and the ring fingers of each hand, which overlie the ends of the occipito-frontal diameter. An assistant handles the pelvimeter and, by making firm pressure against the abdominal wall, takes the reading. This reading corresponds very closely to the length of the occipito-frontal diameter. From this measurement the biparietal diameter is estimated by deducting 2 cm. from the occipito-frontal when the latter is below 11 cm., and 2.5 cm. when the occipito-frontal is above 11 cm.

PREPARATION FOR LABOR

Equipment of the Practitioner's Obstetric Bag.—*It must ever be kept in mind by the student and practitioner that the conduct of labor or of an obstetric operation demands the same surgical cleanliness as is observed in opening the peritoneal cavity.* The obstetric "kit" should be equipped with the necessities for securing this cleanliness, as well as the instruments and appliances for meeting the several obstetric emergencies.

The obstetric handbag should contain:

1. Two sterile hand brushes.
2. Green soap.
3. Bichlorid antiseptic tablets and lysol.
4. A Kelly pad.

5. A fountain syringe.
6. A rectal tube.
7. One large glass or metal intrauterine douche tube.
8. A soft rubber catheter.
9. A Robb leg holder.
10. An obstetric forceps.
11. A pelvimeter.
12. A hypodermic syringe.
13. Full curved Hagedorn needles.
14. Needle forceps.
15. Suture material (catgut and silkworm gut).
16. Three Kocher clamps.
17. Cord scissors and heavy straight scissors.
18. Two 4-pronged volsella.
19. A large Sims' speculum.
20. A Ward placental forceps.
21. Two sponge-holding forceps.
22. A curette.
23. Sterile gauze sponges.
24. Sterile gauze (in a container) for uterine packing (3 inches × 10 yards), or three or four gauze roller bandages (3 inches wide).
25. Sterile tape for the navel.
26. An ether inhaler.
27. A thin gum rubber apron.
28. A sterile operating gown.

In addition to the above equipment, the bag should also contain the following drugs:

1. Four ounces of Squibb's ether—ampules of pituitrin (P. D. & Co., or Burroughs' Wellcome).
2. One ounce of Squibb's fld. ext. ergot.
3. One ounce of a 2 per cent. solution of silver nitrate.
4. Morphin sulphate tablets, ⅛ gr.
5. Strychnin sulph., 1/50 gr.
6. Hyoscin hydrobromate, 1/200 gr.
7. Sol. of chloral hydrate, gr. xv to the drachm.
8. Squibb's fld. ext. veratrum viride.
9. Soft capsules quinin bisulphate, gr. v.
10. A tube of sterile lubricant.

Supplies to Be Prepared by the Nurse.—The nurse should be supplied with a list of the things which she should have ready, and this list should include:

A half dozen clean sheets.

One dozen freshly laundered towels.

Two pieces of rubber sheeting wide enough to reach across the bed (in emergency, table oilcloth may be used for the bed protection).

One dozen pieces of cheesecloth, 18 inches square, for wash cloths.

Two or three pieces of unbleached muslin which have been laundered, one and one-quarter yards long by one-half yard wide, for abdominal binders.

A pair of scissors.

Two dozen medium size shield pins (safety pins).

An agate douche pan.

Two or three agate basins of two-quart capacity.

A slop jar, or waste pail.

Two new hand brushes.

Seven gallons of hot and cold sterile water in sterile containers, *covered.*

One yard of strong linen bobbin or a package of sterile tape (1/10 of an inch in width) for tying the navel cord.

One hot water bag.

One woolen blanket to wrap the child in.

An infant's bathtub.

A bath thermometer.

One sterile package of navel cord dressings.

One-half pound absorbent cotton.

Castile soap for child's bath.

Sterile olive oil or vaselin to anoint the child.

Four ounces of liquid green soap.

Four ounces of lysol.

100 bichlorid tablets or germicidal discs.

The child's clothing.

The hand brushes, scissors, gauzes, towels, and ligature material for the child's navel should be wrapped in a towel and sterilized by steam for an hour before using. It is well to do this at the beginning of labor and keep them enveloped in a towel until they

are needed. *Great care should be exercised by the nurse and physician that nothing which is not sterile comes in contact with the woman's genital tract.*

The Lying-in Room.—Unfortunately the obstetrician is seldom consulted as to the selection of the lying-in chamber. However, when it is his privilege to make the selection, he should see that the room is a large, well ventilated one with several windows, preferably with a southern exposure, and that the bathroom is easily accessible.

The room, bedding, and clothing of the patient must be absolutely clean.

The directions to the nurse should include the preparation of the *labor bed*, which should be a *single bed*. The mattress is covered with a muslin sheet, and that with a rubber sheet large enough to reach *across the bed*. A clean muslin sheet is spread over the rubber sheet and pinned fast to the mattress. This makes the permanent bed upon which the lying-in bed is made, by spreading over it a second rubber sheet covered with a muslin sheet, upon which is placed some form of labor pad, to receive and absorb the discharges. This may be made of two or three freshly laundered sheets twice folded and pinned to the labor bed, or an aseptic labor pad one and a half yards square made of cotton batting, cotton waste, or paper wool, covered with gauze or linen, may be used, or a Kelly pad may be substituted for the absorbent pad. The top rubber sheet, muslin sheets, Kelly pad, and labor pad must be surgically clean.

Antisepsis.—Antiseptic agents are employed in obstetrics to secure an aseptic field; fortunately in the whole course of labor, as planned by nature, infection is guarded against by the cleansing of the uterovaginal canal from within out, first, by the rupture of the fore waters, then the delivery of the child, followed by the gush of the hind waters, and finally the expulsion of the placenta through the rent in the membranes by which the child has already escaped. It is, therefore, evident that it is only by the introduction of infecting agents from without that infection can occur. Therefore, everything which enters the vulvovaginal orifice must be as near sterile as it is possible to make it.

The means which we have for securing a relative asepsis are: Dry heat, steaming, boiling, and chemical antiseptics.

Dry Heat.—Instruments, basins, etc., may be sterilized by exposure, in an oven, to dry heat of 284° for half an hour. When it is impossible to secure steam sterilization for sheets, towels, gauzes, etc., they may be wrapped in several layers of thick wrapping paper and baked in an oven for half an hour. Greater dependence may be placed on their sterility by repeating the baking after an interval of several hours before using. Dry heat does not have the power to penetrate dressings and sheets as well as flowing steam.

Boiling for ten minutes is equal to a thirty minute exposure to steam. Both may be utilized for the sterilization of instruments. The germicidal efficiency of boiling is materially increased by the addition of one and a half per cent. of sodium carbonate or washing soda to the water used. The employment of a soda solution removes the greasy matter from the material sterilized and prevents the metallic instruments from rusting.

The chemical antiseptics used in obstetric practice are:

Bichlorid of mercury.
Biniodid of mercury.
Chlorinated soda solution.
Creolin.
Lysol.
Tincture of iodin.

The *bichlorid of mercury* (sublimate) solution is used in the strength of 1 to 2000, and is prepared by dissolving one tablet containing *vii ss. grs. of hydrargyri bichloridi*, to which either acidi tartarici or ammonium chloridi is added to increase the solubility in *two pints of water.*

The *mercuric biniodid* solution is also used in a strength of 1/2000; it has an advantage over the bichlorid, in that it does not irritate the skin or tarnish instruments, but is not so commonly used, owing to its greater cost. The solution is made by adding vii ss. grains each of mercuric biniodid and potassium iodide to *two pints of water.*

The *chlorinated soda* solution is used in a strength of 1 to 10, and is prepared by adding oz. 1 of liquor sodæ chloratæ to oz. ix of water; its odor is lasting and disagreeable; it is an efficient antiseptic for the hands, and does not tarnish instruments.

Creolin and *lysol* are used in strengths of 1 to 100, and are prepared by adding two and one-half drachms of creolin or lysol to

two pints of water. They are non-poisonous antiseptics, and may be used as douches. Their chief advantage is that they may be used for hand and instrument immersion and take the place of lubricants.

Tincture of iodin is used as an antiseptic in the skin preparation preceding certain obstetric operations. It is usually employed in a 3 per cent. or 4 per cent. solution applied to the skin surface over the entire operative field and allowed to dry for ten minutes; a second coat is then applied which in its turn is allowed to dry. It may be used in its [illegible] sterilize the cervical canal before operative intervention, [illegible] as a vaginal disinfectant just preceding the repair of v[illegible]d pelvic floor injuries.

Non-metallic utensils may [illegible]ected with any of the foregoing agents, though heat is the most effective.

Metallic instruments are best sterilized by boiling in a 1½ per cent. soda solution. They should, for convenience in subsequent handling, be wrapped in a towel before their immersion in boiling water.

Dressings, gauzes, bed linen, etc., may be sterilized by steaming in a properly constructed sterilizer. The exposure should be for at least one hour. When chemical solutions are employed instead of steam there must be a complete immersion for at least half an hour.

The obstetrician should, after careful preparation of his nails, hands and forearms, don a sterile operating gown and sterile rubber gloves. The nurse should wear only wash dresses recently laundered, and should prepare her hands with the same care as does the physician, before coming in contact with the obstetric patient. Neither physicians nor nurses who are engaged in obstetric work should care for contagious cases or expose themselves by handling [illegible] has the right to aseptic [illegible].

[illegible] *by Those Who* [illegible] *in the Con-* [illegible] *Surgery.*—

[illegible] be kept short [illegible]

[illegible] scrubbed with [illegible] brush for five

minutes, special attention to be given to the finger tips and free edges of the nails. The removal of the dirt and superficial epithelium is mechanical and takes time. This preliminary scrubbing is the most important step in the hand preparation.

3. The soap and suds are thoroughly removed by rinsing in sterile water. When sterile water is not available, running tap water will suffice, care being taken not to allow the hands to come in contact with any unsterile object.

4. The hands are then immersed for two minutes in a 70 per cent. alcohol solution and the forearms scrubbed with gauze wipes wet with the solution. This helps to remove the fatty matter from the skin, and by dehydrating the skin makes the antiseptic, into which the hands are next immersed, sink into it more deeply.

5. The hands and forearms are next held in a mercurial solution (1 to 2000) for five minutes. A solution of sublimate in 70 per cent. alcohol is more effectual than the aqueous solution.

The hand brushes used in the preliminary scrubbing with soap and water *must be sterile*. Their sterilization may be accomplished by boiling in a soda or a lysol solution for ten minutes, when a proper sterilizer is not available. The foregoing method of hand preparation has proved eminently satisfactory for a number of years, and has, in my clinics and private practice, supplanted all other methods, except the *chlorinated soda method, which may be used when the hands have been recently exposed to infectious material.*

Steps 1, 2, and 3 are the same as in the method already described.

While the hands are still wet from rinsing off the soap, the skin is covered with a paste made by wetting with boiled water a handful of fresh chlorinated lime. The paste is rubbed over the hands with a crystal of washing soda, making a lime lather, and then the hands and forearms are scrubbed in the lime paste with a soft sterile hand brush for five minutes, rinsed with sterile water, immersed in a solution of 70 per cent. alcohol, and finally rinsed again with sterile water.

After the employment of one of the foregoing methods the hands are covered with sterile rubber gloves and the accoucheur is ready to proceed with the vaginal examination, the conduct of the labor, or his operation.

It is our con[illegible]ction that no internal manipulation, vaginal or uterine, should [illegible] made without gloves. It is not possible to render the skin sterile, [illegible]or, though it may be superficially sterilized by either of the fo[illegible]going methods, it does not remain so for many minutes, since t[illegible] germs lodged in the sebaceous glands and hair follicles find the[illegible] way to the surface as the hands perspire.

Should glove[illegible] not be worn the hands should be frequently immersed in a solu[illegible]ion of bichlorid in alcohol, always before each internal examina[illegible]on.

After cleansing the hands or donning sterile gloves, to prevent reinfection of the [illegible]ch nothing that is *not aseptic*. A creolin or lys[illegible]r cent.) may be substituted for the sublimate at the pl[illegible]e operator. These have the advantage of supplying a s[illegible]icant.

Preparation of Rubber [illegible]—Rubber gloves may be made absolutely sterile by boiling in plain water for ten minutes. They may then be allowed to float in a $\frac{1}{2}$ per cent. lysol solution until they are needed for use; the lubrication furnished by the lysol facilitates drawing the glove on the hand.

Lubricants are not generally needed in obstetric practice, owing to the natural lubrication of the passages. However, many examinations can be facilitated by smearing the hand with sterile glycerin prepared by *heating* it for ten minutes to 212° F. A sterile solution of green soap is an excellent lubricant as are the more expensive trade preparations, such as lubricondrin, K-4, etc.

Preparation of the Patient for Labor.—At the onset of labor the patient is given an enema, a bath, and a change of clothing. It is well to have the undervest removed and for the patient to wear a short bed gown, made of thin French flannel. The nurse then prepares the external genitals, the inner surfaces of the thighs, and lower abdominal wall. This is best done on a douche pan. The [illegible] about the vulva and pubes is clipped away, and the parts [illegible] scrubbed [illegible] with green soap and warm [illegible] used as a scrub. [illegible] sterile water over the [illegible] gently scrubbing the [illegible] The genitals are [illegible]

[illegible] is normal acid

secretion being sufficient for its protection. In case of profuse greenish, yellowish, or fetid discharges, the vaginal and cervical canal may be prepared by cleansing with green soap and warm water, using the fingers of the sterile gloved hand as a scrub instead of gauze or cotton. Great care must be exercised to use only gentle friction, as the destruction of the vaginal epithelium by too great trauma diminishes its resistance to infection. The preparation is completed with an antiseptic douche of 1 per cent. lysol. This douche should be continued for at least five minutes, the reservoir being at a low elevation.

The object of this cleansing is prophylaxis not alone against infection of maternal wounds, but of the child's eyes as well.

When the patient has been seen a few weeks before labor, and is the subject of a profuse or purulent vaginal discharge, disinfection may be effected by douching twice daily with a 2 per cent. lactic acid solution, a gallon or more being used at each sitting.

No attempt is made to sterilize the cervical canal unless intrauterine manipulation or instrumentation is contemplated, in which case the cervix is exposed with a speculum and the canal painted with the tincture of iodin.

It is well for the nurse, after cleansing the external genitals, at the onset of labor, as already described, to apply a compress kept wet with a saturated boric acid or weak sublimate solution, to be worn during the first and second stage. Before each internal examination the compress is removed and the genitals are carefully bathed with an antiseptic solution.

SIGNS OF BEGINNING LABOR

The precursory signs of beginning labor, as recognized by the patient herself, are *lightening* and *irritability of the bladder* and *rectum*, shown by frequency of urination and bowel movements. The woman may be conscious of the uterus sinking lower in the pelvis and her waist bands becoming looser a week or ten days before the subjective signs of actual labor occur.

The subjective signs of actual labor are:

(1) An increased frequency of urination and defecation.

(2) The occurrence of a bloody vaginal discharge—the show.

(3) The expulsion of the mucous plug from the cervix.

(4) The occurrence of rhythmic pains first felt in the lumbosacral, then in the lower abdominal region.

EXAMINATION AFTER BEGINNING OF LABOR

Should the patient be seen by the physician for the first time after labor has already begun, and when no antepartum examination has been made, as has been described in a previous chapter, he should promptly make the following observations:

On exposing the abdomen he should by examination make note of the existence of such complications as: Pendulous abdomen, hydramnios, complicating tumors, or twins; he should also determine:

(1) The presentation, position, and posture of the fetus.

(2) The location of the placenta.[1]

(3) The location, rate, rhythm, and force of the fetal heart tones.

(4) The condition of the bladder, whether full or empty, as shown by the presence or absence of a globe-shaped tumor above the pubes.

(5) The hardness of the head and whether or not it is engaged, or can be engaged by suprapubic pressure.

He should then, after thorough disinfection of the external genitals of the patient and of his own hands, which should be further protected by sterile rubber gloves, proceed to make a pelvic examination, observing:

(1) The *pudendum*, for rigidity, edema, former injuries, new growths, and inflammation.

(2) The *vagina*, as to the condition of its mucous membrane, whether healthy or not, the character of its secretion, and the presence or absence of former injuries.

(3) The condition of the bladder and rectum, whether full or empty.

(4) The bony pelvis, noting whether or not the head has e

[1] The placenta never occupies the side of the uterus on which the dorsu lies. When the round ligaments are far apart, converging downward, the p

gaged, which should be *the case in all primiparæ at the beginning of labor* if there is no disproportion between the head and pelvis or other abnormality. Should the head not be engaged, he should proceed to measure the diagonal conjugate and the other diameters of the brim and outlet, and note the general shape and inclination of the pelvis.

(5) The cervix, for the amount of dilation, its dilatability and for former injuries.

(6) The bag of waters, to determine whether the membranes are ruptured or unruptured, and, if still intact, their shape and size.

(7) The presentation, position, and posture, and the presence of a caput succedaneum, if the waters have escaped, and its size.

Finally he should determine the rate of progress in the first stage, by the degree of cervical dilation, the condition of the bag of waters, and the force of the uterine contractions. In the second by the situation of the leading pole, the occiput, as related to the landmarks of the birth canal, the degree of rotation as shown by the relation of the sagittal suture to the outlet diameters, and the advance of the head with each pain.

In the internal examination a vertex presentation is recognized by the hard globular character of the head and by tracing the sutures and fontanelles. The *position* of the vertex is determined by locating the sagittal suture and its two terminals, the anterior and posterior fontanelles, and finding which end is forward. *Posture* is recognized by noting the relative descent of the fontanelles in their relation to the planes of the pelvis. *When the flexion is perfect, the posterior fontanelle is found at a lower level and is more accessible than the anterior.* When the head is semi-flexed the anterior and posterior fontanelles may be found upon the same level in their relation to the pelvic plane in which they lie. Examine deliberately all accessible fetal parts with a firm touch, for a positive diagnosis of the position, the posture, and the relation of the presenting part to the pelvis must be made. An anesthetic may be necessary.

The examination is best begun during a pain and continued into the interval. The frequency and strength of the pains and the general condition of the patient, including her pulse and temperature, should complete the observation.

The prognosis as to the termination of labor must be guarded, as it is quite impossible to estimate with accuracy the dilatability of the cervix or the force of the contractions in the individual woman. All else being normal, the duration of labor will depend on the strength and frequency of the uterine contractions and the ability of the patient to help them by her voluntary efforts, when the time comes for such exertion. No definite or positive statement should be made.

MANAGEMENT OF THE STAGE OF DILATION

During this stage, after the physician has assured himself of the diagnosis and the stage of progress, he can do but little to help the woman. The patient should be advised against bearing down with the pains, and be encouraged to empty the bladder and rectum. The backache may be relieved, the rectum and sigmoid evacuated, and the pains accelerated by the employment of a low soap-suds enema to which a teaspoonful of turpentine is added. Adequate rest and nourishment are imperative, and when the pains are well established and are good, strong and regular, much relief may be given the patient by the administration of morphin and scopolamin (Gaus), hypodermatically into the arm or buttocks. The initial dose should be morphia sulphat., gr. ¼, scopolamin, gr. 1/150, followed in one hour by a second injection containing 1/200 of a gr. of scopolamin; if the "Dämmerschlaf" is not produced, the scopolamin may be repeated in an hour. The woman continues to have labor pains, but when aroused has no recollection of her suffering.

Chloral may also be used to relieve the severity of the pains. It is employed in doses of gr. xv in water, every fifteen minutes till three doses are given. The patient dozes between the pains and the rest conserves her nervous strength, while the power of the contraction is not affected or is increased. Chloral is not well borne by the stomach.

Repeated doses of opiates should seldom be given, owing to their narcotizing effect on the child, and then only in event of great pain and restlessness. Occasionally toward the termination of the first stage, when the membranes have ruptured, but the cervix still resists the pressure of the advancing head, a hypodermic injection of

morphia, gr. ¼; atropin sulph., gr. 1/150, may ease the severity of the pain occasioned by the passage of the head through the rigid cervical ring which it relaxes.

The employment of chloroform or ether (to the stage of general relaxation) is very rarely permissible in the latter part of the first stage to relieve the cervical spasm (*when the pains are frequent, strong, and regular and the canalization is almost completed*), the continued use of chloroform or ether at this time, however, is almost certain to impair the efficiency of the pains. For, once begun, it cannot be easily discontinued till the expulsion of the child. Prolonged chloroform inhalation is dangerous, producing organic changes in the liver besides being a cardiac depressant. Chloroform or ether should therefore be withheld until absolutely required in the latter part of the *perineal stage.*

In the first stage one careful internal examination which shall determine (1) the size and condition of the cervix; (2) the condition of the membranes; (3) the presentation; (4) the position; (5) the posture, and (6) the relation of the presenting part to the pelvis, will usually be sufficient. Frequent vaginal examinations expose the woman to infection. *Nothing so surely protects the parturient against infection as the avoidance of all internal interference.* In many of the foreign clinics labor is conducted to its termination without a single internal examination being made. The midwife watches the progress of labor by abdominal palpation.

Careful observation must be made of the maternal and fetal pulse rate throughout the course of this stage of labor. A rise in the maternal pulse in the intervals between the pains is a sign of muscular fatigue. A fetal pulse of below 110 or above 160 to the minute should be regarded as a signal of danger to the child. The *significance of the change in rate of the fetal pulse is greater after the membranes have ruptured,* for the child is comparatively safe from interference with the placental circulation when the membranes are still intact. Therefore *time* and *patience* should be the basic principles in the management of this stage. It is only in the event of evidences of suffering or exhaustion on the part of the mother or the child that active measures are permissible for accelerating or terminating this stage. It is a general rule to remain with the patient, or at least in the house, from the time the external os has reached the size of a silver dollar (2 inches in diameter).

MANAGEMENT OF THE STAGE OF EXPULSION

The stage of expulsion begins when the canalization of the cervix is complete and the presenting part commences to pass through the cervix out of the uterus. The patient should take the bed at the beginning of this stage or sooner if the pains are severe or the membranes have ruptured.

She should be dressed for the bed, with her night clothing turned up and pinned under the arms, or she may wear a short confinement jacket. A clean folded sheet may be fastened about the waist like a skirt and serve the purpose of protecting the patient's clothing and the upper part of the body from soiling with the genital discharges. Obstetric leggings supported from a band at the waist may be substituted for the sheet. These precautions simplify the duties of the nurse in cleansing the patient, and make it easier for her to leave the woman clean and dry at the close of labor.

The bag of membranes should, when possible, especially in the primipara, be preserved until it protrudes at the vulvar orifice. The bag of waters is a perfect hydrostatic dilator, and its preservation insures complete dilation of the cervix, the vagina, and vulvar orifice, which helps to minimize the amount of laceration. Artificial rupture before this time is inadvisable. If the membranes be still unbroken they should be ruptured artificially when they reach the pelvic floor and begin to distend it. This may be done with the fingernail, or the puncture may be made with a sterile hairpin or scissors, passed up against the distended bag of waters, with the point resting on the finger as a guard. The membranes should not be ruptured during a pain, except when the head is firmly engaged in the pelvis, for unless the brim is blocked with the presenting part, the sudden gush of liquor amnii may carry down with it a loop of the cord.

A "puller," made by twisting a sheet into a rope, and fastening it by one end at the left side of the foot of the bed, gives the patient something to pull upon during the pains, and is of great aid in increasing the efficiency of the voluntary expulsion efforts of the abdominal walls. The use of the puller should not be permitted when the labor is overrapid, or in multipare who give a

history of previous precipitate deliveries, for *slow delivery is the surest prophylactic against outlet injuries.*

Position of the Patient in the Second Stage.—Intelligent advice as to the position of the patient in the second stage of labor contributes largely to her comfort, and has some definite influence on the course of the mechanism. The latero-prone position, with the hips slightly elevated, favors anterior rotation, besides relieving the patient of much of the severe sacral pain experienced at this time. The patient should lie on her left side in left vertex positions and on the right side when the occiput is to the right, until the rotation is completed.

During the perineal stage the left lateral position offers decided advantages, in managing the escape of the head by preserving a more perfect mechanism and diminishing to some degree the expulsive power of the voluntary muscles.

For all internal examinations the dorsal recumbent position is the best, while an exaggerated Trendelenburg posture aids materially when the abdomen is pendulous by bringing the axis of the uterus into that of the pelvic brim.

Examinations.—As in the first stage, *vaginal examinations should be infrequent*, a single examination at the beginning of the second stage usually being sufficient. This should be made immediately upon the rupture of the bag of waters, as it is desirable to make sure that the cord or a hand has not prolapsed with the gush of waters and that no other irregularity is present. Once assured that the head is engaged and all is normal, *further interference within the passages* is not only *unnecessary* but is *injurious*. To examine internally in the second stage oftener than once an hour is *unnecessary* even for the *tyro*. The progress of labor while the head is passing the brim may be observed by palpation over the lower abdomen. After the head has sunk well into the lesser pelvis, the rate of descent may be watched by examining through the pelvic floor, with the finger on the skin surface near the posterior vulvar commissure. By deep pressure at this point, the head can be felt before it rests on the floor. When it begins to distend the posterior segment, inspection will furnish the necessary information. By these means internal manipulations may be reduced to a minimum, and sometimes they may be wholly omitted.

Anesthetics.—During the latter part of the perineal stage an

anesthetic, if properly administered, may be used with advantage to the woman. Ether should be the choice, administered by the open method. The aim in obstetric anesthesia is to blunt the pain, not to abolish it, hence it is *given only with the pains* for short periods and intermittently. At the moment of expulsion it may usually be carried nearly or quite to the surgical degree. When complete anesthesia is required for obstetric operations, we have found the employment of ether-oxygen vapor narcosis to have decided advantages, being less liable to narcotize the child. The excessive use of anesthetics, especially chloroform, is dangerous and is not infrequently a contributing cause of death in labor.

It is generally a good rule to withhold anesthetics as long as the pains are well borne without them, as it is beyond question that they impair the strength of the uterine contractions.

Recent studies have shown that the use of chloroform during labor is not safe, and is capable of producing serious and even fatal organic changes in the mother.

Many untoward results have followed upon the careless and faulty methods of administration during labor, owing to the general impression, which has become traditional, that the pregnant woman bears an anesthetic better than her non-parturient sister. *This is not so. Care in administration is just as essential here as in the narcosis for surgical operations.*

The head should be low and turned slightly to one side, false teeth must be removed, the clothing about the neck loose, the eyes covered with gauze pads moistened in boric acid solution. The skin about the mouth and nose protected from ether irritation by smearing with sterile vaselin, the heart carefully examined, and the pulse counted and recorded before the narcosis is begun. The open method should be employed. The mask known as the Ferguson inhaler affords large evaporating surface and ample air space. The ether is dropped upon the mask, using five to ten drops at each respiration. Whatever effect is to be produced must be obtained before the pain reaches its height, for normally at the acme of the uterine contraction the abdominal muscles are fixed and respiration is temporarily suspended.

Regulation of the Expelling Forces.—If the pains are feeble they may be stimulated by massage of the uterus and postural methods, as by the employment of the *squatting posture* for the

patient during the pain. The pressure made by the thighs upon the abdomen augments the expelling force of the abdominal muscles.

When the labor is over-rapid, the force of the pains may be moderated by the use of anesthetics and by regulating the action of the voluntary muscles by the latero-prone posture.

Anesthetics can retard or arrest expulsion according to the freedom of the dosage. This has a decided bearing on the prevention of pelvic floor injuries, as the chief prophylaxis against pelvic floor lacerations during the birth is the slow and gradual delivery of the head by its smallest circumferences, allowing sufficient time for the dilation of the vagina, the pelvic floor, and the vulvovaginal orifice.

The Perineal Stage.—When the head begins to bulge the perineum the patient is placed in the lateral posture, and the expulsion is retarded until the resisting structures have had time to stretch,

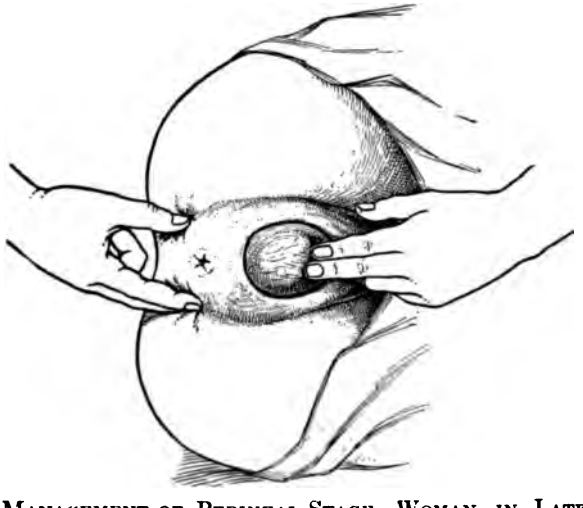


FIG. 59.—MANAGEMENT OF PERINEAL STAGE, WOMAN IN LATERO-PRONE POSITION.

the speed of the delivery being controlled with anesthesia and by pressure with the fingers against the advancing occiput, for not only the rate but the mechanism of the expulsion must be regulated by keeping the smallest circumference of the head in the

grasp of the resisting girdle. This may be done by maintaining exaggerated flexion, by making pressure on the occiput until the occipital protuberance is free and the nucha is well up against the subpubic arch. At the same time, the pelvic floor may be supported by upward pressure with the outspread hand, applied to the distended perineum, so that the thumb and index finger encircle the posterior commissure of the vulva, or by pressure with the thumb and index finger posterior to the anus, as in Fig. 59, which helps to crowd the head further into the subpubic arch as the forehead is about to escape, and so relieve the tension on the fascial structures of the pelvic floor. The suboccipito-bregmatic, suboccipito-frontal, and the suboccipito-mental circumferences should successively pass through the vulvar ring. From the time the pelvic floor begins to bulge, the birth of the head should rarely occupy less than half an hour. Shelling out the head between pains or attempts to govern the speed of the expulsion and preserve the mechanism with the fingers in the rectum subject the patient to a danger from infection, without preventing rupture of the soft parts. Pelvic floor injuries occur in about 34 per cent. of primiparous labors.

FIG. 60. MANAGEMENT OF THE PERINEAL STAGE, WOMAN IN THE DORSAL POSITION.

By watching the circulation in the stretched out posterior segment of the pelvic floor, we may anticipate an inevitable rupture of the pelvic soft parts and prevent injury to the important structures by [illegible] the resisting ring of the introitus ***bilaterally***. This procedure is known as episiotomy. These incisions can be best made with the patient in the lateral posture, while the vulvar ring is tense during a pain.

Technique of Episiotomy. The incision is made at a point in

blood is probably brought about by the force of thoracic aspiration in the child.

After the cord is clamped and cut it may be tied firmly with aseptic narrow linen bobbin, about 2.5 cm. (1 inch) from the umbilicus, after the jelly of Wharton has been pressed out from the part to be ligated, by reclamping the cord at this point with a *broad Kocher compression forceps.* The excess of cord is then cut away with a pair of sterile scissors, about ¼ of an inch outside of the ligature, and the end of the stump pressed with a sterile gauze sponge to see if it bleeds. If any oozing continues, the cord should be tied again on the proximal side of the first ligature.

Dickinson has suggested and practices excision of the cord at the cutaneous margin of the umbilicus; he catches and ligates the umbilical vessels individually with fine catgut, and then sutures the skin edges over the excised stump and seals the wound with a primary sterile dressing. This is an excellent disposition of the cord, but to our mind dangerous teaching for general practice, as its success depends absolutely on an aseptic technique.

A second clamp or ligature to control the placental end of the cord is required in case of twins, since otherwise, if the placental circulations communicate, the second child may be lost by hemorrhage from the cut end. When we can be sure that there is not a second fetus, there is some advantage in allowing the blood in the placenta to escape and thus diminish the bulk of the placental mass, which facilitates its subsequent delivery.

MANAGEMENT OF THE PLACENTAL STAGE

From the moment the head is born the hand of the obstetrician or the nurse should be held on the abdomen over the fundus of the uterus till the placenta is expelled and the retraction of the uterus is complete. There is usually an interval of from three to five minutes after the birth of the head before contractions are resumed. During this time the hand on the fundus may make gentle friction to promote the normal contractions *if there is any vaginal hemorrhage. If, however, there is none, the fundal hand should remain passive.*

The placenta is usually expelled spontaneously in the course of fifteen to twenty minutes. Should this not be the case at the end

of half an hour, no hemorrhage occurring in the interim, attempts at expression of the placenta after the *method of Credé* may be employed.

Credé's method is to reinforce the expulsive strength of the uterine contractions by grasping the fundus through the abdominal wall, with the thumb in front and the fingers behind, and, at the

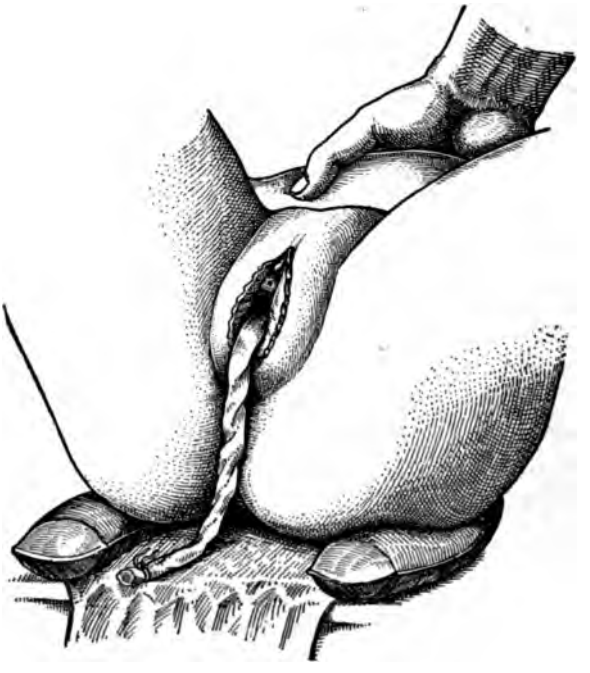


FIG. 61.—GRASPING THE FUNDUS ACCORDING TO CREDÉ.

acme of the pain, not sooner, compress the *fundus firmly* downward *in the axis of the birth canal.* The *fundus should be carried well back* during the manipulation to *bring the uterine axis more into the line of the vaginal axis.* This process may be repeated with each pain, at the acme of the contraction, until the placenta is delivered. *Vaginal bleeding* will appear in the interval between contractions when the *placenta begins to separate.* This bleeding is from the placental site, which cannot retract until the placenta is completely detached. No traction should be made on the cord to

assist the delivery of the placenta. Occasionally, when the placenta is in the vagina or in the grasp of the lower segment, funic traction is admissible. The separation and expulsion of the placenta from the upper, contracting segment of the uterus may be recognized by an upward movement of the fundus, as the placenta passes into the lower segment and vagina.

Expression by the Credé method may frequently be aided by the patient straining forcibly during the manipulation. Should

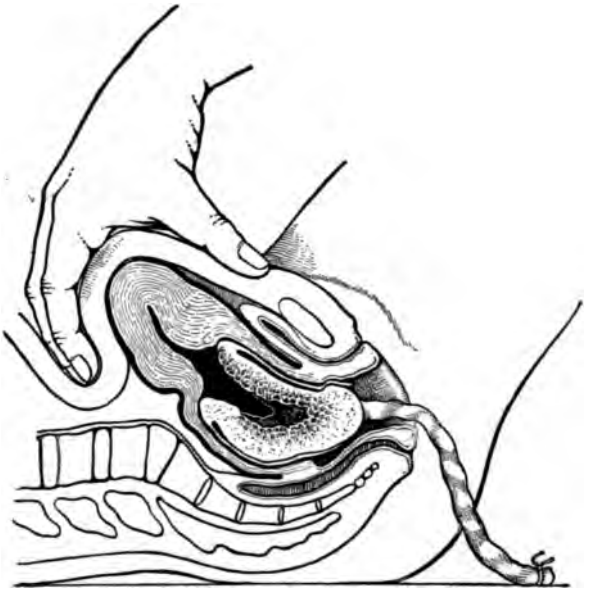


FIG. 62.—EFFECT OF CREDE'S METHOD ON THE UTERUS.

expression of the placenta fail, and there be no uterine bleeding, the placenta may be left in the uterus for several hours, without injury to the patient, at the end of which time spontaneous delivery may occur or a single expressive effort may cause its expulsion. These external methods failing, or in event of uterine hemorrhage, the placenta may be removed manually by seizing its lower edge with the gloved hand in the vagina and the fingers passed through the cervix. Great care must be exercised to see that no fragment is left behind. A digital exploration of the interior of the uterus

will determine if the afterbirth has come away complete. On expulsion of the afterbirth it should be turned into the membranes with its fetal surface out, that the membranes may be twisted into a rope and gently pulled away from the uterine attachment by slight traction in the axis of the uterus. This traction should *only* be *made when* the *uterus is in relaxation,* as during its contraction the membranes may be held in its grasp, torn off, and left behind.

Examination of the Placenta and Membranes.—The placenta and the membranes should be carefully inspected to learn whether fragments of either have been left behind in the passages.

The membranes are best examined by transmitted light, to see that both amnion and chorion are complete. When viewed in this manner, a single membrane is quite translucent; both together are somewhat opaque.

Fragments of membrane, wholly or partly in the vagina, *should be removed. When wholly in the uterus they are better left to be expelled with the lochial discharge,* the patient being placed in the Fowler position in order to secure postural drainage.

Manipulation within the passages, especially within the uterus, for pieces of retained placenta or membranes, at the close of labor is unnecessary and exposes the woman to infection.

TREATMENT OF INJURIES TO THE SOFT PARTS FOLLOWING LABOR

Cervical Lacerations.—Some degree of cervical laceration takes place in nearly all primiparous labors; *the majority need no treatment as spontaneous union takes place if the convalescence is aseptic and the injury is not too extensive.* The tear is usually unilateral, and on the left side when the birth has been spontaneous; bilateral when the delivery has been instrumental, particularly when the head has not passed the cervix before the forceps were applied.

Cervical lacerations which give rise to troublesome hemorrhage or are extensive should be immediately closed by suture.

Method of Repair.—Frequently no anesthetic is necessary, as the cervical tissues are insensitive owing to the long trauma which they have sustained during the labor. If narcosis is needed, ether should be the choice. The patient is placed on a table in the lithotomy position with her legs retained by a proper leg holder. A

large Sims' speculum or Simon retractor is introduced in vagina to expose the cervix, and the anterior and posterior the cervix are grasped with four-pronged volsella and draw down. The traction usually controls the hemorrhage as v exposes the extent of the tear.

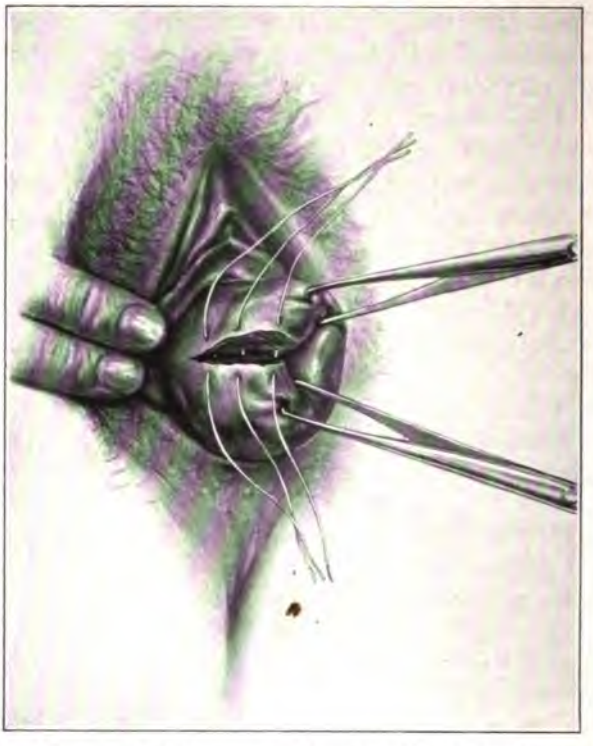


FIG. 63.—METHOD OF REPAIR OF PRIMARY CERVICAL LACERATI

The surfaces of the cervical wound are then brought to and sutured with No. 2 chromic gut, the first stitch being above the angle of the tear, the sutures placed about ¾ of a apart and tied to coaptate without constricting the included

Lacerations of the Pelvic Floor.—Some degree of pelvi laceration occurs in from 15 to 40 per cent. of all primi labors, and some further injury is sustained by about 10 pe of multiparæ. Injury to the soft parts is greater in private

tice and among the better class of patients than in the women of the working class attended in hospitals. This is due largely to the frequency of surgical intervention before nature has completed the dilating process, an unfortunate practice which is common with many busy general practitioners who attend midwifery cases.

The principal contributing and exciting causes of pelvic floor injuries may be found in the funnel pelvis with its narrow pubic arch, which pushes the advancing head backward so that the nucha pivots on the ischiopubic rami in extension, and thus exposes the posterior segment of the pelvic floor to greater distention. A relatively small vulvovaginal orifice, or rigidity of the pelvic floor, or a primipara advanced in years, predispose to lacerations because of the inelasticity of the pelvic soft parts.

Faulty mechanism, as unrotated occipito-posteriors, in which the flexion is incomplete, too rapid delivery without previous preparation of the vagina and vulvovaginal orifice, and the unskilled and improperly timed use of instruments make up the chief exciting causes.

Lacerations of the pelvic floor may be *complete* or *incomplete,* and when *incomplete* the tear may be *external,* when only the external structures are involved and the levators are left intact, or *internal,* when the tear runs up on one or both sides of the rectum, along one or both vaginal sulci through the fibers of the puborectalis and pubococcygeus but without skin injury, or *combined,* when the laceration is both internal and external, beginning in one or both vaginal sulci and severing all of the structure from above downward, and from within out between the vagina and the rectum. When the laceration is confined to one side it takes nearly a straight course, terminating below in the perineum and above in the vaginal sulcus. When the tear extends into both vaginal sulci the tear presents a Y shape, which allows the anterior wall of the rectum to protrude into the vagina with each straining effort, owing to the division of the levator fibers in front of the rectal tube.

Complete tears include a division of all the soft structures between the vagina and the *posterior rectal wall,* including the sphincter ani muscle.

Degrees of Laceration.—A simple classification is one which divides injuries of the soft parts into tears of the first, second, and third degrees.

First degree: External tears, not including the supporting muscles.

Second degree: Tears involving all the structures between the vagina and rectum *to* the sphincter ani muscles.

Third degree: Tears extending into the rectum, in which there is a complete severance of all the soft parts of the pelvic floor and anterior wall of the rectum, including the anal sphincter.

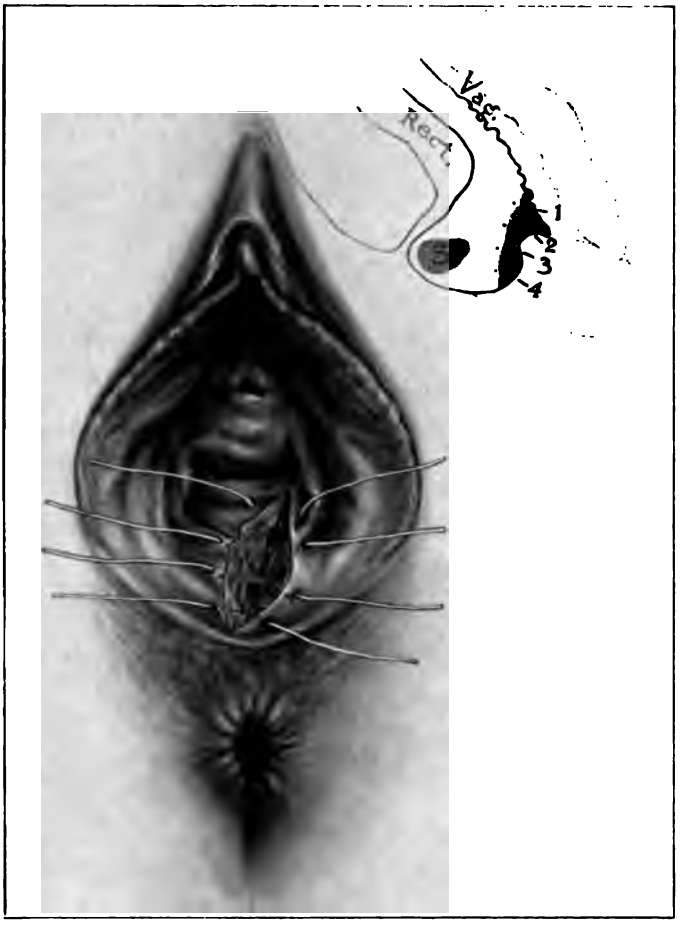
Treatment.—All pelvic floor injuries, whether they involve the perineum alone or extend up the vagina through the levator or through the sphincter muscles, *should be repaired.* The time at which this repair should be made will depend first upon the extent of the injury; second, on the condition of the woman; third, on he competence of the operator and his ability to secure aseptic surroundings.

Simple lacerations at the vaginal orifice, not involving the deeper muscular and fascial structures, may usually be sutured at the close of labor. This repair may often be done while waiting for the delivery of the placenta, and thus save the necessity of further anesthesia, as the sensibility of the injured parts is more or less obtunded for a time, immediately following the birth of the child. When, however, the deeper structures have been injured, the sphincter ani torn through, or the soft parts are edematous from the trauma of a difficult instrumental delivery, or the patient is a nephritic or has had serious hemorrhages, suture of the tear should be postponed until some degree of involution has taken place, the edema subsided, the devitalized tissues regained their circulation, and the patient has reacted from the shock of labor.

The results of primary suture are better, in extensive injuries, when the repair is made about forty-eight or seventy-two hours after delivery.

The operation should be done in a good light, with the patient in the lithotomy position on a table. A sheet sling or a Robb leg holder may be used to keep the thighs flexed and abducted. These may be applied in the following manner: The hips are brought to the edge of the table and a twisted sheet or leg holder is fastened loosely around one leg just below the knee, and the thigh flexed on the abdomen, while the other end is carried over one shoulder, across the back of the neck and under the opposite arm, pulled taut and fastened loosely about the opposite leg below the knee. An

nesthetic is necessary, and ether administered by the open method preferable. When the patient is anesthetized and in position, the



G. 64.—SUTURE OF AN EXTERNAL UNILATERAL TEAR OF THE VULVO-VAGINAL ORIFICE.

ılva, pubes, inner surfaces of the thighs, and the vagina should be eansed as for a vaginal operation, and the disinfection completed ith a vaginal douche of a saturated boric acid solution. A large erile pack of gauze is then placed in the vagina, against the cer-ix, to prevent the lochia from flowing over the field of operation.

The wound is exposed by placing a "guy" suture on each labiu
at the skin margin of the tear, and catching the posterior vagin

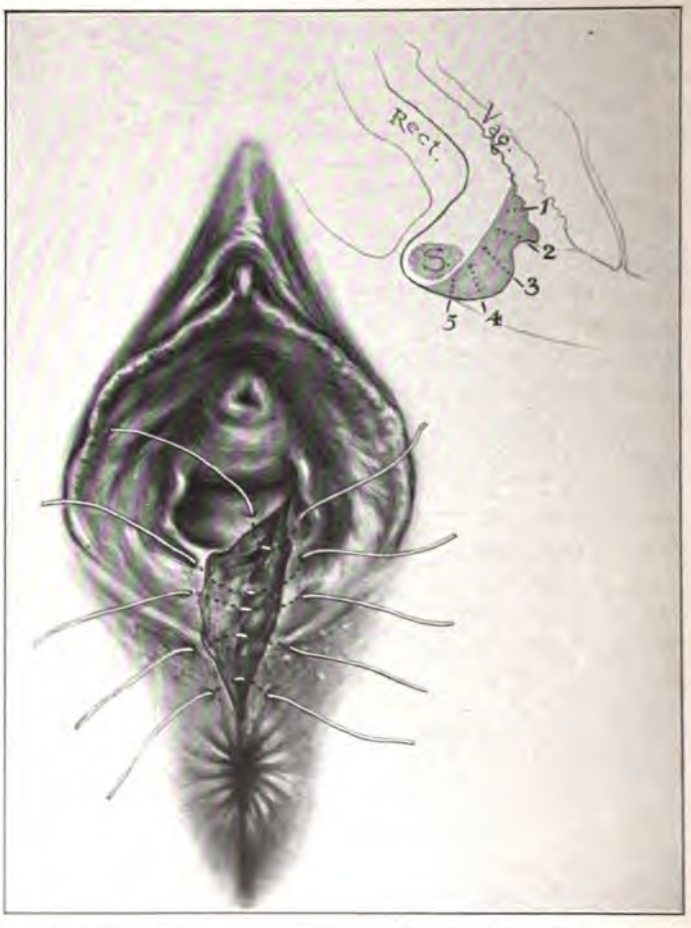


FIG. 65.—REPAIR OF UNILATERAL SECOND DEGREE TEAR OF PELVIC FLO

wall with a volsella at what before rupture was the center of
lower end. By lifting this point nearly to the meatus, at the sa
time retracting the labia by traction on the "guys" already plac
the trough-shaped wound on one or both sides of the vagina will
plainly exposed, and a tenaculum may be placed in the upperm
angle of the rent. The wound surface is then sponged dry wi

gauze compresses, and the full extent and character of the injury made out. We begin the repair by placing the sutures in such a way as to accurately restore the normal relations of the parts. This is best done by introducing the first suture just above the uppermost angle of the sulcal tear, and closing the lacerations in the sulci from above downward, the plane of each suture being nearly parallel with the skin surface of the perineum, the deeper portion of the loop being nearest the skin, so that the severed structures may be grasped and lifted up and attached to the vaginal septum. When the lacerations in the vaginal sulci are properly closed the remaining wound in the skin surface will be insignificant, and may be brought together with three or four sutures introduced from the skin side (as in Figs. 64, 65). The stitches in the sulci should be placed at intervals of ½ an inch, beginning at the upper or vaginal angle of the wound. A full curved Hagedorn needle, armed with No. 2 chromic gut, is entered close to the edge and just above the upper angle of the wound, and given a wide lateral sweep through the lip, catching the severed ends of the puborectalis, emerging just short of the bottom of the wound. It is then reinserted at the bottom and passed in a reverse direction through the opposite lip, emerging close to the edge. Care is needed to avoid passing the needle into the rectum. The loop, as the suture is drawn taut, should be nearly circular, bringing all parts of the severed surface into apposition. As the sutures are laid, the opposite ends of each are caught with catch forceps and held up over the pubes until they are ready to tie; this brings the deeper portions of the wound into easier reach for placing the succeeding stitches. When the sutures are all placed, they are tied from above down and only tightly enough to *coapt, not constrict,* the wound surfaces. Before tying each suture in the vagina, the wound is sponged with gauze and all blood clots removed. *When all of the vaginal sutures have been tied, the gauze pack against the cervix is removed and the skin edges approximated.* No. 2 chromic catgut should be used to close the vaginal sulci and the deep muscular structures, fine silkworm gut to close the skin wound. The ends may be left long and knotted, and the knot covered with a *lead shot.* By observing this suggestion their removal will be facilitated.

Lacerations of the third degree, involving the sphincter ani

muscle and the anterior rectal wall, are repaired in the following succession of steps: *first, the closure of the rectal wall; second,*

FIG. 86. REPAIR OF A THIRD DEGREE TEAR.

isolation and coaptation of the ends of the sphincter muscles, and last, by repair of the tears in the vaginal walls and on the skin surfaces.

The woman is subjected to the same preliminary preparation as has been described for repairing the lesser injuries, except that, in

tion. An iodoform gauze tampon, to which a sterile tape is attached, is placed in the rectum to protect the field of operation. We then proceed to repair the rectal wall by closing the wound with sutures of very fine black silk, or No. 1 chromic gut, which are armed with a full curved, smooth-pointed needle at each end. One end of the suture is introduced at the upper margin of the wound, from the vaginal side, passing through all coats into the rectum. The other end enters at a corresponding point on the opposite side, and is passed through into the rectum. The suture is tied on the rectal side and the ends left long. When silk is used, the stitches are placed about a quarter of an inch apart until the entire rectal wound is closed, the long ends of silk being brought out through the anus. The rectal mucous membrane may be closed with a buried suture of fine catgut introduced from the vaginal side, including the muscular coat. After the anterior rectal wall has been repaired, the ends of the sphincter ani muscle, which may have retracted within the tissues or may stand out plainly, projecting above the wound surface, must be isolated and united. The exposure of the sphincter ends may be facilitated by drawing them out with tenacula. Two or three No. 1 chromic catgut sutures are then passed through each end of the severed sphincter and caught with catch forceps drawn taut, and held forward by the assistant to expose the internal sphincter.

Before tying the external sphincter sutures, the internal sphincter should be closed with a No. 2 plain catgut mattress stitch passed close to the rectal mucous membrane and parallel with it. This may be tied at once and the ends cut short. The external sphincter sutures are then tied, and the tension on them is relieved by placing one or two silkworm gut or silver wire sutures from the skin surface through the end of the external sphincter on one side to near the rectal wall and through the opposite end, emerging at a corresponding point. These reinforce the deep sutures and, when tied just tightly enough to coapt the surfaces, act as splints for the sphincter ends during the process of healing. The remainder of the wound is then closed as in the incomplete operation already described.

The tampon is removed from the rectum before the sutures in the sphincter are tied.

Vaginal Tears.—In labor in which the occiput lies to the

mother's back, descending to the pelvic floor as a posterior position, and in which anterior rotation is attempted, or when the second stage is prolonged and the vagina is small, anterior and lateral tears of the vagina are comparatively common. These are usually more marked on the left side, and include the muscle and fascia of the urogenital trigonum. *The anterior vaginal wall and anterior lateral sulci should always be inspected for injuries before the tears of the posterior wall are repaired.* Immediate suture gives most satisfactory results. Careful approximation of the entire depth of the wound, with interrupted sutures of No. 2 chromic catgut, is all that is necessary. *...rior wall,* unless repaired, *always result* in the *for...cele,* which is difficult to repair at secondary operation.

Lacerations which have be...ed in a previous labor may frequently be repaired during ... puerperium at about the end of the first week, though there is greater danger from thrombophlebitis, when the denudation and dissection are done within a few days after labor than there is in the primary suture of a fresh tear, owing to the general enlargement of all of the veins and plexuses during pregnancy. New avenues of absorption are opened. The method of operating does not differ from that usually employed in the restoration of the pelvic floor. The most scrupulous asepsis is imperative.

After-care of Pelvic Floor or Vaginal Operations.—The after-care is very simple. The patient should be placed in the Fowler position and encouraged to favor postural drainage by assuming the latero-prone position, both right and left, many times a day. Should she be in great pain, codein in 1-grain doses may be administered by the rectum.

The catheter is usually required for the first day or two after suture of the pelvic floor. It should be omitted if possible, yet the puerperal woman must not be allowed to go longer than twelve hours without evacuating her bladder. *Great care must be used in catheterization, as the possibility of cystitis is increased by the cocci and discharges always present near the perineal wound.* The vulvovaginal orifice must be carefully irrigated with an antiseptic solution before and after each catheterization and urotropin in 7½ gr. doses should be administered in a full glass of water four times a day to render the urine antiseptic and act as a prophylactic

against infection of the urinary tract. The wound is not dried or dusted with powders after *irrigating.*

The bowels are opened on the second day and once daily thereafter. *Enemata are specially to be avoided in operations upon the sphincter.* The non-absorbable sutures are removed at the end of a week or ten days, when the patient may be allowed to sit up. No douches are given until the end of the second week, as we have found our results to be better since their *omission.* The douche when given early only disturbs the normal process of tissue repair.

CARE OF THE PATIENT AT THE CLOSE OF LABOR

It is unsafe for the physician to leave the patient for at least an hour after labor, or until he is sure that *good retraction* of the *uterus* is taking place, and that there is no hemorrhage. Immediately after the delivery of the placenta, the fundus of the uterus is found about 5 cm. above the pubes. Gradually the fundus rises upward, by the formation of a blood clot within the uterine cavity, until it is at the level and a little to the right of the umbilicus. *The contained blood clot* acts as an *intrauterine tampon,* which stimulates contraction and retraction, and which in the primipara is so vigorous that the blood clot is promptly expelled and the uterine cavity practically obliterated. To watch the primary readjustment of the uterine muscle fibers and the height to which the fundus rises, the *physician* or *nurse* should keep one hand upon the abdomen over the fundus for at least thirty to forty minutes after the delivery of the placenta. Should relaxation occur, the uterine tumor becomes rapidly larger, and an increase in the genital bleeding is noted; gentle friction may promote the necessary contraction and arrest of hemorrhage. Should the fundus remain low in the pelvis and the bleeding continue, it is because *no intrauterine clot has formed* to plug the vessels. To promote its formation, the uterus may be grasped by the thumb and fingers above the pubes, just below the upper segment, and lifted out of the pelvis. Slight constriction of the lower segment against the sacral promontory will check the bleeding and allow an intrauterine clot to form. The use of ergot and pituitrin favors uterine contraction and retraction. Ergot may be given hourly as a routine, in half drachm doses of the fluid extract, until three doses have been taken, or used only

when there are signs of relaxation, as a prophylactic against postpartum hemorrhage. Postpartum inertia is not uncommon when the patient has been the subject of hydramnios, twins, etc., or has been subjected to a long general anesthesia, or is exhausted, with a rapid pulse and low blood pressure. Ergot is best used hypodermatically in the form of ergone (25 min.), or ergotole (25 min.), combined with pituitrin (1 ampoule). The generous use of ergot in the puerperium is of value also as a prophylactic against puerperal infection, since it tends to prevent the formation and the prolonged retention of blood clots within the uterus, and by its action on the muscular fibers tends to close the lymphatics and blood vessels against absorption. Moreover, by thus limiting the blood supply it promotes involution.

Cleansing of the Patient at the Close of Labor.—Special care must be taken to cleanse the patient and leave her in a dry, clean bed at the close of labor. The nurse should bathe the external genitals, and the soiled parts of the patient's body, with a weak antiseptic solution, and change her clothing and bed linen if soiled. Cleansing of the genitals may be best accomplished by placing the woman on a douche pan and pouring a pitcher full of water or of an antiseptic solution over the vulva and the separated labia, to remove the blood and clots. Fresh boiled cheesecloths or squares of sterile gauze are used for bathing.

After the external genitals are cleansed, a sterile lochial guard is applied and fastened at each end to the binder or, in case the binder is dispensed with, to a wide abdominal band with a tailpiece front and back, to which the ends of the vulvar pad may be pinned.

A folded napkin is commonly used for the vulva dressing. It should be sterilized by steaming or boiling, and dried before it is applied. A special dressing may be secured from the surgical supply houses or made by the nurse, of absorbent cotton, cotton batting, cotton waste, or other absorbent material, loosely folded in a cheesecloth envelope. It should be ten inches long, four inches wide, and two inches thick. A tailpiece about ten inches long at each end of the pad serves for pinning it to the abdominal binder or waistband. The pads are removed when soiled and burned. An abdominal binder should be used for the first few days after labor. It is to be made of a straight piece of unbleached muslin, a yard and a quarter long and half a yard wide. When applied it should

reach to just below the trochanters and fit snugly, being shaped to the curves of the body. It should be moderately tight for the first twelve hours to support the lowered abdominal pressure. Subsequently it may be loosened or be wholly discarded, as it is not indispensable. *No pad is needed over the fundus.* The support given by a snug abdominal binder is grateful to the woman as well as being of some clinical advantage during the period of abdominal relaxation immediately after labor. The sudden emptying of the abdomen of its content allows the vessels of the abdominal plexuses to engorge from lack of support, and materially lowers the blood pressure. After the bowels have moved, and the patient is allowed the use of her abdominal muscles, the binder is of no further use, and its continuance may cause harm.

After the woman has been cleansed, the clothing changed, and the binder and vulva dressing applied, the clean bed may be protected with a *draw sheet* made of a clean sheet folded to four thicknesses, which is placed under the patient's hips, drawn taut across the bed, and pinned to the mattress. This may be changed as often as soiled without remaking the bed and disturbing the patient. Nothing is more grateful to a patient than a smooth, dry surface to lie upon.

The physician should *never leave* a *patient after delivery without noting* the *rate* and *quality of the pulse*, the *presence or absence of temperature*, the *amount of the lochial flow* and the *height, position, and firmness of the uterus.* These observations should be recorded by the nurse, to whom specific instructions should be given with reference to the future care of the puerperal patient, particularly in the matter of rest, sleep, diet, evacuation of the bladder, and the time at which the child shall be put to the breast. *She should be instructed* to *watch the amount* of the *bloody vaginal flow* and *note* from time to time the *height* and *condition of the fundus.*

A drachm or two of the fluid extract of ergot may be left with the nurse to be given if the uterus tends to relax, or, in the event of hemorrhage, also a rectal suppository containing opium or codein (gr. i-ii), to be used, if required, for the relief of severe afterpains.

She should further be instructed as to the strength and the nature of the antiseptics to be used for cleansing the genitals, and

directed to *inspect* the *navel stump for bleeding at frequent intervals during the first few hours after the birth.*

Besides *these specific directions,* which *must never be omitted, and should be written,* it is well to give the nurse general directions as to the care of the child, which should include when it is to be bathed, the care of the eyes, the cord, the mouth, the bowels, and the kidneys, its pulse and temperature, and the position most favorable to its respiration.

CHAPTER VIII

PHYSIOLOGY OF THE PUERPERAL STATE

Certain phenomena are normal to the puerperal state which, occurring at other times, would cause alarm:

(1) The postpartum chill.
(2) The slow pulse rate.
(3) Slight elevation of temperature.
(4) Retention of urine.
(5) Peptonuria.
(6) Sluggishness of the bowels.
(7) Activity of the sweat glands.

(1) Within fifteen or twenty minutes after the delivery of the child the woman experiences a chilly sensation, or suffers from a distinct chill, which is due to vasomotor causes, and has no pathological significance. A hot drink and a few hot water bottles placed about the patient usually bring about a prompt reaction by establishing the vasomotor balance.

(2) The pulse rate as well as the blood pressure falls, shortly after labor, to below the normal standard. For a week or more, if there has been no toxemia of pregnancy, or no infection has occurred, it may remain below 60 per minute. In exceptional instances, just after delivery, the rate may be as low as 40.

(3) The maximum temperature for the first four or five days of the normal puerperium should not be more than 100° F., while during the second week post partum the evening temperature should not rise above 99°. A woman who has sustained severe trauma during her labor, though there be no infection, may have a temperature for the first two days of even 102°. Any rise, however, above 100° F. must be considered pathological. Elevation of temperature has more significance when it occurs in the later days of the puerperium than when present immediately following the labor.

(4) Owing to the recumbent posture, to lowered intraabdom-

inal pressure, to urethral spasm, to the bruised, swollen, and sensitive condition of the structures about the urethra, the patient is liable to a retention of urine in the first few days following labor. The secretion is greatly increased after childbirth, and overdistention of the bladder not infrequently results.

(5) Peptonuria is normal in the puerperal state, peptone being a product of uterine involution, while an excess of acetone is commonly found in the urine of the first three days—this is probably a starvation acetonuria. Glycosuria is quite common, and fifty per cent. of puerperæ have a slight albuminuria.

(6) Sluggish action of the bowels is the rule for the first days of the puerperium, owing to the loss of intestinal and abdominal tonicity.

(7) The sweat glands after labor become unusually active, the sweat secretion is profuse, and during sleep the secretion may become excessive. This helps to correct the hydremia of pregnancy and keep the body surface cool and moist.

Condition of the Uterus After Labor.—At the close of labor the upper segment of the uterus is thick and moderately firm, while the lower segment remains thin and relaxed for about twelve hours after the birth. During the next six days it gradually regains its shape and firmness, until at the end of the second week the involution of the cervix goes on proportionately to that of the body.

The lymph spaces and blood channels are greatly enlarged, a condition favorable to resorptive activity, which, with the relaxed condition of the lower segment, constitutes one of the greatest elements of danger from septic infection in the lying-in period.

Cavity of the Puerperal Uterus.—After the membranes and the placenta have been expelled the *deeper layer* of the *decidua remains* to be shed piecemeal with the lochial flow. Shreds of the outer superficial layer, too, are retained to be loosened and discharged with the lochia. The *placental site* is slightly elevated above the general surface of the interior of the uterus, and is studded with small blood clots lodged in the mouths of the vessels, making irregular protrusions into the cavity.

The cavity first contains blood and blood clots, and later its walls are smeared with a mucosanguinolent fluid, and the endometrium becomes a granulating surface.

Involution.—Involution is the process by which the

trophied structures of the uterus and other genital organs are restored to the non-gravid condition, normal to the parous woman. During this process the muscle fibers atrophy by fatty degeneration and shrinkage of the individual fibers, the blood vessels diminish in size and become more tortuous, and the endometrium, which has been exfoliated after labor, is wholly renewed.

The uterus *measures* 18 to 20 cm. (7 to 8 inches) in length by 10 to 12.5 cm. (4 to 5 inches) in width; the thickness of its walls in the upper segment is 2.5 cm. to 3.7 cm. (1 to 1½ inches). The depth of the cavity progressively diminishes day by day under normal conditions until the involution is complete.

At the close of labor the depth of the cavity is about 15 cm., or 6 inches.

At the tenth day post partum, the depth of the cavity is about 10.7 cm., or 4⅛ inches.

At the end of the second week, the depth of the cavity is about 9.7 cm., or 3⅞ inches.

At the end of the third week, the depth of the cavity is about 8.8 cm., or 3½ inches.

At the end of the fourth week, the depth of the cavity is about 8.0 cm., or 3⅛ inches.

From the end of the fourth week the change in the size of the uterus is very slight, and depends largely on the care which is given to the woman's pelvis. Involution is seldom completed before the twelfth week, though the duration of *uterine involution is usually placed at six weeks.* When it is complete, the thickness, the width, and the length of the uterus are approximately 1, 2, and 3 inches, respectively.

The normal uterus of the parous woman is somewhat larger than the uterus in the virgin state.

The situation of the fundus serves as a clinical guide to the rate of the involution.

The situation of the fundus at the close of labor is nearly midway between the umbilicus and the top of the pubic bones; an hour or two later, owing to the formation of the intrauterine blood clot, it is just above the umbilicus and usually more or less dextroverted. Its descent from this level is progressive, if the involution is going on normally, until at the tenth day the fundus is usually found at the level of the brim. When the position of the fundus

is observed to serve as an index of the degree of involution *the bladder and rectum must be empty*, as the height of the fundus varies with the fullness of the bladder and rectum.

The weight of the uterus at the termination of labor is about thirty-five (35) ounces; at the end of the first week it is about sixteen (16); at the end of the second week, twelve (12); and at the end of the third week, eight (8). After the involution is complete the uterus weighs but 10-13 drachms, or about an ounce and a half. The great weight of the uterus during the first weeks of the puerperium, and a lack of appreciation of its significance by the practitioner and patient, is one of the greatest causes of uterine *descensus*. Normal involution is interrupted by certain interpartal and puerperal complications, so that the *size of the uterus rather than the day of the puerperium* should be the guide of the degree of involution and indicative of what privileges may be granted the woman. Involution is slower in non-nursing women; after twin births, or overdistention of the uterus from hydramnios; premature labor; much hemorrhage, whether antepartal, interpartal, or postpartal; retention of secundines, and septic infection. It is partially arrested in endometritis and by getting up too soon. The involution may also be retarded by violent emotional disturbances.

At the close of labor the cervix is a soft and shapeless mass, having an almost gelatinous consistency, hanging in the vagina as a bruised curtain, with innumerable minute lacerations in its circumference. Within twelve hours it begins gradually to be reformed.

The os internum is large enough to admit two fingers at the end of twenty-four (24) hours, but closes firmly after the expulsion from the body of the contained blood clot, which usually takes place by the end of the second day. The internal os may remain patulous, if there is any intrauterine content, as retained membranes, placenta, etc.

The os externum, however, will admit one finger even after seven to fourteen days. When the cervix has regained its form, the involution goes on proportionately to that of the body of the uterus, unless it has sustained extensive injury. The lower border is *permanently* [illegible] to a greater or less degree, most frequently on the left side, in all parous women, owing to laceration of the cervical ring which occurs in all labors.

The Vagina.—The hypertrophied vaginal walls are much relaxed after labor. Their involution progresses with that of the uterus, but the vagina is never wholly restored to the nulliparous condition, as the walls are permanently enlarged and relaxed.

Other Pelvic Structures.—The ovaries and tubes, the muscular structures of the pelvic floor, of the abdominal walls, and all other structures which have undergone hypertrophy during pregnancy participate in the retrograde process and are partially, or wholly, restored to their antepartum state. This restoration depends on the amount of injury sustained during labor and the presence or absence of septic infection in the puerperium.

After-pains.—After-pains are periodical uterine contractions occurring after labor. They may continue for a few hours or for several days post partum. They are always more or less painful in multiparæ, owing to the greater relaxation of the uterus in women who have borne children, and the consequent liability to the retention of blood clots in the uterus at the close of labor. The multiparous uterus never retracts so well as the primiparous. Generally the postpartum uterine contractions are painless in primiparæ after the first clot is expelled.

After-pains accomplish and maintain the retraction of the uterus and are, therefore, conservative, when not too severe. They accomplish a physiological purpose, and normally cease altogether by the third or fourth day. Early rising from the bed, for an hour or so each day, or the assumption of the Fowler position for postural drainage, favors their early subsidence.

The after-pains are likely to be intensified by the reflex stimulation produced by putting the child to the breast.

The Lochia.—*The lochia are the genital discharges which immediately follow labor.* They are more or less bloody in character for the first four or five days, when they are called the *lochia rubra.* The bloody character of the discharge may continue longer if the retraction of the uterus is not good. Relaxation allows the formation and retention of blood clots within the cavity, which shows the character of its content by a bloody discharge. The *lochia rubra* contains shreds of decidua and of placental tissue, blood, degenerated epithelial cells, mucus, and numberless microorganisms. The discharges then become serosanguinolent, and are called *lochia serosa.* A flow of this character continues for two or three days,

when it begins to have a creamy appearance and contain fat granules, epithelial cells, leukocytes and cholesterin, and is termed the *lochia alba*. This continues for three or four weeks, or until the endometrium has been completely regenerated.

For a week or more after labor the reaction is alkaline, then neutral or acid. The total amount is estimated to be about three and a quarter pounds.

In normal cases the lochial flow continues for from two to four weeks. The quantity, character, and duration of the lochia are indices of the stage of involution.

Postpartum Calls.—The patient should be seen within twelve hours after labor, except when a competent nurse is in charge, who is capable of making a systematic examination of the mother and child, and reporting her findings to the attendant. For the first three days the woman should be visited once or twice a day, and once daily thereafter until the seventh day. During the remainder of the postpartum month occasional visits should be made at intervals of three or four days.

First Visit.—At the first visit a *systematic examination should be made.* The *general condition* of the mother, with her *pulse* and *temperature,* should be noted, as well as the *amount* and *character* of the *lochia.* (The lochial guard should be carefully inspected.) The abdominal binder should be loosened and the uterus examined by palpation through the abdomen for size (the height of the fundus), for firmness, and for tenderness. The abdominal examination will also determine the condition of the bladder, whether it is overfilled or not. Learn if it has been evacuated and the quantity of urine voided. *Frequent urination should always suggest the possibility of overdistention.* A specimen of urine should be taken for examination.

The breasts should be inspected and, if large, supported by a breast binder. The condition of the nipples should also have attention.

The physician should inquire if the patient has had sufficient sleep and the proper amount of nourishment.

The condition of the mother having been ascertained, the child should have attention; its color, respiration, the caput succedaneum, if one exists, the eyes, with the amount of swelling and discharge, being examined in succession. The breasts should be ex-

amined for caking or milk engorgement; the cord for evidences of bleeding or infection. It should be ascertained whether the child has passed urine and meconium, which serve as evidence that the passages are pervious. Should no meconium have been passed, the rectum may be explored with an oiled catheter or the little finger, to determine its patency. Finally the baby's rectal temperature should be taken.

Subsequent Visits.—Especially to be observed at the daily visits are the pulse, the temperature, the condition of the breasts, nipples, bladder, the amount and character of the lochia, the involution of the uterus, and the general condition of the mother. Abdominal examination of the pelvic contents should be made at about the tenth day, before the patient is permitted to leave the couch, and again at the end of the fourth week.

These examinations should determine the condition of the introitus vaginæ, the vagina and pelvic floor muscles; the condition of the broad ligaments, whether free or the seat of exudate, the condition of the cervix, whether lacerated or gaping; and the shape, size, position, density, and mobility of the uterus.

The patient should never be dismissed from observation until the involution is complete and the pelvic organs are entirely restored to the normal non-gravid state.

The child should be carefully examined at each visit. Too much reliance must not be placed on the nurse's record; the responsibility for its condition rests on the physician.

The long continuance of the lochia rubra is usually associated with some degree of sepsis within the uterine cavity. A thrombophlebitis in the placental site is a comparatively common lesion. The persistence of the bloody flow in the third and fourth week, especially when associated with bearing down and sacral pain, should suggest a redisplacement of the uterus or subinvolution. *Metrorrhagia in the later weeks of the puerperium always demands a pelvic exploration.*

Evacuations of the Bladder.—Owing to the edema and swelling about the urethra and the lowered intraabdominal pressure which follows labor, there is danger of *overdistention of the bladder* from retention of urine. This should be guarded against by having the patient attempt to empty her bladder within six hours after delivery, and once every six or eight hours thereafter. Should she

be unable to void, the retention may sometimes be relieved by the application of hot fomentations over the hypogastric region, in conjunction with a hot irrigation against the meatus urethræ. This failing, a rectal injection of warm water may cause the bladder to contract, especially if the woman be allowed to expel the enema in a sitting or semi-sitting posture. Suprapubic pressure during the attempts at urination is occasionally of value. Most patients will urinate, if allowed to get out of bed and use the commode, and unless the labor has been operative, and the patient has sustained extensive pelvic floor injuries, there can be no objection to permitting her to sit up to evacuate the bladder. The sitting posture has a further advantage, that it empties the vagina of clots and favors uterine drainage.

When the labor has been unusually severe, the anesthesia prolonged, or the pelvic floor badly torn, involving the sphincters, or where an immediate repair has been made, it is advisable that the patient maintain a recumbent position for the first few days, as sitting up under such circumstances is *not without danger*. It is in *this class of cases* that the *catheter must* be used to relieve the retention.

The use of the catheter is frequently attended with infection of the bladder and of the vesical neck, resulting in a chronic trigonitis or tracheloeystitis. It is, therefore, imperative that the catheter be withheld, if possible. When required, it should be used in the following manner: The instrument, if it be used by the nurse, should be a No. 10 or 12 soft rubber catheter. The catheter must be boiled for ten minutes immediately before using, and, after sterilizing, must be handled *only* with surgically clean hands.

The patient lies upon the back with the knees drawn apart, and the external genitals exposed (in a good light). The nurse, after scrubbing her hands, bathes the labia and surrounding parts with an antiseptic solution. She then resterilizes her hands and, with the thumb and finger of one hand, retracts the labia, to fully expose the meatus, while she disinfects it and its surroundings with a gauze sponge soaked in the antiseptic solution (1-2000 bichlorid). After this is done, while still retracting the labia, she passes the catheter, smeared with a sterile lubricant, into the urethra, 4 cm. (about 1½ inches), or until the urine begins to flow. *The labia are held apart until the catheter is in the bladder.* The urine may

be collected in a cup or small bowl. The evacuation of the bladder is repeated every eight hours. Care must be taken to prevent the entrance of urine into the vagina and its contact with the genital wounds. This is accomplished by compressing the catheter near its outer end to hold the column of urine in the tube during its withdrawal.

When the catheterization has to be repeated for several days, some urinary antiseptic, as urotropin, grs. vii in eight ounces of water, or five-grain tablets of salol, should be administered at four-hour intervals, as a prophylactic against cystitis.

The Bowels.—The bowels are to be opened on the second or third day and once daily, thereafter. For this purpose a simple enema of soapsuds and warm water is usually sufficient to produce a satisfactory evacuation. Subsequently the daily movement may be obtained by the administration of such mild laxatives as citrate of magnesia, rubinat, or Pluto water, or cascara sagrada. Strong cathartics should be avoided, not only because of their disturbing effects upon the bowel, and their tendency to make the colon bacillus more active, *but they are likely to disturb the child.*

[NOTE.—We have repeatedly produced a marked elevation of temperature and a leukocytosis in the blood, with a full dose of oleum recini given on the evening of the second day. So constant was the effect that this routine has been discontinued.]

Rest.—If the after-pains are severe enough to prevent sleep, they may be relieved by one or two doses of codein, gr. i, with five grains of aspirin. Since we have adopted the use of the Fowler position as a routine after labor, we have found that the afterpains have been inconsiderable; as postural drainage favors the early evacuation of clots.

The drain upon the woman's resources, from the labor and during the puerperium, is considerable, and every effort should be made to have her obtain sufficient rest, sleep, fresh air, and good food. The diet may be generous, including cereals, milk, eggs, bread and butter, chicken, lamb, well-cooked vegetables, cooked fruits; while some tonic digestive, containing iron, quinin, and strychnia, may be of advantage in improving her general tone.

Antisepsis of the Lying-in Woman.—Strict cleanliness of the patient's person, personal linen, and bed linen is imperative. The vulva dressing should be changed every three or four hours during

the first three days, and thereafter often enough to prevent the least putrefactive odor. A clean pad should be used after the woman has urinated, or had a bowel movement. *Before reapplying a sterile pad,* the nurse should *cleanse* (with an antiseptic solution) *the external genitals,* and their immediate surroundings and other parts of the body which may be soiled by the discharges. *No vaginal douches* are to be employed. Sepsis or fetor is controlled by posture and rigid external cleanliness.

The vaginal douche post partum is dangerous practice, unless it be given with the most scrupulous attention to aseptic detail. The nurse should be scrupulously clean. She should wear *only* wash dresses and change them frequently. *Her hands must always be sterilized before touching the genitals or breasts of the patient, or changing the dressing on the navel, or bathing the baby's eyes.* Strict asepsis is as essential for the nurse as for the physician.

Diet of the Puerperal Woman.—Convalescence goes on more rapidly with proper feeding. The normal lying-in woman needs an abundance of easily digestible and well-cooked food, yet an excess, or too great a restriction, in the diet must be avoided. No fixed routine should be adopted, as it is better, if possible, to adapt both the quality and the quantity of the food to the needs of the individual patient. For the first twenty-four hours or longer, if the patient is much exhausted, or has had a prolonged anesthesia for an operative labor, the diet should be restricted to fluids or light solid food, consisting of milk, milk preparations, gruels, beef juice, animal and vegetable broths, eggs (raw, boiled or poached), raw oysters, custards, well-cooked cereals, tea and cocoa made with water, the milk to be added on serving.

After the first two or three days, when the bowels have moved, and in the absence of exhaustion or fever, a moderately full mixed diet may generally be permitted. The patient should be fed six or seven times a day, taking hot milk, broth, or cocoa, on waking, between meals, and before retiring for the night.

The heaviest meal should be in the middle of the day. To establish a daily action of the bowels, cooked fruit in considerable quantity may be introduced into the diet.

Tardy Involution.—Tardy involution of the uterus is a complication of the puerperium, not uncommonly met in non-nursing women, or women who have had frequent pregnancies and sustained

lacerations of the cervix, or have been the subjects of postpartum hemorrhage, retention of secundines, or slight degrees of sepsis, with coexistent endometritis, etc. To meet this complication, measures may be used to promote involution, such as *massage,* in the form of gentle friction over the fundus for ten minutes twice daily. The hand is placed on the abdomen over the uterine tumor, and is moved in a circular direction over the uterus, or it grasps the body, through the abdominal wall, with the thumb in front and fingers behind, and makes friction over the fundus.

Manipulation of the uterus is dangerous in the second week of the puerperium, and should never be employed if the tardy involution is due to sepsis, as emboli are liable to be dislodged from the thrombosed vessels in the placental site, causing serious results.

Galvanism has a stimulating effect on the muscle and the blood supply of the uterus. One electrode may be placed over the upper part of the sacrum, and one upon the abdomen, over the uterus; ten to twenty milliampères are to be used at each sitting. The séances last for ten minutes, and may be repeated twice daily. *Faradism* can be employed in a similar way, and is, in our opinion, of greater value in reducing the size of the postpartum uterus than galvanism.

The continued use of *ergot*, either in the form of the extract of ergot alone, in 1-grain doses, three times a day, or in combination with iron, quinin, and strychnia, making the much used postpartum pill, aids in reducing the size of the uterus. Unfortunately ergot may diminish the milk secretion. A hot vaginal douche, of two or three gallons, at a temperature of 120° F., given twice daily with a Davidson syringe, temporarily depletes the pelvic circulation, and is of some benefit when the uterus is large and heavy. Immediately following the douche, the patient should be placed in the genupectoral position for five minutes, which permits the uterus to rise out of the pelvis and further relieve the engorgement. Douches should not be begun until about ten days after labor. The curette in tardy involution has but a *limited* field, and should *only be used in case of hypertrophied decidua, when metrorrhagia is persistent. The use of the curette is dangerous in the puerperium,* especially when the *subinvolution is accompanied with an elevation of temperature or any exudate in the pelvis.*

Regulation of the Lying-in Period.—While it is seldom possi-

ble in hospital practice to keep the patient in the hospital long enough to secure involution, in private practice the physician can regulate the lying-in period, *if he will*, even among those of moderate means, and keep his patient under observation until the uterus has returned to its normal size, position, and condition.

The First Week.—During the first week the patient keeps the bed, but after the first few hours she has considerable license. She may assume the sitting or half sitting posture to take her meals and to nurse the baby, and, if necessary, for evacuation of the bladder and rectum. She should assume the lateroprone posture, both right and left, several times a day, and lie upon her abdomen for at least an hour daily. Frequent change of position favors uterine drainage and massages the uterine supports.

The Second Week.—During the second week she has greater liberty, while the greater part of her time is spent on the bed or lounge. She may sit up for her meals, to urinate, and for bowel movements, and she should spend at least half an hour, twice daily, in abdominal and leg exercises to keep up her muscular tone.

The Third Week.—She may be moved to a chair for a part of the day, having the liberty of the room. After sitting up for any length of time, she should be instructed to take the genupectoral position before lying down. Prescribed exercises for the legs and abdominal muscles are to be taken daily.

The Fourth Week.—If all goes well, she may leave the room and have the benefits of air and sun. Physical exercises should be continued. The duration of the lying-in period and the degree of freedom to be given the patient after the second week must, however, depend on the character and amount of the lochia, the general progress of her convalescence, and the rate of the uterine involution.

Establishment of the Milk Secretion.—Before the true milk secretion begins, the mammary glands furnish a thin, slightly viscid, yellowish fluid, which contains epithelial cells, fat globules, and certain bodies called colostrum corpuscles. This substance is rich in proteids and saline matter, and is known as *colostrum*. Formerly it was supposed that this secretion was of value to the child, because of its moderate laxative properties. Recent observation has not confirmed this view. No colostrum corpuscles should be found in the breast milk after the tenth day. The true milk secretion is

usually established by the third day in primiparæ, and on the second in multiparæ. Some mammary engorgement always takes place and causes a slight elevation of temperature, which may be relieved by a breast binder and a saline laxative.

Signs of Deficient Lactation.—Unfortunately, from ten to twenty per cent. of women are unable to nurse their babies, owing to deficient milk secretion, the signs of which are that *the breasts remain persistently flabby, and the child is not satisfied, and shows signs of inanition, the most important of which is loss of weight.* The mother's milk supply may be at fault in quantity or in quality. The clinical test of its fitness or unfitness is the child's gain and general condition. To gain normally in weight, the baby should increase from five to six ounces per week for the first five (5) months, and a pound monthly for the remainder of the first year. The child's weight should be taken and recorded twice a week for the first three months, thereafter weekly. The best time to weigh the child is just after the bath and before nursing.

Measures for Increasing the Maternal Milk Supply.—Fresh air and moderate exercise in combination with a generous, mixed diet, and plenty of milk, are the best galactagogues. Tonics, especially strychnia, contribute to improve the general tone of the patient, and by so doing may increase the milk secretion. Faradism applied directly through the breasts, once or twice daily, with the positive pole over the nipple, may stimulate the mammary function. Massage of the breasts, and especially of the abdomen, from below upward, with a view to increasing the blood supply of the breast, helps, as does also thyroid extract, in gr. i doses (3 or 4 times daily), which seems to have some influence on the mammary circulation and improve the quantity and quality of the secretion.

Special foods have been recommended in case of scanty secretion, such as beans, lentils, parsnips, and vegetable foods containing phosphorus. Milk and cocoa, taken as a part of each meal, have strong endorsements. Innumerable proprietory preparations have been used and recommended to increase the mammary secretion. Our experience, however, makes us doubtful whether any of these preparations have any influence, as when fresh air, moderate exercise, and an abundance of proper food have failed to produce sufficient milk, the substitution of artificial feeding has usually be-

come necessary. Malt preparations taken with the meals aid digestion and may increase the appetite. Coffee should be forbidden to the nursing woman, as it diminishes the secretion of milk.

Care of the Breasts and Nipples.—The care of the breasts and the preparation of the nipples for nursing should be begun six or eight weeks before labor, as has been already stated in the chapter on the hygiene of pregnancy. After the birth, the nipples need special care to prevent the formation of fissures. The nurse should cleanse the nipple before and after each nursing with a bland antiseptic solution, such as a saturated solution of boric acid, to which one-eighth (⅛) part of glycerin has been added; while before each nursing the child's mouth should be cleansed in a like manner with a saturated solution of boric acid, care being used to avoid injury to the buccal epithelium from too vigorous handling. Excessive nursing must not be permitted, for the nipple is injured by long-continued maceration, and avenues for infection are opened.

The nurse must be warned of the risk of carrying infection to the nipples, or to the child, when her hands are soiled from handling the lochial guard. *The nipple should never be touched by the nurse until she has first thoroughly disinfected her hands.*

When the breasts are engorged, the engorgement may be relieved by applying hot stupes to each breast for fifteen minutes, or until a superficial blush is produced, when the lactiferous tubules may be emptied by gentle massage. The direction of the stroke should be from the nipple outward to unload the veins.

Massage is prohibited in the presence of inflammation, hence it is important to differentiate between simple engorgement and mastitis.

Painful distention of the breasts may be relieved by the free *exhibition of saline cathartics* in the form of a saturated solution of magnesium sulphate administered in drachm doses, without dilution with water, by the *restricted ingestion of fluids,* and by the use of a snugly applied *breast binder,* making even compression over the gland. Painting the skin overlying the gland with equal parts of glycerin and the fluid extract of pinus canadensis, and *covering the breast* with a thin layer of cotton batting before applying the binder, promptly relieve the pain and check the dis-

Contraindications to Nursing.—There are certain conditions of the mother which prohibit the child from nursing. These are recent syphilis, if the child is not already infected, tuberculosis, marked anemia, chorea, epilepsy, poor quality, or deficient quantity, of milk, and the existence of pregnancy.

CHAPTER IX

THE CONDITION OF THE CHILD AT BIRTH

The weight of the newborn infant averages about 3250 grammes (3175-3288), or 7 to 7¼ pounds. Male children usually weigh about a quarter of a pound more than girl babies. Children of very young primiparæ are usually smaller than the average, and weigh less than subsequent births, while those of old primiparæ (35-40 years) are larger.

A loss of weight takes place during the first three days amounting to from six to eight ounces, which is due to inanition, consequent upon the absence of the milk supply. Normally the child regains its initial weight by the end of the first week or ten days, and from then on should gain from five to six ounces a week for the first five months, when the weight should be double that at birth. For the next ten months the gain should average a pound a month, until, at fifteen months, the child should have trebled its original weight, after which time the gain is slower.

Measurement and Appearance of the Normal Child at Birth—Signs of Maturity.—The length of the child at birth is from 45 to 50 cm. (18 to 20 inches). The suboccipito-bregmatic circumference measures 33 cm. (13¼ inches), and the length of the foot is 8 cm. (3⅛ inches), while its weight is about 3250 grammes. The face and body are plump, the eyes are usually open, and the child should cry lustily. Lanugo is almost wholly absent from the body. The vernix caseosa, as a rule, is present only on the child's back and the flexor surfaces of the limbs. The fingernails overreach the fingertips, and the toenails extend to the end of the bed of the nail.

The cranial bones are hard, and the sutures and fontanelles small, the cartilages of the ear and of the nose have become firm, while centers of ossification are developed in the epiphysis of the femur and in the astragulus.

The temperature of the child at birth ranges from 98.6° Fahrenheit to 99° Fahrenheit, but is easily influenced by slight causes.

Disturbances of digestion, malnutrition, or infection of the navel cord are the common causes of sharp elevations in the temperature of the newborn.

The Circulation.—At birth the fetal pulse rate ranges from 120 to 140 per minute. It should be counted by listening to the beat of the heart. The ductus venosus and the umbilical vein are obliterated within a week, the ductus arteriosus within a few weeks. The foramen ovale may not close for several weeks or even months, and occasionally the upper part *remains permanently open.* The umbilical arteries are obliterated in their upper portions within five days, the lower portions remain open and form the superior vesical arteries.

The Stomach.—The stomach of the newborn infant is placed high on the left side under the false ribs; its axis is almost longitudinal. In a child of normal weight its capacity should be one ounce at birth and increase about one ounce per month up to the sixth month.

Respiration.—The lungs are *collapsed at birth* and the respiratory tract is *devoid of air,* until the first respiratory effort. If the second stage has been prolonged, or when the head comes last, as in breech births, the air tract may contain blood and vaginal mucus, which is drawn into it by premature efforts at respiration. It is for this reason (to allow the mucus in the trachea to drain by gravity) that the child should be held in an inverted position until respiration is established.

The *first respiratory movement* is due in part to *air hunger, from the arrest of the maternal supply of oxygen,* and in part to *reflex contraction of the respiratory muscles excited by contact of the air with the moist surface of the skin.* The average rate of respiration in the newborn is 45 per minute.

The Blood.—The blood makes up about 8 per cent. of the total body weight in the newborn infant. The number of the red corpuscles to the cubic millimeter is in excess (6,000,000-7,000,000), and the hemoglobin percentage much greater than in adult life. (The hemoglobin in the first three days may be as high as 120 per cent.)

The ordinary jaundice which is seen in the newborn infant during the first week is due, according to most authorities, to the overabundance of red corpuscles, which are destroyed in the liver, giv-

ing rise to an excess of bile pigment, thus setting free the coloring matter in the blood, which is directly absorbed by the tissues.

The Skin.—The skin of the child's back and of the flexor surfaces of the limbs is more or less thickly covered with a cheesy coating, the *vernix caseosa*, which consists of lanugo, epithelial scales, and sebaceous material. During the first two or three days the epidermis is partly exfoliated, leaving the skin red and irritable.

The Bowels.—The contents of the intestines are meconium, which consists of intestinal secretions and bile, together with lanugo and epithelial scales derived from swallowed liquor amnii. The meconium is gradually passed off, and the stools become *feculent*, with a sour smell and acid reaction, within the first three or four days. The child has from two to four bowel movements daily.

The Genitourinary Organs.—The bladder usually contains urine at birth. The urine is of low specific gravity, from 1003 to 1010, containing more or less marked traces of albumin. It sometimes gives a reaction for sugar. It does not, as a rule, stain the diaper, though uric acid deposits simulating blood stains may often be observed on the napkin. The child urinates frequently (ten to twenty times in twenty-four hours).

In boys the testicles have descended into the scrotum. The prepuce is normally adherent to the glans penis. In the newborn the preputial orifice is usually too small to permit easy retraction of the foreskin. If the foreskin cannot be retracted, because of the firm adhesion to the glans, the preputial orifice may be nicked with the scissors and the foreskin stripped back by freeing the adhesions.

The Nervous System of the New-Born.—The nervous system is much more irritable and the nerve centers more unstable than in later life.

The sensibility of the skin is feeble at birth, but it is fully established within the first two or three days following.

The taste is only sensitive to strong impressions, while at birth the child is deaf, since the meatus is closed and the middle ear is consequently devoid of air. Loud sounds become audible within a few hours. The retina is sensitive to light, though objects make no impression upon it.

The Secretions Are All of Later Development.—The lacrymal and the sweat glands are not, as a rule, developed in the first few months, and but little saliva is secreted; while the amylolytic

function is feeble and not competent to digest starches until after the sixth month.

The Caput Succedaneum.—The caput succedaneum and the distortion in the shape of the head from molding disappear gradually, without treatment, and in the course of two or three weeks the head should have its normal contour.

CARE OF THE NEWBORN CHILD

The management of the newborn child should include a discussion of the methods for:

(1) The establishment of its respiration
(2) The incubation of the feeble or premature infant
(3) The details of bathing
(4) The prevention of ophthalmia
(5) The care of the umbilical stump and navel dressing
(6) The form of clothing best adapted to the newborn
(7) Directions as to nursing and sleep.

Respiration.—Immediately upon its birth the child should be suspended by the feet to promote the drainage of inspired mucus from the respiratory tract, and at the same time cause a flow of blood to the brain. If this does not provoke inspiration, gentle flagellation of the back and buttocks, blowing on the face, dashing a few drops of cold water on the chest, or the sudden immersion of the body into a bathtub of cold water, will usually cause the child to make a deep inspiratory movement.

Asphyxia Neonatorum.—Asphyxia of the newborn infant occurs from a deficient supply of oxygen in the blood, and is generally the result of injuries which are sustained during birth, disturbing the placentofetal circulation, of compression of the cord, of premature separation of the placenta, from a short cord or a cord coiled about the child's neck, or of pressure on the fetal head in prolonged and difficult labors producing fetal inspiration, especially in forceps operations and breech extractions. The prognosis varies with the *degree* of asphyxia (asphyxia livida, asphyxia pallida). The chances of the child are generally *good* in the *cyanotic,* and *grave* in the *pallid stage.*

Simple measures, such as already referred to for provoking respiration, are usually successful in the cyanotic stage, particu-

larly if they are supplemented by clearing the throat of mucus with the finger wrapped with soft linen, or by aspiration of the mucus with a soft rubber catheter introduced into the trachea, or, in marked venous congestion, by allowing one or two drachms of blood to escape from the cord while the child is suspended by the feet. The fetal heart must be constantly watched during our attempts to establish respiration, as it serves as an index to the degree of asphyxia. When very slow, the child's surface temperature must be maintained by immersing the body and the lower extremities in water, at 100-105° Fahrenheit. If the child is pale and collapsed a rectal injection of water at a temperature of 105-108° Fahrenheit may be given, should the child make no attempts at inspiration.

Holden's method of direct insufflation with oxygen should be used after the throat is cleared of mucus. The child is laid on its back, in a bath of warm water, with the head partially extended, to straighten the trachea. The hand is placed under the shoulders and the neck allowed to rest in the cleft between thumb and index finger, which steadies the head. A close-fitting mouthpiece, or small rubber funnel connected by rubber tubing to an oxygen tank, is then firmly placed over the child's mouth and the oxygen turned on. Almost immediately the rate of the heart beat will be increased and the cyanosis of the skin changed to pink, while upward stroking of the chest wall along the long thoracic nerve will cause the child to make inspiratory efforts.

For several years this method has supplanted all others in my clinic. We have combined it with the Byrd and Laborde methods to be described later.

In hospital practice the use of the pulmotor has replaced other methods of resuscitation.

In case no oxygen is available, the following methods are of value:

Direct Insufflation (Mouth to Mouth).—The child is laid on its back in a warm blanket upon a table; the throat is cleared of mucus; the head is partially extended by placing a fold of blanket under its neck; the face is cleansed and covered with a clean piece of sterile gauze. To prevent inflation of the stomach, the hand is held firmly on the epigastrium. With the operator's mouth against the gauze directly over the child's mouth, the operator expands its

lungs by blowing gently into them. Expiration is produced by compression of the chest wall with the hand. This is repeated sixteen to twenty times per minute as long as the heart beats.

Schultze's Method.—For inspiration the child should be suspended by the shoulders, face from the operator, by placing an index finger in each axilla, holding the thumb in front and two fingers extended over the posterior aspect of each shoulder, expanding the chest, while the head is kept steadied and extended between the ulnar surfaces of the hands.

For expiration the position is inverted by swinging the trunk and lower limbs upward and toward the operator's face, flexing the body in the lumbar region. *The first movement should be one of expiration,* which helps to rid the trachea of mucus. The objections to this method are, first, the chilling of the body; second, the shock involved, so that in feeble infants, if used at all, it must be done with great caution. This, and direct insufflation with oxygen, or by mouth to mouth, are the most effectual methods in asphyxia of the newborn.

Sylvester's Method.—The child is placed in a supine position, with the head well extended by a fold of blanket under its neck. For inspiration, the arms are drawn well above the head; for expiration, they are placed by the sides and the thorax gently compressed. The value of this method is increased by making forward traction on the tongue during inspiratory movement.

Byrd's Method.—The child is held supine upon the hands of the operator at right angles to the forearms. For inspiration the radial borders of the hands are lowered. For expiration they are raised. The child is successively folded and unfolded.

Laborde's Method.—With the child lying in a supine position on a table, or in a warm bath, with the head extended, gentle intermittent traction is made on the tongue about eighteen times to the minute.

When respiratory movements have been established *but remain persistently feeble,* a weak Faradic current, one pole of which is applied to the nuchal region and the other over the epigastrum, combined with the continued inhalation of oxygen, may induce deeper and stronger respiratory efforts.

Should all of the foregoing methods fail, and the fetal heart, however slow, continue to beat, an injection into the umbilical vein

of 30-50 cm. of sterile normal salt solution, containing 0.5 per cent. of fructosate of sodium, may be given. The salt solution dissolves CO_2.

Incubation of Feeble or Premature Infants.—The premature infant presents two physiological abnormalities, a subnormal temperature and the inability to ingest and digest a sufficient quantity of food. Therefore, premature, puny, and anemic children will generally require incubation. The infant prematurely born should be kept in the incubator for as many weeks as it is premature. It should be removed from it only for feeding and bathing, when it must be carefully guarded from exposure. Premature and feeble infants nurse poorly. They may be given sufficient nourishment, by drawing the milk from the breast with a sterile breast pump, and giving it to the child by gavage, in a bottle or with a medicine dropper. The child should be fed every hour, beginning with a drachm at each feeding. The interval and quantity should be gradually increased.

The temperature of the incubator should be at first about 90° F., and gradually be lowered to that of the room during the few weeks preceding the final removal of the child. Ample ventilation must, of course, be provided, and this is extremely difficult in the several hot-air apparatuses in general use. During the last few years we have substituted for the regular incubator a square incubating box, 30 inches long, 20 inches wide, and 24 inches high. A hot water bottle is placed in each corner, under a feather pillow which covers the bottom. The infant, who has been previously rubbed with warm oil, is wrapped in a layer of absorbent cotton and placed in the box. The box is covered with one or two thicknesses of clean cheesecloth, and a thermometer is kept in the compartment with the child, that the temperature may be accurately maintained.

The Details of Bathing.—The face is bathed on the birth of the head, and the eyes are cleansed with a boric acid solution and carefuliy dried, as a prophylactic against ophthalmia.

The body is smeared with warm sweet oil or vaselin to facilitate the subsequent removal of the vernix caseosa. A tub bath is not given until the cord falls off and the umbilical wound has healed, a warm sponge bath being substituted.

After the cord falls, a daily bath is given by immersion. A

morning hour should be chosen midway between feedings. The temperature of the water should be 98° Fahrenheit *by the bath thermometer;* that of the room 75° Fahrenheit. The least chilling is injurious.

The nurse should have a warm, dry towel laid upon a warmed blanket ready to receive the child, and dry it on its removal from the bath. The duration of the bath should not exceed five minutes. A square of fresh boiled cheesecloth serves as a washrag.

Only a bland mildly alkaline soap (Castile) should be used, and little of that. Special attention must be given to the scalp to remove the scales of epithelium and sebaceous material.

The full bath is repeated daily in summer and daily or every other day in the colder months, depending on the robustness of the child. Parts of the body exposed to soiling must be cleansed as often as soiled.

In puny and anemic children the full bath must be postponed for several days. They do better if a daily rub with warm sweet oil is substituted, the face and eyes only being cleansed with water. If the child is kept clean and the skin thoroughly dried, infant powders are unnecessary.

The Prevention of Ophthalmia Neonatorum.—The instillation into the conjunctival sac of each eye of one or two drops of silver nitrate solution, 2 per cent. (or gr. x, ℥ i), or of a 10 per cent. argyrol solution, should be a routine procedure at each birth, whether in hospital or private practice, as the prevalence of gonorrhea among the innocent is so great that the physician cannot take the chance of discriminating. When silver nitrate has been used, the excess may be washed away with sterile salt solution.

Argyrol in a 10 per cent. solution is much less irritating than the nitrate of silver, and is nearly or quite as effective.

The Navel Dressing.—The physician, after resterilizing his hands, or donning sterile gloves, should dress the stump of the navel cord with sterile absorbent cotton, saturated with strong alcohol. The stump should be turned to the left side to avoid injurious pressure on the liver, and retained in this position by a loose abdominal binder. Rapid desiccation is the chief reliance for preventing putrefactive changes in the stump. The alcohol dressing promotes desiccation, while powders tend to hinder the drying, and are best omitted.

After each bath, if a full bath be given, the navel stump should be carefully bathed with strong alcohol and a fresh sterile dressing applied. It is better to substitute for the tub bath a sponge bath, or in feeble children an inunction with sterile sweet oil until the cord falls off.

This usually occurs on the fifth or sixth day. The navel wound may then be dressed with a compress of sterile gauze, spread with a layer of sterile zinc ointment to prevent its adhesion to the wound. This is removed daily until the wound is healed.

It is imperative that the umbilical wound be kept surgically clean or septic infection of the navel may result in phlebitis of the umbilical vein, pyemia, and death. This is one of the commonest causes of fatality in the newborn.

Clothing of the New-born Infant.—The skin should be protected, the extremities and body alike, with woolen or linen mesh undergarments of light weight. It is well to have changes for night and day use. No garment must be used until laundered. A serviceable outfit for the first six or nine months of the infant's life is:

(1) A belly band of fine French flannel, 4 inches wide by 20 inches long, to fasten with tapes, or a knitted mesh band supported from the shoulders.
(2) A napkin made of linen diapering, freshly laundered and dried.
(3) An undershirt of the softest silk and wool or linen mesh, opening in front, without sleeves for summer, with long sleeves for winter use.
(4) A fine flannel princess dress, with high neck and sleeves, opening in front and about twenty-five inches long, to be worn in winter under the muslin slip.
(5) A muslin slip made in similar style.
(6) Woolen socks, long enough to cover the legs to the knees.

The use of short-sleeved, low-necked, long-skirted lace slips is to be disparaged; the baby needs protection and comfort during its early life, not style.

The belly band and all bands in the clothing should be supplied with tapes for fastening, or should be sewed on. No pins should be used about an infant's dress, except the diaper pin to hold the

napkin. All bands should be loose enough to admit two or three fingers underneath them in order that there shall be no constriction or restriction of the baby's free movement.

At night the child should have a sponge bath and the underclothing changed; the muslin and flannel slip are replaced with a light flannel or linen mesh nightdress, having a drawstring at the bottom, so that the feet are protected from cold.

Nursing.—The child is put to the breast after the mother has had rest and sleep, and has recovered from the shock of labor; usually at the end of ten to twelve hours. Each nursing should not be longer than fifteen minutes.

Until the milk secretion is established on the second or third day, the child should not be given the breast oftener than every four hours, thereafter at intervals of two or two and a quarter hours. *The milk becomes too rich with too frequent nursing, too thin when the intervals are too long.* One interval at night is lengthened to four or six hours. It is well to wake the child, if necessary, on the hour, and thus establish a regular habit. Children gain better when brought up by routine.

The intervals should be extended to three hours by the time the child is three months old, and to three and a half to four when it passes six months. After the seventh or eighth month, one or more artificial feedings daily will be required, together with the addition of a few teaspoonfuls of fresh orange juice, given just after the bath.

Should the mother be unable to nurse the child, or should the child show constant loss of weight from the mother's milk, wet nursing or artificial feeding must be substituted. It is difficult to procure a good wet nurse when one is wanted, because she must meet certain definite requirements in order to be a good substitute.

A good wet nurse should be of a mature age, between twenty and thirty-five, preferably a multigravida. It is essential that her own child be within one or two months of the same age as the foster child. A menstruating woman is sometimes unsuitable; a pregnant one is always so. She must be of sound physical and mental health, and be willing to submit to a thorough physical examination, especially for tuberculosis, syphilis, and other contagious diseases. A Wassermann reaction should be taken of both the serum and of the milk. The breasts should be of somewhat conical form,

well developed, with prominent veins, and have well formed and healthy nipples. Her own child should be seen and examined as to its growth and development, for its condition speaks for the quantity and the quality of her milk. Personal cleanliness is a factor in the success of a wet nurse.

A properly fed, healthy baby should sleep from eighteen to twenty hours out of the twenty-four, waking for its nursing. The child should be taught to lie in its crib or basket, out of doors in summer, in a cool, ventilated room in winter, and should not be handled by the nurse or mother.

Weaning.—Weaning should be a gradual process and should not be thought of while the child shows a weekly gain, until after it has cut eight teeth. Should this period fall in the hot months weaning may be postponed until cooler weather.

CHAPTER X

ARTIFICIAL FEEDING

When constitutional diseases of the mother render nursing inadvisable, or when the supply of mother's milk is insufficient, or the quality is poor, as is shown by a loss in the weight of the child, or the persistent disturbance of its digestion, or when a proper wet nurse is not available, resort must be made to artificial feeding, by the modification of cow's milk, as a substitute for what the child should receive from its mother.

Cow's milk should be the basis of the substitute food for at least the first year and a half of the child's life. Unfortunately, there are marked differences between cow's milk and human milk. The most important of these are in its gross appearance, its reaction, its specific gravity, the character of the curd, and the amount of casein, sugar, and ash which it contains.

A tabulated comparison shows that human milk and cow's milk differ in the following points:

HUMAN MILK	COW'S MILK
In gross appearance is yellowish, or bluish, and more or less translucent.	Cow's milk is dead white in color and opaque.
In human milk the reaction is alkaline.	The reaction in cow's milk is acid.
The specific gravity of human milk is 10.24-10.35.	The specific gravity of cow's milk is 10.30-10.35.
The character of the curd in human milk is light, flocculent, and easily digested.	The character of the curd in cow's milk is dense and tough.
Casein, or proteids, make up from 1 to 2 per cent. in human milk.	The casein and proteids in cow's milk amount to 4 per cent.

Human milk contains from seven to seven and one-half per cent. of sugar, as against five per cent. in cow's milk, while the amount of ash in cow's milk is about five times greater than that found in human milk. Cow's milk differs further from human milk, in that the albuminous envelope surrounding the fat globule is thicker and tougher, and cow's milk is the habitat for numberless millions of both pathogenic and non-pathogenic bacteria, while human milk is usually sterile.

Certified milk from a good dairy is better than one cow's milk, because it is more nearly constant in quality. In using cow's milk as the basis of modification, *four basic facts must be kept constantly in mind: first,* the *total quantity of the modified mixture required; second,* the *chemical difference in the reaction of the cow's milk,* as compared with breast milk; *third,* the protein material is far less digestible, and in greater quantity, in cow's milk; and, *fourth,* the prevalence of bacteria in cow's milk.

Sterilization by heat destroys the germ content and retards the fermentative changes. It does not destroy the products of fermentation, but impairs the nutritive value of the milk. Pasteurization, or exposing the milk to a temperature of not less than 150° Fahrenheit for twenty minutes, will render the milk sufficiently germ-free for infant food, and produce a minimum injury to the nutritive value of the milk. Pasteurization is always advisable when the cleanliness of the milk cannot be trusted, especially during the summer months. When certified milk can be obtained and kept chilled below 60° Fahrenheit, from the time of milking until it is used as the basis for modification, no sterilization or pasteurization is needed.

The ratio which the proteids bear to the fat in an artificially prepared food should be as follows: In the *first month* the *proteids should bear a 1 to 3 relation to the fats. After the fourth month, the ratio is gradually increased until the relation is 1 to 2, which proportion may be continued until the end of the tenth month, when the child's digestive apparatus is capable of handling proteids and fat in about equal proportion, as is found in cow's milk.*

In order to reduce the tendency of casein to coagulate into large, firm masses on entering the stomach, a diluent, such as sterile water, or dextrinized gruel, or whey, must be added to re-

duce the amount of proteid to the proper level. While this dilution reduces the percentage of casein, it also reduces the percentage of fat and sugar, bringing the *percentage of each below that* found in human milk.

To make up for this reduction in the percentage of fat and sugar, fat is added in the form of cream, and the sugar percentage increased by the addition of sugar of milk. *In making up the percentage of sugar to the standard of human milk, one ounce,* or about three level tablespoonfuls, *of milk sugar may be added to each twenty ounces of the mixture, which adds approximately 5 per cent. of sugar.* Since the *cow's milk is acid,* while the *human milk is alkaline,* the acidity should be corrected by the addition of 5 per cent. of lime water (one ounce to each twenty ounces of the mixed food), or one grain of bicarbonate of soda to each ounce of the milk mixture.

In order to obtain milk containing the required proportions of proteids and fat for dilution, the sealed bottle of certified milk is placed in the refrigerator and allowed to stand for four hours, when the milk will be found to have fully creamed; the line of demarcation between the cream and the under milk will be plainly visible. The *upper two ounces of cream will contain about 14 per cent. of fats;* the upper ten ounces, or the upper third of the bottle, known as "ten ounce top milk," about 12 per cent., while the upper half, or "sixteen ounce top milk," approximately 8 per cent. The percentage of *proteids* and of *sugar* is the *same in all top milk as in whole milk.* The top milk may be removed with a Chapin dipper, or by syphonage of the under milk, leaving only the desired strength top milk in the bottle.

The strength of the food is regulated by the amount of dilution, and varies with the age and capacity of the child.

Thin cereal, gruels, or whey, when used as diluents, prevent the casein from forming large, tough curds in the stomach by breaking up and softening the curd.

To prepare a dextrinized gruel, take a tablespoonful of barley, wheat, or rice flour, and mix it into a paste with cold water, add water to the amount of one pint, or in that proportion, and boil for twenty minutes. After allowing the gruel to cool to 100° Fahrenheit, a teaspoonful of Foebes' diastase is added, and the gruel is allowed to stand for ten

minutes, permitting the ferment to act, when it is ready to be used as a diluent.

To prepare whey, a pint of milk is heated in a suitable vessel to a temperature of 115° Fahrenheit, and maintained at this temperature while 1 or 2 drachms of Fairchild's essence of pepsin is added. The separation of the curd begins to take place almost immediately, and the curd is formed within a half hour. The whey is then strained off, through several thicknesses of sterile cheesecloth, leaving the coagula in the strainer. Whey contains about 1 per cent. of proteids, .22 per cent. of fat, and 4 per cent. of sugar. By stirring the curd before straining, the percentage of fat may be raised to nearly 2 per cent.

The proteid strength may be increased by adding the white of an egg, which, when added to a pint of the food, adds about one per cent. of proteid.

Before using whey as a diluent, and mixing it with top milk, it should be heated to 150° Fahrenheit to check the ferment; otherwise the contained ferment will curd the top milk. Whey should always be cooled to 100° Fahrenheit, or less, before it is added to top milk.

Spring water rather than boiled water may be used for dilution. Water thins the milk, but has no modifying effect, as do dextrinized gruels, on the curd.

In making up formulæ for the feeding of the newborn infant, it is well to begin with a lower proteid percentage (1 per cent., or less than 1 per cent.) than is present in mother's milk.

In illustration, for an infant one week old, we may use:

2 oz. of 10-ounce top milk, 12 per cent. of fat,
17½ " of water, gruel, or whey,
½ " milk sugar,
½ " lime water, or 16 grains of soda bicarbonate.

Or:

1 oz. lime water,
2 " cream (top), 14%,
3 " milk,
14 " of water,
1 " sugar milk.

Such a mixture is low in fats and very low in proteids.

In artificial feeding, aside from the quality of the mixture,

which is increased by lessening the proportion of the diluent as rapidly as the child's digestion will permit, the quantity must be governed by the capacity of the infant's stomach, which is very small, i. e., about 5 drachms at birth, and an ounce by the end of the first week; from then on its capacity increases about a drachm and a half a week during the first five months, while after that age the rate of increase is smaller; hence, overfeeding must be guarded against, and regularity insisted upon, in order that the child may be trained in regular habits.

The following table may serve as a guide in regulating the amount of feeding:

Age	Intervals	Amount of Each Feeding	Number of Feedings in 24 Hours
1st day	2 hours	2 drachms	10
2nd day	2 hours	½ ounce	10
3rd day	2 hours	1 ounce	10
2nd week	2½ hours	1½ ounces	10
6th week	3 hours	2½ ounces	8
3 months	3 hours	4 ounces	7
6 months	3 hours	5 ounces	6 or 7
9 months	3 hours	7 ounces	6
12 months	3½ hours	8 ounces	6

Small and feeble children should be fed more frequently and in smaller quantities; robust children in larger amounts, and with stronger mixtures.

The interval should be lengthened at night to four or six hours.

The space at my disposal is too limited to go into the complex problem of infant feeding. The student is referred to the text-books on Pediatrics.

CHAPTER XI

DISORDERS OF THE NEWBORN INFANT

CONSTIPATION

Constipation in the newborn is usually due to a dietary error, therefore its treatment is to regulate the digestion and the feeding. Enough cream may be added to the food to raise the proportion of fat to 4, 5, or even 6 per cent. This alone frequently overcomes the constipation in [illegible] Even a moderate excess of fat, however, is not, [illegible] borne. The addition of a little salt to each bot[illegible] ative effect, 2-5 gr. to the ounce.

Suitable laxatives are

℞ Ext. sennæ fluid[illegible] F.) ..... ʒ s.s.
Sacchari lactis .... gr. x

M.—This may be given at [illegible] in a teaspoonful or two of water, or of syrup of manna, [illegible] lved in and given with the milk.

℞ Ext. sennæ fluid., deodorat. (N. F.) ..... ʒ s.s.
Potassii et sodii tartratis ..... ʒ j
Glycerini ..... ʒ s.s.
Aquæ ..... ad ℥ iv

M.—Dose: A teaspoonful, p. r. n.

Phillip's milk of magnesia is an eligible laxative for infants. The dose is one teaspoonful one to four times a day.

Useful rectal measures are the injection of equal parts of glycerin and water, ʒ ij, sweet oil, ʒ iv, or warm water, ℥ j. The use of a suppository of soap or cacao butter, or a glycerin or gluten suppository generally provokes immediate action of the bowels. Yet glycerin suppositories may prove too irritating to

INDIGESTION

The symptoms are flatulence, sour, green, and curdy stools, vomiting an hour or more after nursing or feeding, restlessness, disturbed sleep, colic, failure of the normal gain in weight.

Treatment.—The treatment should consist mainly in the regulation of the nursing or feeding. *The food is almost invariably the source of the trouble.* The health and habits of the mother should be enquired into. It is sometimes useful to dilute the mother's milk by giving the child a teaspoonful or two of warm water with the nursing. In acute indigestion all feeding should be stopped for several hours, and the colon and lower intestinal tract washed out by colonic flushings with a saline. Whey or dextrinized gruel may be substituted for milk. Sometimes the first thing needed is to relieve the stomach of its contents by lavage. Four to five 1/10 gr. doses of calomel given at intervals of a half hour may be useful.

COLIC

Colic is always indicative of a faulty digestion.

Treatment.—The treatment consists in removal of the cause, correction of the digestive error, and regulation of the feeding.

For the pain, chloral is almost a sovereign remedy. The dose is gr. j in water, ʒ j, or in syrup of vanilla and water, āā ʒ ss, repeated once to three times daily, or p. r. n.; milk of asafetida, ʒ i by the mouth, or ℥ i per rectum, is generally effective; warm applications or rubifacients to the abdomen, or warm rectal injections, ʒ j, are useful palliatives. The curative treatment must consist mainly of measures addressed to the digestive disorder.

DIARRHEA

Diarrhea is generally caused by indigestion.

Treatment.—All feeding should be suspended for from 6 to 12 hours, and no milk should be allowed for 24 or 48 hours. The white of egg or a dextrinized barley gruel or whey may be substituted. The strength of the gruel for this purpose may be 2 to 4 tablespoonfuls of barley flour to the pint. Milk feeding, when

resumed, must be begun cautiously. A mild laxative, preferably castor oil or calomel, in minute doses, or both, may be indicated to remove irritating material. Then bismuth subnitrate, gr. x, may be given every one or two hours to check the movements. Should this fail, camphorated tincture of opium, drops iij to x, may be added to each dose of the bismuth. *Calomel is especially useful in case of vomiting; opium for pain, frequent stools or tenesmus.* The number of stools should not be reduced below 4 daily. Irrigation of the colon once or twice daily with normal salt solution is indicated only in the presence of putrescible accumulations or acid

Symptoms.—The r[illegible] of the mouth is studded with white patches, with an a[illegible]eddened mucous membrane, due to the presence of a fung[illegible] patches resemble milk-curds in appearance, but are disti[illegible] from them by their firm adhesion and by the detection [illegible] saccharomyces albicans and spores of the parasite under the microscope.

Treatment.—To destroy the fungus, the patches should be sopped every two hours with a saturated solution of boric acid or with a solution of sodium sulphite, one drachm to the ounce. For the stomatitis, which persists after destruction of the fungus, a half-saturated solution of potassic chlorate may be used, or better, as being less toxic, sodic chlorate as a mouth wash. The child must not be permitted to swallow any of these solutions. The accompanying gastrointestinal disorders are to be treated as in other cases.

INTERTRIGO

Intertrigo is an erythema or chafing of the skin about the arms and buttocks, due to acrid discharges or uncleanliness in the care of the infant.

Treatment. The parts should be kept clean, and care taken to do no mechanical violence to the skin by too much friction. As an infant powder lycopodium and oxid of zinc should be used in equal parts, dusted on the affected surface after first bathing the

soiled surfaces with warm borax water 3 ii-Oi. Talcum powder is a useful application.

CEPHALHEMATOMA

Cephalhematoma is an extravasation of blood, usually between the pericranium and the cranial bones, which lifts the pericranium from the bone; rarely it occurs internally. After a few days a hard ridge develops at the margin of the tumor, owing to a periosteal inflammation. It rapidly increases in size, possessing the physical signs of a cystic tumor, with sharply defined boundaries. Its situation is most frequently over one parietal bone; it may be bilateral; exceptionally it is the site of the caput succedaneum.

Prognosis.—In the internal form the prognosis is grave if cerebral symptoms develop. The external variety, as a rule, terminates in subsidence of the tumor in about three months.

Treatment.—If the swelling grows, it may be strapped firmly after shaving the head. If pus forms early incision is indicated. Otherwise no treatment is required.

PREPUTIAL ADHESION

In male children the adhesion of the foreskin to the glans, which is usually physiological in newborn children, may cause irritability of the bladder and other reflex disturbances. In such cases the preputial orifice should be dilated very gently and the adhesion broken up till the foreskin can be fully retracted. Nicking the prepuce in the median line on the dorsum with scissors may be required to permit retraction. The prepuce, being drawn back, is liberated from the glans by the aid of a smooth, blunt, stiff probe; a dressing of vaselin or of bismuth powder, together with daily retraction, will prevent readhesion.

ICTERUS

Icterus occurs in a large proportion of newborn infants. It begins from the first to the fifth day after birth, most frequently on the third or fourth. It is observed oftenest in premature and feeble infants and after difficult labor. There are two forms, the

mild and the grave. Both possibly are due to resorption of bile, due to the small lumen of the biliary ducts; yet by most authorities the latter is attributed to blood changes, due to streptococcic infection of the blood current, producing disintegration of the red blood corpuscles.

In the mild form the conjunctivæ and the urine are not stained. In the grave form the conjunctivæ and the urine are stained and the stools are clay-colored. This form may be due to general sepsis or to serious organic disease.

Treatment.—As a rule, no treatment is required. In persistent cases attention [illegible] he bowels being kept open by enemata, or, if need [illegible] a mild laxative, as sodium phosphate, combined if [illegible] occasional small doses of calomel, constitutes t[illegible]

In persistent icter[illegible] g discoloration, and especially in the presence of sep[illegible] high temperature, treatment is generally futile.

OPHTHALMI[illegible] NATORUM

Cause.—The cause is infection of the conjunctivæ, usually from the genital tract of the mother. The gonococcus of Neisser is the infecting organism in more than one-third of the cases. The ordinary pyogenic bacteria or the Loeffler bacillus may be the active agent. Generally it begins on or before the third day. The eyelids are edematous and puffed out, secreting a seropurulent discharge, and the conjunctivæ are red and velvet-like in appearance, while the cornea loses its luster.

Prognosis.—The prognosis for the sight is grave in the absence of timely treatment. Most serious is a mixed infection with gonococcus and streptococcus or with streptococcus and Loeffler's bacillus. A bacteriological diagnosis is important with relation to prognosis. In this country thirty-two per cent. of all cases of total blindness in asylums are said to be due to ophthalmia neonatorum. Almost without exception, under skillfully conducted management, the suppuration is promptly controlled and the sight is not permanently impaired.

Treatment.—*Prophylactic.*—The maternal passages should be disinfected before and during the labor in case of gonorrheal

infection. The child's eyes should be cleansed immediately after the head is born. One or two drops of a two per cent. solution of nitrate of silver, or a ten per cent. argyrol solution, should be instilled into each conjunctival sac shortly after birth. The latter is now generally preferred. It is important in preparing the solution that it be not boiled, and that it be not exposed to light. Silver is precipitated by the action of heat or light, and the solution then becomes irritating. The prophylactic use of the silver solution should be the rule in hospital and private practice. The eyes of every child should be treated with the solution within a few minutes after birth. It should never be omitted when the mother is known to be the subject of leucorrheal discharges. When properly employed the immunity is practically absolute. Should the use of the silver solution be followed by much serous oozing, the latter may be promptly relieved by a single application to the conjunctiva of a one-grain-to-the-ounce solution of atropin, one drop in each eye.

Curative.—At the onset of the inflammation, ice water compresses, renewed every few minutes, are useful in the absence of corneal complications. The eyes are cleansed of pus every hour or oftener, *day and night,* by irrigating with a warm saturated boric acid solution.

After free discharge is established, the conjunctival surfaces should be brushed, after cleansing, once or twice daily, with a two per cent. aqueous solution of nitrate of silver, and one or two drops of a 25 per cent. aqueous solution of argyrol, freshly made, should be instilled into each eye several times daily. This is continued till the discharge loses its purulent character. Frequent cleansing with the boric acid solution must still be practiced until all discharge ceases. Anointing the edges of the lids with vaselin favors drainage by preventing the lids from becoming glued together. The nurse should be drilled in the method of manipulating the lids.

The advice of an oculist should be had and the responsibility shared.

UMBILICAL INFECTION

The cause is uncleanliness in the care of the umbilical wound. The infecting organism is most frequently the streptococcus. The septic process may result in a mere local ulcer covered with a grayish diphtheritic membrane, or in umbilical phlebitis and septicemia. In the latter event there are fatty degeneration of the organs, icterus, cyanosis, and hemoglobinuria; the termination is fatal, usually by convulsions. Pus may be present in the umbilical vessels from infection through the navel, even when the wound has healed promptly. Cellulitis of the abdominal walls and peritonitis are frequently observed. Septic processes in remote organs are common complications.

Treatment.—In local sepsis frequent antiseptic cleansing of the wound surface and dressing with aristol, bismuth powder, or iodoform and bismuth suffice. The peroxid of hydrogen is a good antiseptic for disinfecting the wound surface. It is non-poisonous and practically non-irritant. Inunctions of quinin and the use of stimulants by the stomach help to increase the resisting power. In systemic infection treatment is futile.

UMBILICAL FUNGUS

Umbilical fungus is an overgrowth of granulation tissue, which projects in a mass like a strawberry from the navel. It bleeds readily, and secretes a purulent discharge.

Treatment.—It is destroyed by cauterization with a solid stick of silver nitrate, or it may be ligated and excised.

OMPHALITIS

Omphalitis is a septic inflammation of the navel and the tissues surrounding the umbilicus, in which the skin and subcutaneous connective tissue are hard, red, and infiltrated, giving the abdomen a conical shape.

Treatment.—Treatment includes disinfection of the umbilical wound, radial incisions into the surrounding skin to relieve the tension, and the employment of antiseptic poultices. Unfortunately the prognosis is grave, and general infection can seldom be averted.

TETANUS NEONATORUM

The disease begins toward the end of the first week. The cause is infection, generally of the navel, with the tetanus bacillus.

The symptoms are those of surgical tetanus. The termination is almost invariably fatal within two or three days.

Treatment.—As far as possible all sources of peripheral irritation should be removed. Feeding is maintained through the nostrils, using predigested milk, or, this failing, by rectal injections. In feeding through the nostrils the food is poured from a special narrow pointed spoon. The drug treatment consists in the use of potassium bromid, gr. iv, every two to four hours, or of chloral, grain j, every hour. These remedies must be given by a stomach tube or rectal tube. Sulphonal, gr. iij, every two hours, by the rectum, has been used with success. Serum treatment, properly carried out, should be tried.

MELENA NEONATORUM

Melena neonatorum, gastrointestinal hemorrhage, is an extravasation of blood into the alimentary canal. The condition appears in the first hours of infant life, and is characterized by the vomiting of blood either in an unaltered state or as "black vomit," and by the passage of dark, pitchy, and grumous stools, mixed with meconium.

The infant shows symptoms of internal hemorrhage.

Treatment.—Between 30 and 40 per cent. of infants so affected die. The subcutaneous injection of human blood serum, 10 c. c., three times a day, has given the most satisfactory results. No other form of treatment has seemed to affect the outcome.

UMBILICAL HEMORRHAGE

Umbilical hemorrhage may come from the cord or from the umbilical ulcer after the cord has dropped off. The bleeding may proceed from faulty ligation of the cord, syphilis, or acute fatty degeneration with hemoglobinuria. The hemorrhage usually begins within a week after birth. Eighty per cent. of the children die.

Treatment.—In simple cases religate the cord and apply a compress, or lift the umbilicus, transfix it with two hare-lip-pins, and apply a figure-of-eight ligature. In cases dependent on a dyscrasia, treatment generally is futile, though the injection of human blood serum may have some effect in staying the hemorrhage.

MASTITIS

Swelling of the breasts is frequently observed in newborn children during the first week. As a rule it calls for no treatment. If pus forms, which is very rarely the case, it should be evacuated.

A BLOODY GENITAL DISCHARGE

A bloody genital discharge is sometimes observed in female children in the first few days after birth; no treatment is required.

DUCHENNE'S PARALYSIS

A paralysis of certain muscles of the arm may result from injury to the brachial plexus during delivery. The injury is most frequently due to traction upon the upper roots of the brachial plexus from lateral flexion of the neck. In typical cases the arm hangs powerless by the side and is partially rotated inward. The prognosis varies with the extent of the injury. Recovery usually follows, but may not be complete for months or even years.

Treatment consists in massage, and the use of electricity to be begun after the age of two or three months.

CHAPTER XII

THE PATHOLOGY OF PREGNANCY

In the chapter on the development of the ovum, we learned that the impregnated ovule lies in, and derives its nourishment from, a decidual bed of hypertrophied mucosa, and that the fetal ovoid is composed of the chorion, with the placenta, the amnion, the liquor amnii, and the fetus itself. Therefore, in a consideration of the pathology of pregnancy, we must discuss those diseases which attack the several structures of the fetal ovoid and the bed upon which it grows, i. e.:

(1) Diseases of the decidua
(2) Anomalies of the amnion and of the liquor amnii
(3) Diseases of the chorion
(4) Anomalies and diseases of the placenta
(5) Anomalies of the umbilical cord
(6) Anomalies and diseases of the fetus, together with those diseases of the mother, such as the toxemias, which jeopardize the life of the fetus.

DISEASES OF THE DECIDUA

The decidual mucous membrane of the pregnant uterus may be the seat of many of the diseases which attack the uterine endometrium in the non-gravid woman. Owing, however, to the presence of the fetus, decidual inflammation has more serious consequences than a similar affection in the non-gravid uterus.

Acute Endometritis or Deciduitis.—Acute decidual endometritis may be present in the course of any acute febrile disease. In the course of the exanthemata, cholera, and typhoid fever, the endometrium participates in the infection. It may result from septic infection after attempts at criminal abortion, or an acute gonorrheal infection of the endometrium may occur simultaneously

with impregnation, and be the cause of the subsequent abortion. Acute decidual inflammation is attended with more or less constitutional disturbance, such as increased temperature and pulse rate, together with local pain and tenderness over the hypogastrium and inguinal regions. The uterus itself is sensitive and limited in its motion, owing to the muscular spasm of the inflamed ligaments. It is often attended by hemorrhage and frequently results in abortion. There is no treatment, except to attempt to decrease the severity of the symptoms by rest, enemata, ice bags, and opium, until the acute stage is passed.

Chronic Diffuse Endometritis.—The causation is not fully understood, though a preëxisting endometritis usually antedates the diffuse inflammation during pregnancy. The anatomical changes in the decidua are mainly hyperplastic; the membrane assumes unusual proportions. It frequently gives rise to abortion, as a large part of the nutritive material intended and needed for the development of the fetus is devoted to the nourishment of the thickened decidua. When abortion does not occur and the pregnancy goes to term, adhesion of the placenta and membranes is a frequent consequence.

Chronic Catarrhal Endometritis (*Glandular Endometritis*).—In catarrhal endometritis there is a *glandular hyperplasia* involving all of the gland structures. There is also a persistent patency of the gland ducts, which allows exit for their secretion. It is *attended* by a *profuse discharge of watery mucus from the uterus*, termed hydrorrhea gravidarum. The hydrorrhea may occur in the earlier, but is most common in the later months of pregnancy. Sometimes the *fluid collects in considerable quantity between the chorion and the decidua* and *is discharged in gushes.* Repetition of this accumulation tends to separate the ovum from its decidual bed and is followed by abortion or premature labor, though this is the exception, as in most instances the pregnancy is not interrupted. Rarely the uterus becomes excessively distended by the accumulated fluid. The inflammation most frequently affects the decidua vera, though it may also involve the reflexa. The presence of the secretion precludes the fusion, which normally takes place between the decidua vera and the reflexa. It is attended with hypertrophy of the connective tissue and of the glandular elements. Some observers claim that the discharge

of watery mucus is due to an early rupture of the membranes, high up in the uterus. Repeated examinations of the discharged fluid have, however, shown its chemical composition to be different to that of the liquor amnii.

In this condition the hyperplasia of the uterine mucosa, which is normal to the early months of pregnancy, is exaggerated and is continued into the later months of gestation. It affects all the elements of the decidua and results in a greatly increased thickness of this structure. Hemorrhage frequently occurs into the decidua and small cysts have been observed.

The cause is a preëxisting endometritis, which may be of the septic, syphilitic, or gonorrheal type. When the process is rapidly developed, it is attended with hemorrhage into the decidua, or with partial separation of that structure; abortion or premature labor is then the rule.

The hydrorrheal discharges are to be distinguished from liquor amnii, from urine, and from leucorrheal secretions. *The condition tends to deplete the woman's general health, making her blood more or less hydremic.*

THE TREATMENT is to be directed mainly to the correction of the resulting debility and anemia. The administration of a solution of the arsenate of iron (Zamboletti's solution), hypodermatically, or other hematinic remedies and general tonics are indicated. Above all, *proper hygiene is imperative.* Uterine sedative measures are sometimes useful.

Cystic Endometritis.—*Cystic endometritis is distinguished by the formation of retention cysts,* due to an obstruction of the gland ducts by proliferation of the interglandular connective tissue. The decidua about the cysts is hypertrophied, and on section presents an overdevelopment of connective tissue, an increase of decidual cells and embryonal tissue. There is a hypersecretion from the uterine glands, which may occasion a hydrorrhea, as in the catarrhal type already described.

Polypoid Endometritis.—Polypoid endometritis is rarely met with. It is supposed to be due to syphilis, though the causes are unknown. It is characterized by polypoid growths or villus-like projections, developed upon the ovular surface of the decidua, which stand out from the mucous membrane, to the height of half an inch or more, smooth of surface and very vascular. Between

the projections are the openings of the uterine glands. The entire membrane is greatly thickened and presents the characteristic lesions of simple diffuse endometritis.

The pathological lesions are generally limited to the decidua vera; rarely they involve the serotina. Death of the fetus and abortion is a common result before the fourth month. All of these chronic affections of the decidua are unfavorable to the life and growth of the fetus and increase the morbidity of the mother, as the woman is more liable to hemorrhage and sepsis.

ANOMALIES OF THE AMNION AND THE LIQUOR AMNII

The *amnion is a serous membrane* and is, therefore, liable to changes of secretion, to inflammation with its resulting plastic exudate, and the formation of adhesions and adhesive bands, which may produce unfortunate results during the development of the fetus. The secretion of the *amnion* is called the *liquor amnii*. The normal quantity of the amnial liquor at term is about two pints. When there is a deficiency of the liquor amnii, and the quantity is less than the average, the condition is called *oligohydramnios*.

Oligohydramnios.—Its occurrence is rare. Occasionally the quantity is so deficient as to seriously interfere with the growth of the fetus, and the extreme scantiness of the amniotic fluid may even be attended with adhesions between the amnion and the fetus with the formation of amniotic bands from the organization of the plastic exudate.

Intrauterine amputation of fetal extremities and other developmental arrests or anomalies sometimes result from these amniotic bands. It is claimed that hare-lip, cleft palate, navel cord hernia, and spina bifida may be produced by this agency. We know from clinical observation that oligohydramnios is one of the causes of clubfoot and spinal curvature.

Hydramnios or polyhydramnios may be defined as the accumulation of the amnial liquor to an amount in excess of four pints. Slight increases in the amount of the liquor amnii are frequent and pass unnoticed. In some few extreme cases the quantity may reach thirty to fifty pints.

FREQUENCY.—It has been noted, by careful observers, to occur

in the minor grade about once in one hundred pregnancies, while the pronounced hydramnios, which gives rise to discomfort and pressure symptoms, is observed but once in about three hundred pregnancies.

ETIOLOGY.—The *excessive accumulation* of the *amnial liquor* may be derived from (a) *a maternal source,* (b) *a fetal source,* (c) from both, or from *sources unknown.* In about 44 per cent. of the cases no assignable cause can be found. Among the causes which are attributed to a *maternal source* are maternal hydremia and other causes of general anasarca. It is stated that "the thinner the maternal blood the greater is the quantity of the liquor amnii." Or it may be due to deficient resorption of the liquor amnii, as when the origin of the hydramnios has been due to an associated nephritis or anasarca in the mother. The larger number of cases, however, in which the cause can be explained at all are developed from FETAL SOURCES, such as (a) the abnormal persistence of the vasa propria (a capillary network of the *subplacental* chorion) immediately underlying the amnion, which is normally present in the early months of gestation; (b) abnormal pressure in the blood vessels of the cord from obstruction to the umbilical circulation, by the cirrhotic liver of syphilitic children, a tortuous or knotted cord, or its vicious insertion; (c) acute amniotitis; (d) the excessive excretion of the fetal urine; (e) exudation of the fetal skin; (f) fetal syphilis.

DIAGNOSIS.—There is a *history of pregnancy,* together with the symptoms of a cystic abdominal tumor, which grows rapidly. The *increase in the size of the uterus is out of proportion to the period of gestation* and *the uterus presents a permanent tension.* In acute cases the distention is sudden and painful.

The tumor may usually be defined as the uterus, except in extreme cases, where the outline is lost and the distention is limited only by the capacity of the abdomen. The *fetal heart sounds* are *dulled* or *entirely absent.* There is a *preternatural mobility of the fetus, permitting external ballottement,* except when the distention is extreme; the suprapubic edema adds to the difficulty of palpation. The breathing becomes labored, and the patient suffers from general pressure symptoms. In extreme amniotic distention the cervix is obliterated and the os externum patulous. It is to be distinguished from pregnancy associated with ascites,

ovarian cyst, and twins, by the history of the growth, and by establishing the existence of a pregnancy, by palpation and auscultation of the tumor.

PROGNOSIS.—The prognosis is *unfavorable to the child* owing to *premature birth, dropsical affections, malformations* and *malpresentations,* which are common in hydramnios. *The fetal mortality is about 75 per cent. For the mother the prognosis is generally good,* though it is graver in the acute variety with extreme distention.

TREATMENT.—Many cases require no treatment other than enforced rest in bed until the membranes rupture and the head is engaged, and so firmly corks the brim against the descent of a loop of the cord. In *case of alarming symptoms from rapid accumulation of fluid* and *overdistention of the abdomen,* induction of labor by puncture of the membranes is permissible. This may be done with a catheter high up within the uterus, in order that the liquor amnii may drain away slowly, trickling down between the membranes and the uterine wall. This favors retraction and prevents shock.

The danger is from *shock* and *hemorrhage,* so that on the birth of the child precautions may be needed against postpartum hemorrhage. Special care should be taken to promote retraction of the uterus after delivery. Operative procedures other than version or perforation are seldom called for, as the child is commonly non-viable in the presence of great amniotic distention.

DISEASES OF THE CHORION

The *chorionic villi may persist around the periphery of the entire ovum;* when such is the case the fetus is completely enveloped by a thinned out placental layer called a "placenta membranacea." Or the villi may undergo either a cystic or a fibromyxomatous degeneration.

Cystic Degeneration of the Chorionic Villi.—Cystic degeneration of the chorionic villi, or *vesicular mole,* or *hydatidiform mole,* is due to a proliferation of the epithelial cells of the syncytium and Langhans' layer (the epithelium covering the villi). The blood vessels of the villi are obliterated and, by hyperplasia of the syncytium and by hyperinfiltration of the structures within

the villus, the extremities of the villi are converted into cysts. *The degenerative change is usually found equally distributed over the whole chorion.* The cysts vary in size from that of a millet seed to that of a grape. Occasionally they may reach the size of a hen's egg.

Each cyst springs from another and *not from a common stalk,* and is *connected with the base of the chorion by a pedicle of varying length and thickness.* They may be many thousands in number. The ovum grows rapidly, and the total mass may be as large as the adult head by the end of the third or fourth month. The embryo surrounded by its amnion may, or may not, be found within the vesicular mass. Rarely the proliferation of the cells of Langhans' layer of the villi penetrates into the uterine tissue, perforates the uterine wall, and leads to spontaneous rupture of the uterus and peritonitis. The cyst content is a clear translucent liquid containing albumin and mucus. The degeneration usually begins at a period when the villi are almost equally developed over the whole ovum, i. e., before the third month.

In twin pregnancies one or both ova may be affected. The disease may be considered as a true myxoma of the chorion. It is met with most frequently in women who have borne full-term children, sometimes in more than one pregnancy in the same individual.

FREQUENCY.—It occurs once in about two thousand pregnancies.

ETIOLOGY.—Very little is known of the etiology. Recent histological studies have thrown no light on the cause, which apparently resides in the ovum. Endometritis, syphilis, and the absence or deficiency of allantoic vessels, commonly assigned as causes, probably have no part in the etiology.

THE DIAGNOSTIC SIGNS.—The disease is rarely recognized before the end of the third month. (1) The first point of importance is to establish the diagnosis of pregnancy by the presence of the positive signs, the changes in the shape, size, and consistency of the uterus, available in the first few months. (2) *The uterus rapidly increases in size, its growth is out of proportion to the stage of the gestation;* the uterus is too large for the first two months, later it is sometimes too small. The sudden distention and rapid growth of the uterus usually cause distressing nausea

and even vomiting. (3) *The discharge from the uterus of blood, or bloody serum, is more or less constant, the flow is usually not profuse* and *does not appear until near the end of the third month.* (4) *The uterus is usually doughy, it loses its elasticity.* (5) *Vesicles,* or *cysts, may escape in the vaginal discharge,* though their presence is but rarely noted. (6) While the uterine tumor may reach nearly to the umbilicus, *no fetal heart sounds, fetal parts,* or *fetal movements can be detected,* and internal *ballottement is absent.*

The presumptive diagnosis is made on (1) *the rapid enlargement of the uterus toward the end of the third month;* (2) *the intermittent serosanguinous discharge* and *the absence of any positive sign of the fetus within the uterine cavity.* The existence of a cystic chorion can only be determined in many instances by the direct digital exploration of the uterine cavity and the detection of cysts.

Prognosis.—The maternal mortality is from 10 to 15 per cent. The immediate causes of death are hemorrhage, sepsis, and perforation of the uterus by a proliferation and penetration of the syncytial cells of the chorionic villi, in which case, when the vesicular mass is expelled or removed, there may be fatal hemorrhage from the torn uterine sinuses. Except when the cystic degeneration is confined to a very limited area, the embryo invariably dies and disappears by absorption. The chorion may become adherent to the uterine wall and be retained for many months. Usually, however, the chorionic mass is expelled by the sixth month. Chorioepithelioma is preceded by vesicular mole in about forty per cent. of the reported cases, hence the importance of microscopic examination of the uterine contents in every case of cystic degeneration.

Treatment.—The treatment is mainly expectant, *until no evidence of a living fetus can be found,* or *the hemorrhage is considerable,* when immediate steps should be taken to empty the uterus. The hemorrhage may be controlled and dilation of the cervix secured by the employment of a cervicovaginal tampon. *Evacuation of the uterus should never be attempted until sufficient cervical dilation is attained, to permit expulsion of the cystic mass, or allow of its extraction with the fingers or pl·*
forceps. If sufficient dilation cannot be obtained by

anterior vaginal hysterotomy may be used to give sufficient space for manual evacuation. Removal, with the fingers in the uterus, is safer than attempts at instrumental extraction, as the evacuation may be done more cautiously and the uterine wall is often extremely thin. *Removal with the curet is always incomplete and is attended with the dangers of fatal hemorrhage and perforation.* After the uterus is emptied manually, the uterine cavity should be firmly packed with gauze soaked in the tincture of iodin, the excess of which is squeezed out before using. This pack should remain in the uterus for ten minutes and then be withdrawn. The iodin destroys the remaining cysts and disinfects the cavity. Ergot may be used freely, to make the uterus contract. Two weeks after evacuation, when considerable retraction of the uterus has taken place, the cavity should be thoroughly curetted and the curettings examined by a competent pathologist for evidence of chorioepithelioma. The patient should be kept under observation for several months and the curetting repeated, in case metrorrhagia should occur. Should any evidence of chorioepithelioma appear, an immediate hysterectomy is imperative.

Fibromyxomatous degeneration of the chorion is extremely rare. It consists of a fibroid degeneration of the connective tissue of the villi, forming solid instead of cystic tumors. The symptomatology and treatment are similar to those of cystic degeneration.

ANOMALIES AND DISEASES OF THE PLACENTA

Placenta Membranacea.—A placenta membranacea is a broad, thin placenta with persistence of the villi over the entire surface of the chorion. Abnormal adhesion is common with this anomaly.

Placenta Prævia.—The placenta is prævia when its attachment encroaches upon that portion of the uterus which is subject to dilation during the first stage of labor.

Placenta Succenturiata. Subsidiary Placenta.—This term is applied to a wholly or partially independent placental cotyledon. The anomaly is usually single, sometimes multiple. In the absence of vascular connection with the main body the detached portion is termed "placenta spuria."

Cysts of the placenta are of frequent occurrence. The cysts

are small and are seated beneath the amnion. They are probably developed from the chorial villi.

Syphilis.—In syphilis of the mother, contracted before or shortly after conception, the placenta is syphilitic in about half the cases.

In maternal syphilis, contracted after the seventh month of pregnancy, neither child nor placenta is infected.

In syphilis of paternal origin the fetal structures of the placenta are affected; when the disease is of maternal origin the decidua is involved and the fetus diseased.

The syphilitic placenta is larger and paler than normal, and if the fetus is dead presents a dull greasy appearance. The size may exceed the normal by fifty per cent. or more.

Syphilis of the placenta is always dangerous, and may be fatal, to the fetus.

Edema may be present in hydramnios, in occlusion of umbilical veins, or in maternal anasarca.

Apoplexy.—Extravasations of blood into the placenta may occur at one or several points. Hemorrhages in the early months of pregnancy occur near the fetal surface, in the later months near the maternal surface of the placenta.

The causes are placentitis, general infectious diseases, nephritis, pelvic congestion, traumatism. Extensive effusions of blood result in the death of the embryo or fetus, and consequent abortion or premature labor. Small extravasations generally are tolerated with no apparent ill result. Small blood collections may be found partially organized, or may become fatty or calcareous.

Fatty degeneration may result from endometritis, placental hemorrhage, or chronic inflammation of the placenta. Death of the fetus may ensue.

Placentitis may affect the whole, rarely a portion only, of the placenta. Placental inflammation may result from endometritis existing at the time of conception, or from syphilis or acute sepsis. The normal placental structure is replaced by fibroid tissue. There are hypertrophy and sclerosis of the decidua. Abnormal adhesion of the placenta is attributed to this cause.

Calcareous degeneration is common and is unimportant.

White infarcts are very commonly observed in the placenta. They are dense whitish or yellowish fibrous masses, varying in

size from one to two or three centimeters in diameter. They are of no pathological importance when small and few in number. When numerous and extensive they may cause the death of the fetus. They have their origin in local hyalin degeneration.

Other anomalies and diseases are fundal insertion, crescentic shape, bilobed, multilobed, annular, circumvallate placenta, *anomalies of size*, too large or too small, caseous degeneration, carcinoma, sarcoma.

ANOMALIES OF THE UMBILICAL CORD

Length.—The umbilical cord may be abnormally long, six feet, or short, seven inches.

Excessive length of cord may predispose to prolapse, to torsion, to knots, or to coils about the fetus, and to obstruction in the funic vessels. A short cord may lead to premature separation of the placenta during labor.

Excessive torsion of the umbilical vessels may cause partial occlusion. It is sometimes accompanied with serous effusion into the peritoneal cavity of the fetus and with edematous swelling of the cord. In most cases torsion of the cord itself is developed only after the death of the fetus.

Stenosis of the arteries is sometimes observed. The causes are excessive proliferation of connective tissue in the walls of the arteries, atheroma, and thrombosis. The lumen of the umbilical vein may be narrowed by thickening of its walls in syphilis. This is due to an edema and leukocytic infiltration of the spaces between the muscle fibers.

Knots occur rarely. They result from the passage of the fetus through a loop of the cord. They are seldom firm enough to endanger the life of the fetus.

Hernia.—Hernial protrusion of the omentum or intestinal loops may take place into the cord. It results from imperfect closure of the abdominal walls at the umbilicus, and is usually accompanied with other errors of fetal development.

Cysts are frequently observed in the sheath of the cord. They are due to liquefaction of mucoid tissue or of blood extravasations.

Coils about the fetus, especially the neck, are of frequent oc-

currence. Sometimes an arm or a leg is thus encircled. Rarely is the circulation impeded, either in the funis or the girdled member. Extensive coilings may give rise to the dangers of short cord.

Coiling of the cord about the neck of the child sometimes may be recognized during pregnancy by depressing the abdominal wall of the mother opposite the child's neck; the fetal pulse-rate is retarded when the cord is pressed upon.

The insertion may be *marginal* or *velamentous*. In the latter anomaly the vessels pass for a greater or less distance between the membranes to the edge of the placenta. As the vessels are more or less separated and unprotected, they are liable to be torn during labor. Such an accident almost surely results in the death of the child unless it is born promptly.

When the insertion of the cord is marginal, the placenta is sometimes termed a battledore placenta.

Other abnormalities occasionally observed are tumors, varices, calcareous deposits.

PATHOLOGY OF THE FETUS

Anomalies of Development.—The principal anomalies of fetal development are briefly the following:

(a) Hemiteria (literally, half monstrosity).—Under this head are included dwarfs and giants, microcephalus, sternal fissure, spina bifida, clubfoot, supernumerary digits, double uterus, double vagina, supernumerary ribs, etc.

(b) Heterotaxia.—Under this head are included transposition of viscera, hernial protrusion, imperforate rectum, vagina, esophagus, etc., persistent foramen ovale, persistent ductus venosus, persistent ductus arteriosus, etc., webbed fingers or toes, harelip, cleft palate, epispadias, hypospadias, hermaphrodism.

(c) Teratism. 1. *Ectromelic Monster.*—A monster having one or more aborted extremities.

2. *Symelic Monster.*—A monster having its lower limbs partly or wholly united.

3. *Celosomatic Monster.*—A monster having partial or complete eventration.

4. *Exencephalic Monster.*—In this anomaly the brain is malformed and protruding from the cranial cavity.

5. *Pseudencephalic Monster.*—Here the cranial vault and the larger part of the brain are absent.

6. *Anencephalic Monster.*—The cranial vault and the entire brain are wanting.

7. *Cyclocephalic Monster.*—A monster in which the nose is wanting and the eyes are partially fused into one.

8. *Octocephalic Monster.*—The ears meet or are fused in the median line.

9. *Omphalositic Monster.*—This monster is one of twins which has a parasitic existence in utero. Its nourishment is derived from the companion fetus, and it is incapable of living independently after the cord is divided. The anomaly owes its origin to the fact that the circulation of one fetus has overpowered and reversed that of its companion.

10. *Double Monster, Two Fetuses United.*—There are several varieties:

(a) Sternopagus, joined at the sternum; (b) Ischiopagus, joined at the pelvis; (c) Cephalopagus, joined at the head; (d) Xiphopagus, joined at the xiphoid cartilage.

Syncephalic.—The heads partly fused, the bodies separate.

Monocephalic.—The heads completely fused, the bodies separate.

Synsomatic.—The bodies are partially fused, the heads separate.

Monosomatic.—The bodies are wholly fused, heads separate.

Double Parasitic Monster.—One fetus is attached as a parasite to the other, or inserted or included in it.

Diseases of the Fetus.—The fetus is subject to many of the infectious and other general diseases of postnatal existence. Well-known examples are variola, typhoid fever, pneumonia, syphilis, scarlatina, measles, erysipelas, diphtheria, septicemia, rachitis, valvular disease of the heart, serous effusion, etc.

FETAL DEATH

The fetus may die during pregnancy. Its death may occur in the early months or in the latter half of gestation. It is important to recognize the presence of a dead fetus; a fact that is frequently difficult to determine, especially in the early months, before the

period when in the living fetus the heart can be heard or active fetal movements felt. Often the *diagnosis cannot be made until the ovum is expelled.*

The signs of fetal death are:

1. *A recession of the signs of pregnancy:* the uterus ceases to grow, the circumference of the abdomen no longer increases, and the breasts become flabby.

2. *The uterus loses its elasticity and becomes doughy in consistency.*

3. *The fetal movements are no longer felt* by the mother, nor can they be detected by the physician.

4. *The fetal heart sounds are not heard.* This sign is diagnostic when the heart has been previously heard, and its rhythm and rate noted.

5. *There is an absence of the "choc fetal."*

6. *The temperature of the cervix is no higher than that of the vagina.*

7. *Peptones are usually present in the urine.* Peptonuria is constant after the first few days, when the dead fetus is retained within the uterus.

8. *Acetonuria is always present when the fetus is dead.*

9. *A dark, sanguineous discharge from the uterus which is persistent, always suggests the presence of a dead fetus.*

10. If the head is accessible to bimanual palpation, *a looseness and crepitation of the cranial bones may usually be elicited.*

In addition to the above objective signs of dead fetus, the woman experiences periods of illness and usually complains of many indefinite sensations of weight and discomfort referable to the hypogastric region, general malaise, depression, chilly sensations, loss of appetite, and, if putrefaction has occurred, there is some degree of septic intoxication. In *most cases of suspected death of the fetus repeated examinations will be required to decide the question.*

The causes of fetal death are numerous, as mechanical violence, chronic metritis, maternal nephritis, diabetes, tuberculosis, toxemia, anemia, et cetera. Syphilis is the most frequent factor in causing habitual death of the fetus.

From sixty to eighty per cent. of abortions occur in the pregnancies of syphilitic parents. A Wassermann reaction should be

made in every woman who gives a history of repeated abortions and the delivery of premature dead children.

Fetal syphilis may be determined at autopsy by the *changes* which take place between the diaphysis and epiphysis of long bones. Dissection shows an osteochondritis, especially at the lower end of the femur. The liver is enormously enlarged, even to one-eighth the body weight, and there is some enlargement of the spleen.

An undeveloped uterus, or chronic endometritis, or metritis, has a causal relation to repeated premature births. Pronounced anemia in the mother may be fatal to the fetus, as may tuberculosis, nephritis, diabetes, toxemia, and chronic poisoning.

When the fetus dies in utero, it may be expelled or it may be carried in the uterus for a long period and undergo absorption, or saponify (becoming an adipocere), or go through the processes of mummification, maceration, or putrefaction.

Absorption.—When the fetus dies before the second month, the embryo first becomes liquefied and the ovum may be entirely absorbed, or the ovum may be carried in utero for a long period after the death and absorption of the embryo, and, together with the *placental structures* and *organized blood clots,* become a dense mass of *organized tissue* known as a "fleshy mole." Such a mole may be retained within the uterus for months, producing no symptoms except an occasional metrorrhagia.

Mummification takes place only when the fetus has died in the middle or later months of development. The soft structures become dried and shrunken, and the skin assumes a yellowish-gray color. The placenta undergoes somewhat similar changes.

A *fetus papyraceus* (a paper-like fetus) is a mummified twin fetus which, after death in utero, has become flattened by the pressure of its living companion. The head in such cases may be pressed into the shape of a meniscus lens.

Maceration.—In maceration of the fetus the tissues become softened and sometimes swollen, giving the fetus a bloated appearance, the abdomen is distended, the head is enlarged, the serous cavities contain blood and serum, and the cranial bones are loose under the scalp. The epidermis is exfoliated and the tissues become so soft and friable that the limbs may be easily detached

from the body by traction. The odor is sickening but not putrefactive.

Putrefaction takes place only when the fetus is carried for a time in utero after the membranes have ruptured and saprophytes gain access to the fetus, when decomposition rapidly ensues. The connective tissues become emphysematous, the abdomen is distended, and the body emits a putrefactive odor. The uterus sometimes is tympanitic and the mother suffers more or less from septic absorption.

Treatment.—The uterus should be emptied immediately the diagnosis of fetal death can be positively established. The presence of a dead fetus in utero is always injurious to the health, and may even become dangerous to the life of the mother.

The method to be pursued depends on: (a) the period of pregnancy, (b) the condition of the cervix, (c) the presence or absence of septic absorption.

Before the eighth week, after preparation of the cervix by the use of the cervicovaginal tampon, the dilatation may be increased with a steel branched dilator and the uterine cavity emptied with the curette and forceps. Should the ovum die between the eighth and fourteenth week, greater cervical dilation is needed to allow for the expulsion of the fetus and the placental mass. This may be obtained by the vaginal tampon or dilating bags, and the fetus, its membranes, and the placenta removed with fingers and the ring placental forceps. In the later months labor is induced as in advanced pregnancy with a living child. Spontaneous delivery should be encouraged and trauma minimized. Drainage and retraction of the uterus after labor are secured by the high Fowler position and the exhibition of good doses of ergot. Intrauterine irrigation at the close of labor does no good and may do harm.

ABORTION—MISCARRIAGE

The term *abortion* is applied to the expulsion of the *ovum* during the first three months of gestation.

Premature labor is the birth of a viable fetus before the termination of pregnancy; its course differs in no way from labor at term.

Expulsion of the ovum, occurring between the twelfth to the

twenty-eighth week, presents a clinical picture different to that presented by either abortion or premature labor, and is referred to by many authors as "miscarriage."

Miscarriage is the term to be used to the laity for the interruption of pregnancy before viability of the fetus; while it is used interchangeably with abortion by the profession.

It is estimated that at least twenty-five per cent. of all pregnancies terminate in abortion. Even this large estimate is doubtless too small, if abortions from all causes are included.

Abortion occurs most frequently at the end of the menstrual month, as the attachment of the ovum is least stable at this time, owing to the influence of the menstrual molimen. In a large proportion of cases the abortion takes place at the second month, and is comparatively infrequent after the third, as by that time the uterus has risen out of the pelvis and the ovum is well *buried* in its *decidual bed.*

While it must be admitted that the security of the attachment between the ovum and uterus differs in different individuals and in different pregnancies in the same individual, and that what may be sufficient to cause abortion in one may have no effect on another, the provoking causes of abortion may be grouped and considered under two general headings:

First, *those which primarily cause the death of the fetus,* as *conditions which interfere with the uteroplacental circulation;* its separation and expulsion from the uterus being the result of its death.

Second, *those which act independently of the death of the fetus and cause premature expulsion of the ovum by their effect on the active contraction of the uterus.*

Abortions of the first class (death of the fetus) may occur from malformation in the fetus, disease, mechanical violence, causing fetal death, maternal toxemia or excessive anemia, pathological conditions of the amnion, the chorion, the cord, or the decidua.

Under the second head (the causes acting independently of the death of the fetus) are atrophy or hypertrophy of the endometrium, placenta prævia, oxytocics, reflex irritation of the uterus, i. e., from mammary or rectal stimuli, irritable uterus, chorea, epileptiform convulsions from uremic or other causes, carbon

dioxid poisoning, placental apoplexies, misplacement of the uterus from pelvic adhesions, uterine myomata and cancer, overdistention from hydramnios and multiple pregnancy, direct interference with separation of the ovum, falls or blows, hyperemia of the pelvic organs from circulatory obstruction in the lungs or liver, or from valvular heart disease, violent exertion partially separating the placenta, resulting in retroplacental hemorrhage, or sexual excesses near the menstrual period, etc.

The commonest cause of abortion is endometritis, fully 70 per cent. of the abortions in the first few weeks being due to an unhealthy endometrium, while an irritable uterus, syphilis, retrodisplacements, and chronic nephritis are other frequent causes of repeated abortion.

Diagnosis.—The classical symptoms of an abortion are hemorrhage, pelvic tenesmus, and rhythmical uterine contractions, which are more or less painful. The pain may be due to rhythmic uterine contractions, having the general characteristics of a labor pain or only a severe backache and tenesmus, especially in the early months. The woman may also suffer from associated nausea or even vomiting, chilliness, and a slight elevation of temperature.

The *physical signs* are the *effacement of the internal os, which is shown by the obliteration of the uterocervical angle, dilation of the cervix* (os externum), *the protrusion or partial protrusion of the ovum from the uterine cavity, a contracting uterus, and uterine hemorrhage.*

In making the diagnosis in a case of suspected abortion, three facts must be positively established before any treatment is instituted:

(1) *Is the woman really pregnant?*

(2) *Is the pregnancy within the uterus or extrauterine* (outside of the uterus)?

(3) *If the pregnancy is intrauterine, is the abortion inevitable?*

Abortion in the first weeks of gestation is not always easily distinguished from dysmenorrhea or simple uterine hemorrhage. The diagnosis will depend mainly on establishing the existence of a pregnancy by the changes in the shape, size, and consistency of the uterus, and on the presence of fetal structures in the genital discharges. The ovum when expelled enveloped in a mass of

coagulated blood may escape observation, unless the clots are examined by breaking them up under water. Free hemorrhage, with the expulsion of a large blood clot occurring with a contracting uterus, is significant of abortion.

Ectopic gestation, in which the ovum is in or has been discharged from the ampulla of the tube, is frequently mistaken for simple uterine abortion.

An abortion may be *threatened* or *inevitable. Efforts at expulsion of the ovum, which are attended by slight or moderate hemorrhage and uterine contractions, without dilation of the cervix or change in the uterocervical angle, may be placed in the threatened class.*

While *the presence of the physical signs establishes the diagnosis of inevitable abortion, cervical dilation* and *effacement of the uterocervical angle imply a degree of separation of the ovum from the lower uterine segment too great to permit the further continuance of the gestation.* Severe rhythmical pains with hemorrhage almost surely forebode the expulsion of the ovum.

Every patient suspected of abortion should be subjected to a thorough physical examination of the pelvic organs, not only to establish the presence or absence of the physical signs, but to exclude the presence of a tubal pregnancy. All blood clots and material cast off must be thoroughly inspected and, when possible, examined microscopically.

Prognosis.—There should be no maternal mortality in properly conducted abortions, though every abortion entails some risk upon the woman, and many deaths result directly from mismanagement. The prognosis as to both mortality and morbidity depends in great part upon the treatment. The principal sources of danger are *hemorrhage and sepsis.* The hemorrhage is rarely so great as to be the immediate cause of death, though it contributes to the fatal issue by lowering the woman's resistance.

The presence of necrotic masses of material within the uterus is a serious menace to life, by offering a culture medium to pathogenic organisms, and is the cause of pelvic infection in cases which escape a fatal termination. The danger of sepsis is especially imminent in incomplete abortion.

Treatment.—The treatment of abortion should include a consideration of the following:

(1) The preventive treatment of abortion in women who are predisposed to repeated or habitual abortion.

(2) Arrest of a threatened abortion.

(3) Management of inevitable abortion.

(4) Treatment of incomplete and septic abortions.

(5) After-treatment.

PREVENTIVE TREATMENT.—The preventive treatment of abortion is directed chiefly to the cause. Under the etiology, we have referred to endometritis, irritable uterus, syphilis in one or both parents, retrodeviation of the uterus, and chronic nephritis as being the most frequent causes of repeated or habitual abortions. *Correction of these conditions should be begun before conception takes place, as it is seldom possible to save the ovum by treatment begun after impregnation has occurred.*

Endometritis and *endocervicitis* may be treated by curettage and trachelorrhaphy, if considerable cervical ectropion is present, in the interval between pregnancies. Sufficient time should always be allowed for the complete regeneration of the endometrium to take place before coitus is resumed.

In cases of *irritable uterus* the woman must guard against physical exertion, mechanical violence, nervous shock, and sexual intercourse, especially near the time when the menstruation should occur. She should rest in bed during the menstrual epochs, and relieve the pelvic congestion by the timely use of bland enemata.

Spasticity of the uterus, associated with nervous conditions, as chorea, epilepsy, hysteria, et cetera, may be controlled with proper sedatives.

Syphilis demands active antispecific treatment.

Retroversions, which are repositable, may be corrected and retained in position with a suitable pessary, which, if pregnancy occurs, should be worn until after the third month, when the uterus rises out of the pelvis; little can be done for the woman when *chronic nephritis* is the cause of habitual expulsion of the ovum, as pregnancy increases the effect of the kidney lesion.

THE ARREST OF THREATENED ABORTION.—Threatened abortion may be averted by placing the patient at rest in bed, in the recumbent position, and quieting the nervous and uterine irritability by the administration of opium, bromid, and viburnum prunifolium. Opium is best administered as morphia, given hypoder-

matically in ¼ gr. for the initial dose, and repeated in quantities sufficient to control uterine contractions. Its subsequent administration may be by the rectum, in the form of suppositories containing morphia, ½ gr., or its equivalent. Its sedative action is increased by combining it with the extract of hyoscyamus and viburnum.

Viburnum prunifolium may be used in the form of the fluid extract given in ½ drachm doses, or the solid extract in pill form in doses of grs. iv every three or four hours. It acts as a uterine sedative, but its use is not well tolerated by the stomach.

The hemorrhage may usually be controlled by rest in bed, but occasionally a vaginal tampon of sterile or iodoform gauze may be necessary to check the bleeding. The *vaginal tamponade,* while it *controls hemorrhage, also acts as a uterine stimulant tending to make the abortion inevitable,* therefore it should not be used in threatened abortion, *unless the hemorrhage is considerable.*

THE MANAGEMENT OF ACTUAL OR INEVITABLE ABORTION.—The management of inevitable abortion includes, first, the *control of hemorrhage;* second, the *prevention of sepsis.*

Hemorrhage may be controlled by (a) physical and uterine rest, (b) the cervical and vaginal tamponade, (c) the complete evacuation of the uterus; while sepsis may be averted by (a) the avoidance of trauma and lacerations of the cervix, (b) strict adherence to an aseptic technique, (c) the *timely evacuation of the uterus.*

The conditions which determine the form of treatment to be employed, i. e., whether the *expectant or the radical plan* shall be adopted, are:

(1) The period of the gestation.

(2) The condition of the cervix.

(3) The amount of the hemorrhage.

(4) The presence or absence of sepsis.

The Expectant Plan.—Conditions favorable to the employment of the expectant plan are: (a) *Abortions between the 8th and 12th week of gestation,* as during this period the ovum may be expelled complete; (b) *but slight detachment of the ovum,* as is the case when the cervical dilation is slight; (c) *moderate hemorrhage;* (d) and *absence of sepsis.*

The method of procedure is as follows: The hair about the

vulva is clipped, and the vulvovaginal orifice, the lower abdomen, and inner surfaces of the thighs are thoroughly cleansed with soap and water; the suds are rinsed away and the external genitals bathed with a 1-2000 solution of bichlorid. The bladder is emptied by the catheter. The blood and clots are removed from the vagina with a sterile douche of normal saline solution. The patient is then placed in the Sims position, and the cervix exposed with a Sims' speculum and the vagina dried with sterile sponges. Folded packing gauze in strips, two inches wide and five yards long, makes excellent material for the tampon. With the cervix exposed and sterilized with tincture of iodin, the gauze is packed into the cervical canal and into the fornices around the cervix, filling the vaginal vault. Care must be exercised not to rupture the membranes. The pack is then placed against the os externum and built up from this until the entire vagina is filled.

The pack should be pressed away from the urethra and the base of the bladder to prevent vesical irritation, and held in place with a T bandage. Plain sterile gauze should be removed every twelve hours. A tampon impregnated with iodoform or oxid of zinc may remain for twenty-four hours. The vagina should be irrigated at each removal of the dressing, which should be repeated until the cervix is well dilated and the ovum is expelled or is so well separated from the uterine wall that it may be gently expressed or easily extracted with the fingers. Should a part of the embryo or its appendages remain behind in the uterus, evacuation must be completed with the finger or forceps.

The radical plan of treatment in actual abortion should always be elected in the presence of the following conditions:

(1) When the cervix is sufficiently dilated to admit of the expulsion of the uterine content.

(2) If the ovum is detached, or presenting, or partially expelled.

(3) If the hemorrhage is excessive.

(4) If sepsis is present or imminent.

The condition of the cervix and the period of gestation will determine whether the products of conception should be removed with the curette, placental forceps, or fingers.

The instrumental method is best adapted, and its use should

The Technique of the Instrumental Method.—The patient should be placed on a table in the lithotomy position and the legs held with a suitable leg holder; the vulva, lower abdomen, inner surfaces of the thighs, and vagina rendered aseptic. An anesthetic is usually necessary. When the aseptic preparation is complete; the bladder may be emptied with a catheter. The anterior lip of the cervix is caught with a volsella and held gently forward toward the pubic bones, fixing the uterus. The cervical canal is freed from mucus and disinfected with the tincture of iodin. The ovum is detached with the curet and removed with a pair of long ring forceps (Ward placental forceps), or a straight Keith clamp, having the joint 2½ inches from the distal end. Every part of the uterine cavity is curetted thoroughly, but lightly, with the sharp curette. Care will be required to remove all the decidua from the cornua; this is done with a cross stroke. When the dilation of the cervix will permit, the uterine cavity should always be explored with the gloved finger to know that the entire content is removed. Should sepsis be present or imminent, the empty uterus may be firmly packed with gauze, saturated with the tincture of iodin, the excess of which has been squeezed out. *This pack should only be left in position for ten minutes,* when it *must be withdrawn.*

No douche is required, but the uterus must be replaced to its normal position by bimanual manipulation and a firm pack placed in the vagina against the cervix to hold it well up in the pelvis, stimulating contractions and thus securing drainage. *A uterus in the normal position will drain itself.*

From the 8th to the 14th week, the manual method, supplemented with the placental forceps, is the procedure of choice.

Technique of Manual Method.—After the antiseptic preparation of the external genitals and vagina is carried out and the patient is anesthetized, the uterus is crowded down and fixed with one hand over the abdomen, while the other is inserted into the vagina, and the cavity is evacuated with one or two gloved fingers in the uterus. Masses which cannot be removed with the finger may be withdrawn with the placental forceps under the guidance of the fingers.

The presence of a peri- or parametritis in septic cases does not forbid interference. It makes it rather more imperative. Sepsis

in the uterine cavity tends to perpetuate the periuterine inflammation, maintaining the supply of septic material.

INCOMPLETE ABORTION.—When the abortion has been incomplete and portions of the ovum have been retained, there is always *irregular* and *persistent uterine hemorrhage*, which may *sometimes be copious*. The involution is arrested, the uterus is large, soft, and tender, the cervix is open, and detritus is expelled on manipulation. There is usually some elevation of temperature.

In such cases the uterine cavity should be explored to determine the amount and location of the content. The retained membranes or placental tissue may be removed with the finger, placental forceps, or curette, as in inevitable abortion. Evacuation should always be followed with the iodin-soaked pack, which must be removed in ten minutes.

AFTER-TREATMENT.—The patient should remain in bed, in the Fowler position, for a week or ten days; this secures postural drainage and so minimizes postabortal infection. No interference with the uterovaginal passages is required. The external genitals must be kept scrupulously clean, but no douches are necessary. Involution and firm uterine contraction may be favored by the free use of ergot.

The temperature, the pulse, and the character of the genital discharge are to be watched for several days, and, before the patient is allowed the liberty of the room, a careful bimanual examination of the pelvic organs must be made by the attendant in order that uterine misplacements may be discovered and corrected, and parametritic exudates, if present, recognized. It is just as important that the woman be under observation until involution is complete, *after abortion* as after *labor*.

PREMATURE LABOR

The causes of premature labor are essentially those of abortion. Its course and management do not differ in any important particular from those of labor at term.

ECTOPIC GESTATION

Definition.—A pregnancy which occurs outside of the uterine cavity is termed "extrauterine," or ectopic.

Frequency.—Ectopic pregnancy is of more frequent occurrence than available statistics would lead us to suppose, i. e., it has been estimated that it occurs once in 1,200 pregnancies. We have found that the proportion of ectopics has increased with our diagnostic power to recognize them.

Classification of Extrauterine Pregnancy Based upon the Situation of the Developing Ovum.—(a) TUBAL.—Nearly all extrauterine pregnancies are primarily tubal. In tubal pregnancy the impregnated ovum lodges, and begins its development, in the Fallopian tube.

The ovum may be arrested in its progress toward the uterus, (1) in the *ampulla* by the neck of the tube; (2) in the *isthmic*

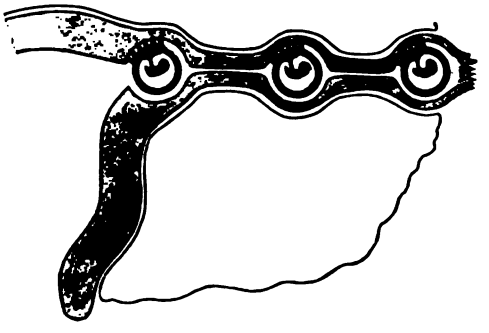


FIG. 67.—THE LOCATIONS AT WHICH THE OVUM MAY BE ARRESTED IN ITS TRANSIT THROUGH THE TUBE

FIG. 68.—A CORNUAL IMPLANTATION IN THE UTERUS

portion; (3) in the *interstitial portion* of the tube, which runs through the uterine wall.

(b) OVARIAN PREGNANCY.—In an ovarian pregnancy the ovum is impregnated in the Graafian follicle and develops within the ovary.

(c) ABDOMINAL PREGNANCY.—In primary abdominal pregnancy the ovum embeds itself in the peritoneum.

Primary implantation of the ovum upon the peritoneum has not as yet been satisfactorily proven. In the majority of the reported cases the ovum has had a tubal attachment and has derived its circulation from this source.

Etiology.—The causation of ectopic pregnancy is not yet definitely settled. All conditions which delay the progress of the ovum from the ovary to the uterus, thus allowing it to develop to such a size that its transit is interrupted, may be considered as causes of extrauterine gestation.

Such causes are chronic salpingitis; congenital anomalies, in length or convolutions; strictures and diverticula; endosalpingitis, crippling the propelling power; and peritoneal adhesions, producing atresia. The majority of my cases have had a history of previous inflammatory lesions.

Pathological Possibilities.—The fruit sac may be located in the *ampulla or free portion* of the tube, or in the *isthmic* or intraligamentous portion, or in the *interstitial* or tubouterine portion of the tube. An ovum developing in either of these locations has distinct pathological possibilities, with the following terminations:

A. An ovum developing in the ampulla may die in situ and become absorbed, or form a tubal mole, or the ovum may be expelled through the fimbriated extremity of the tube into the peritoneal cavity, as *a tubal abortion; 76 per cent. of all ectopics terminate in tubal abortion.* If the abortion is complete the hemorrhage is limited. If incomplete—and tubal abortion is incomplete in the large majority of cases—free (intraperitoneal) hemorrhage may occur, or it may be slight and the pregnancy continue as a secondary abdominal gestation, the placenta retaining, in great part, at least, its tubal attachment, while the membranous envelope is expelled into the peritoneal cavity; or a pregnancy in the outer portion of the tube may become tuboovarian or tuboabdominal by adhesion of the *fimbriæ* to the ovary or parietal peritoneum.

It is believed that primary rupture of the tube always takes place before the 8th week. Primary rupture is seldom fatal, though the woman may die from the initial hemorrhage, or the peritonitis which subsequently develops, or the hemorrhage may cease spontaneously, and the ovum and blood clots be slowly absorbed.

B. When the developing ovum is arrested in the isthmic portion of the tube the pregnancy may terminate by death of the ovum, or the formation of a hematosalpinx, or a pyosalpinx, or a mole; or it *may develop and rupture* into the *peritoneal cavity*

with serious hemorrhage, or *into the broad ligament*, in which case there are several possibilities.

(a) It may become an *intraligamentous pregnancy* and continue to grow, the placenta remaining attached to its tubal bed. This form of ectopic gestation may go to term and become one of the forms of abdominal pregnancy. Should the fetus live and go to term, spurious labor may occur; this ends in fetal death, unless the condition is diagnosticated and the child is promptly delivered by section.

(b) The ovum may die with the formation of a hematoma between the folds of the broad ligament.

(c) The ovum may die, and suppurate, and be cast off piecemeal through the abdominal wall, the vagina, the bladder, and the rectum, or result in septicemia and death.

(d) The ovum may die after the development has advanced to the later months, be carried indefinitely with little or no alteration of structure, or be converted into a lithopedion or a mass of adipocere.

(e) Secondary rupture may take place into the peritoneal cavity with serious hemorrhage and shock. Secondary rupture is usually fatal to the fetus and the danger to the mother is very great. Rarely the fetus may survive as an abdominal pregnancy.

C. Pregnancy in the interstitial portion of the tube or tubouterine pregnancy is an arrest of the ovum in the interstitial portion of the tube and may terminate:

(1) By death of the ovum.

(2) By expulsion of the ovum into the uterus, in which case the pregnancy may terminate as an abortion or proceed and develop as an intrauterine pregnancy.

(3) By rupture into the peritoneal cavity, with death of the mother from hemorrhage and shock. The woman but rarely survives interstitial rupture.

(4) The ovum may rupture into the broad ligament and have the same possibilities as have already been described under isthmic rupture into the ligament.

Interstitial or tubouterine pregnancy generally terminates by rupture before the sixth month.

Termination of Ovarian Pregnancy.—A. The ovum may be ar-

rested in its development in the early weeks, producing a cystic tumor of the ovary.

B. It may rupture the containing sac and be attended with profuse hemorrhage.

Histology and Pathology of Tubal Pregnancy.—The ovum imbeds itself either in the plications of the tubal mucous membrane, when it burrows beneath the mucosa, or directly in the muscular tissue of the tubal wall. The muscle cells are destroyed by the eroding action of the trophoblast, the site of the ovum becoming intramuscular, p[illegible]y of the tube. The blood vessels are also invad[illegible]xtravasation of blood into the peritoneum, through [illegible]nd porous tubal wall, and into the lumen of the [illegible]m the fimbriated extremity into the cul-de-sac, fo[illegible]le. This explains the presence of blood in the perito[illegible] found even before rupture has occurred.

The primary rupture is [illegible] *erosive process*, due to the penetration of the cells of t[illegible] extending through the tube wall to the serous covering, and weakening it until the tube gradually gives way under the pressure of the growing ovum. The decidual formation in the tube is imperfect, occurring only in patches, in other portions of the tubal mucous membrane, and within the uterus, where a more or less complete decidua is developed, which is cast off with the death of the ovum.

Diagnostic Signs of Ectopic Gestation in the Early Months.—The diagnosis is possible before rupture in a large majority of cases.

The History.—The occurrence of an ectopic pregnancy is often preceded by a period of sterility, or the woman has been the subject of a chronic inflammatory lesion of the pelvis, or she may have been just married and present congenital anomalies of the pelvic organs.

There is usually a period of *amenorrhea, together with other symptoms of early pregnancy*, as nausea or some of the breast signs. However, the normal menstrual period may not be skipped, but only be *postponed*, or *prolonged*, or *anomalous* in character. Even before rupture the woman frequently suffers from sharp knifelike pains running through the pelvis, and there is a sensa-

tion of soreness and discomfort in the lower quadrants of the abdomen.

The Uterus.—The *cervix may be softened* and *have a dusky hue*, and the *uterus may be enlarged* and *displaced forward* or *to one side of the pelvis,* according to the size and situation of the growing fruit sac. The cervix is open and is *exquisitely sensitive to motion* and the *uterine cavity is empty.*

The Tumor.—The growing ovum is found beside, or behind, or in front of the uterus, displacing it. The characteristics of the tumor are that it is tense, fluid, tender, pulsating, and rapidly growing.

It should be routine to make a careful pelvic examination of every woman presenting an anomalous menstrual history. If the pelvic findings are suggestive of ectopic gestation, she should be kept in bed under observation until a positive diagnosis can be made or excluded by the physical findings. *A patient suspected of having an ectopic pregnancy should never be examined under anesthesia.*

Diagnostic Signs of an Intraligamentous or Abdominal Pregnancy in the Later Months.—1. Mammary signs of pregnancy.

2. Active fetal movements, which are usually more distinct than in utero gestation.

3. The fetal parts are more accessible to palpation.

4. The fetal heart tones are more intense.

5. Ballottement is obtainable in the fourth and fifth months.

6. The uterus is displaced upward, forward, and to one side, and can be differentiated from the fetal tumor.

The most reliable diagnostic point in the later months is evidence of an existing pregnancy, *with a uterus which is normal* or *but little developed,* and *distinguishable from the tumor mass.*

Shrinkage of the tumor generally follows the death of the fetus.

Signs of Tubal Abortion or Primary Rupture.—1. *Special significance should be given to the history of a postponed, skipped, prolonged, or anomalous menstruation, which is followed by metrorrhagia, irregular in occurrence and in amount.* The bleeding is observed especially at the time of the painful paroxysms. The bleeding may be more or less profuse, or be only a persistent

spotting of a reddish-brown discharge, mixed with mucus which does not clot.

2. The pain occurs in abrupt paroxysms, and is referred to the pelvis or lower abdomen. There are *colicky exacerbations* and *intervals free from suffering.* The paroxysms usually appear from a few days to several months after a normal or anomalous menstruation.

3. *An irregular genital hemorrhage* usually follows or occurs with the attack of pain. In some cases the irregular bleeding begins with the conception, and is only more profuse at the time of rupture.

4. The woman presents symptoms of acute internal hemorrhage, with faintness or more or less collapse. The pulse is rapid, the blood pressure is low. The face may be pallid and a cold sweat appears about the mouth and forehead.

5. The rectal temperature may be subnormal just after rupture, *but is generally slightly elevated,* 100° to 100.4° F.

6. A decidual cast is expelled from the uterus, either as a complete cast of the uterus or in shreds with the genital discharge.

7. There are abdominal tension and tenderness over the region of the fruit sac, usually in one or the other iliac fossa; later there is evidence of a moderate peritonitis in the lower quadrants of the abdomen.

8. On pelvic examination the physical signs of hematoma or hematocele may be found. *In the former the uterus is displaced upward and to one side by the mass in the broad ligament, while in the latter the uterus is fixed and pushed forward and upward or downward by a sensitive, boggy and ill-defined mass in the cul-de-sac. Both masses increase in size if the hemorrhage does not cease spontaneously.*

9. *Movement of the cervix almost always causes exquisite pain, due to the peritoneal irritation.* The blood will show a moderate leukocytosis, a diminution in the percentage of hemoglobin, and a rapid reduction in the number of red cells. The last two changes are progressive if the internal bleeding continues.

In tubal abortion or rupture with serious hemorrhage the clinical picture is unmistakable. The majority of cases are typical, but we must ever be on our guard for the atypical ectopic. Persistent metorrhagia with sharp attacks of abdominal pain oc-

curring in a woman at rest in bed should always excite suspicion. Repeated blood examination will always tell the tale. All doubt may be settled, and a positive diagnosis made, by making a cul-de-sac incision via the vagina, and demonstrating the presence of free blood in the peritoneum.

Uterine abortion and dysmenorrhea sometimes simulate very closely a ruptured tubal pregnancy or a tubal abortion, and these must be excluded by the physical signs.

Intraperitoneal rupture is usually distinguished from extraperitoneal *by more hemorrhage* and by the *physical signs* of *free fluid* in the *pelvic peritoneum.* The presence of free blood, or even soft blood clots, in the peritoneal cavity is difficult of recognition by vaginal touch. When the blood effusion is encysted, the condition may be confounded with a hematoma in the broad ligament. Free blood in the peritoneum may be detected with certainty by a posterior colpotomy.

Extraperitoneal rupture is characterized by the presence of a circumscribed and more or less firm tumor (blood clot) in one broad ligament, as revealed by the vaginal touch. The blood collection may dissect up the peritoneum and burrow behind the uterus. Examination by the rectum often facilitates the diagnosis. A sacculated tube, firmly adherent to the broad ligament, or an encysted blood clot in the peritoneum, may counterfeit intraligamentous rupture and may be mistaken for it even at an operation.

Before opening the abdomen, if the diagnosis cannot be established otherwise, the uterine cavity may be explored or the cul-de-sac opened. It should not be forgotten that intra- and extrauterine pregnancy may coexist.

Differential Diagnosis.—Uterine abortion, dysmenorrhea, ovarian cyst, intraligamentous cyst, simple fluid accumulation in the tube, hydrosalpinx, pyosalpinx, hematosalpinx, and a retroverted and gravid uterus *must be excluded.* In every case of uterine abortion, the possibility of ectopic gestation should be borne in mind.

The differentiation of ectopic gestation from pregnancy in the rudimentary horn of a uterus unicornis is difficult or impossible; but it is practically unnecessary, since the treatment is essentially the same in either condition. Left to themselves, eighty per cent.

of the latter class of cases terminate in rupture and, as a rule, no symptoms occur to arrest the attention of the patient or physician before the uterus ruptures.

Prognosis.—The prognosis in ectopic gestation depends largely upon the termination. A large proportion of tubal abortions and tubal ruptures recover without surgical intervention; on the other hand, the woman may die within a few hours if the bleeding is not controlled. The prognosis, therefore, depends largely upon early diagnosis and the institution of prompt treatment. Under expert surgical management the mortality should not exceed two per cent.

Treatment Before Primary Rupture.—The treatment before primary rupture should be an immediate celiotomy and the removal of the pregnant tube.

Treatment After Rupture into the Peritoneum.—Whether an immediate or delayed operation shall be done when the rupture has taken place in the peritoneum depends upon the condition of the patient. It is better not to operate during shock, when the patient shows signs of reaction, as there is usually an interval of several days between the primary and subsequent rupture.

The immediate indication is to combat the shock and make preparations for a section.

Should the patient be seen in collapse, she should at once be placed in an exaggerated Trendelenburg posture by raising the foot of the bed, twenty-four to thirty-six inches, and morphia sulph., gr. ⅓, given hypodermatically. *All stimulants must be withheld.* The pulse and blood pressure should be taken every hour and recorded. If the pulse becomes slower and stronger, and the blood pressure gradually rises to 100 mm., the operation should be deferred for at least twenty-four hours to allow reaction to take place. The use of a saline solution by the rectum, administered by the drop method (Murphy drip), contributes a fluid content to the empty vessels. If, on the other hand, under the above treatment, the pulse rises, becoming more rapid, and the symptoms of internal hemorrhage increase, an immediate celiotomy may be made. In an experience of one hundred and sixty-one consecutive ectopics, the writer has had to do but one immediate operation with a mortality of 1.2 per cent.

The preoperative skin preparation should be made on the table:

no cathartics or enemata are necessary. The abdomen is opened rapidly and the hand passed at once to the fruit sac, which is lifted out of the abdomen, and a clamp is placed on the broad ligament, including the tube near the cornua of the uterus, while another is placed on the ovariopelvic ligament beyond the free end of the tube. Compression at these points controls the utero-ovarian anastomosis and checks all hemorrhage. The field is partly cleared of blood; the tube and fruit sac drawn up and cut away above the clamps. The ovarian vessels are then tied with fine catgut between the folds of the ligament, and the two peritoneal layers of the ligament are whipped together with a running suture of catgut.

The blood and blood clots in the peritoneum are removed with the hand and with large gauze sponges. A detailed search of the peritoneal sac for clots is unnecessary and only prolongs the operation. A quart or a quart and a half of normal salt solution, at a temperature of 105° F., may be left in the peritoneum; this will not only dissolve many of the overlooked clots, but help to refill the empty vessels.

When the patient has suffered much blood loss, and the pulse is feeble and rapid, no time should be lost in the peritoneal toilet.

If the bleeding is recent, little or no harm is done in leaving some blood in the peritoneum. The abdomen is closed by the quickest method, with cross sutures of silkworm gut. In septic conditions drainage may be practiced by the vagina. The anesthetic should be discontinued when the peritoneum is closed, a hypodermic of morphia sulphate, gr. ¼, supplying the necessary analgesia. If saline has not been left in the abdomen, one quart may be injected into the rectum, sigmoid and colon, while the patient is in the Trendelenburg position, or a pint of saline may be injected behind each breast. Saline is very rapidly taken up from the colon and cellular tissue. Direct infusion into the vein is apt to cause cardiac dilation and pulmonary edema. By selecting the time of operation, we need less heroic measures than when the operation is done while the patient is in collapse. Direct transfusion of blood has, in ectopics, with extreme anemia and collapse, one of its greatest fields of usefulness.

Treatment After Rupture into the Broad Ligament.—*In the First Three Months.*—Limited effusions of blood do not usually

require surgical intervention. Should the blood collection become septic, the sac may be opened and drained through the vagina.

In large blood collections it is well to make an exploratory abdominal section to observe the limits of the effusion, but, when possible, the drainage should be extraperitoneal or from below.

If the ovum survives the rupture of the tube into the broad ligaments it should be treated as a malignant growth by celiotomy, ligation of the uteroovarian anastomosis, and extirpation of the fruit sac. In extrauterine pregnancy the life of the child is of too little value to weigh against the interests of the mother.

After the Third Month.—While the fetus is extraperitoneal, celiotomy and removal, if possible, of the entire ovum are indicated once the diagnosis is established. When the fetus has been dead for two or three months the placental vessels will be found obliterated, and the complete extirpation of the sac generally is possible. Cutting off the uteroovarian anastomosis by ligation of the broad ligament on either side of the fruit sac usually controls the hemorrhage. The oozing which generally follows the removal of the placenta may be taken care of by firmly packing the bleeding cavity with gauze, the ends of which may be carried into the vagina.

If the fetus is living, it is not always advisable to attempt the removal of the placenta, as the bleeding is sometimes appalling.

The fetal sac may be stitched to the abdominal wall, and its cavity packed firmly with washed iodoform gauze, and the placenta left to separate, which usually occurs within a week or ten days. The recovery, however, is tedious and attended with more or less septic absorption. It may be possible to remove the larger portion of the sac by tying the arteries on both sides and ligating the base in sections with mattress sutures.

Secondary Rupture.—After secondary rupture into the peritoneum, the treatment is the same as has already been described in primary intraperitoneal rupture.

Treatment of Interstitial Pregnancy.—When the diagnosis is possible before rupture the pregnancy may sometimes be terminated safely by emptying the fruit sac through the uterine cavity. We consider this, however, a hazardous undertaking, and prefer to make an abdominal section and excise the cornua of the uterus, including the tube and ovum.

On intraperitoneal rupture, celiotomy is indicated as in pregnancy in the free portion of the tube. Supracervical hysterectomy will usually be required, as the amount of uterine laceration is seldom reparable.

PERNICIOUS VOMITING OF PREGNANCY

There are three types of pernicious vomiting: 1. Neurotic; 2. Reflex; 3. Toxemic.

The pernicious vomiting of pregnancy occurs about once in three hundred pregnancies. It is more frequent in our highly developed nervous women than among the Germans and English.

Etiology.—In a limited number of cases the hyperemesis of pregnancy may be neurotic. However, *the toxemic element is the underlying factor in all types;* it merely acts as a predisposing cause in the neurotic woman or the one who has provoking causes in some anatomical lesion of the pelvic organs, e. g., uterine displacement, anteflexion, detention of the uterus in the pelvis by adhesions or other causes, decidual endometritis, ovarian cysts, twin pregnancy, hydramnios, or vesicular mole.

In by far the larger proportion of instances the cause is a hepatotoxemia, due to faulty nitrogenous metabolism. The failure consists in imperfect elaboration of biliary constituents, in imperfect oxidation, manifested by striking changes in the urine, which show that the amount of urea and total nitrogen excreted is diminished, while the "high ammonia coefficient" indicates that a larger amount of nitrogen is eliminated as ammonia than usual.

Degenerative and necrotic changes corresponding to those of acute yellow atrophy (necrosis in the central portion of the lobules), together with multiple hemorrhages, occur in the liver as a result of the toxemia. The renal changes are secondary, are degenerative in character, and limited to the convoluted tubules. The living epithelium becomes necrotic, filling the tubules with brokendown cells and blocking their lumen.

Diagnosis.—*The diagnosis requires the diagnosis of pregnancy* and the exclusion of causes of vomiting independent of pregnancy, as the presence of local lesions in the stomach and upper abdominal tract. The neurotic type is not usually difficult of recognition, usually occurring in women with a manifest neurosis. A

mild toxemia may underlie the neurosis. Pelvic causes should be detected and excluded by physical examination. *A pelvic examination should be made in every case of hyperemesis of pregnancy.* The diagnosis of toxemic vomiting is made by exclusion, by the urinary findings, and the usual clinical evidence of hepatic insufficiency, as shown by the glycogenic power of the liver to assimilate cane sugar. Especially important among the urinary changes are diminution of urea, total nitrogen, and the excess of ammonia. Indoxyl and skatoxyl are increased. Lucin, tyrosin, albumin, urobilin, and sugar may be found. According to Sondern, one of the first signs of the toxemia of pregnancy is acetonuria. Diacetic acid and betaoxybutyric acid are present later.

Prognosis.—In the majority of cases the symptomatic nausea of pregnancy subsides by the third or fourth month. In hyperemesis of neurotic origin the prognosis is good. In persistent, uncontrollable vomiting, dependent on toxic causes, it is very grave, as even the termination of pregnancy will not repair the intralobular necrosis which has already taken place. A low leukocyte count, which continues while the vomiting persists, is a bad prognostic.

Treatment.—Treatment in the *neurotic form* consists of rest in bed for several days, dietetic measures, nerve sedatives, together with employment of eliminants; in *reflex vomiting*, removal of the cause when possible, such as the correction of uterine displacements, and the treatment of local lesions are in order; in *toxemic cases* restricted diet (milk or milk and cereals), stimulation of the emunctories, lavage, catharsis, diuresis by hypodermoclysis, enteroclysis, etc., are the main reliance. In most instances the uterus must be emptied.

Dietetic Measures.—Breakfast in bed followed by sleep, a small cup of strong coffee before rising; cold vichy or carbonated water several times daily; to this sodium bromid may be added, one drachm to the siphon; milk and lime water or vichy, predigested foods, and other liquid foods, all in small quantity and often; rectal alimentation, giving one egg in four ounces of milk every six hours, uncooked beef juice, or predigested foods. Five minims of deodorized tincture of opium may sometimes be added to the food with advantage. The injections may be given through a soft-rubber catheter attached to a funnel. The rectum should

be washed out twice daily during rectal feeding. Cardiac tonics may be required.

LOCAL MEASURES.—Cervical erosions may be touched with a twenty-grain solution of nitrate of silver every second day.

Uterodisplacements must be corrected. A vaginal gauze pack, renewed every two days, or a properly fitted pessary, is sometimes helpful.

Sexual intercourse should be forbidden.

Copeman's method of dilation of the cervix is sometimes successful. The dilation is best effected with the Hegar's graduated dilators. It need not exceed one inch. This treatment may result in abortion, and should be adopted only as one of the last resorts.

GENERAL THERAPY.—Complete rest in bed is an important aid in controlling the vomiting. The position with the shoulders low and hips elevated helps. Occasionally the elevated trunk posture acts more efficiently.

USEFUL DRUG MEASURES.—Cocain, gr. ⅛ to ¼, repeated three or four times daily, or hourly, until three or four doses are given; a cocain spray to the pharynx or to the nares, in a 1 per cent. solution; chloral, gr. xx to xxx, in solution by the rectum, two or three times daily, best given in milk; the bromid of sodium in similar doses.

Strychnin, gr. 1/40 to 1/30, or tincture of nux vomica, Mv, in water before meals, is indicated in chronic gastric catarrh.

Calomel, in small repeated doses, gr. 1/10, q. ½ h., to 5 or 10 doses, often does valuable service, especially in autotoxis.

Oxalate of cerium, gr. x, q. 2 h., when it can be retained, or subnitrate of bismuth in similar doses, may be tried.

Ether spray to the epigastrium at the onset of each paroxysm is sometimes effective.

An ice bag over the cervical vertebræ, or blister over the fourth or fifth dorsal vertebra, may help.

Oxygen by inhalation has been used with success.

Other measures, such as are useful in vomiting from other causes, may be found of service.

INDUCTION OF ABORTION is indicated when other means fail, especially in autotoxic cases. The persistence of a high ammonia coefficient, the presence of acetone, with a low leukocyte count, in a woman with a pulse of 100 or more, demand that the preg-

nancy be terminated. It should not be too long withheld. It is *justified only* when the mother's life would be endangered seriously by longer continuance of the pregnancy, and then only with the concurrence of counsel.

The method of inducing abortion depends: 1st, on the period of the pregnancy; 2nd, on the condition of the cervix; 3rd, on the general condition of the woman. Between the 8th and 12th week *partial separation* of the ovum with a sound and packing the cervix with iodoform gauze, which is renewed every twelve to twenty-four hours, are satisfactory methods. Either may be relied on or both combined. After the os internum is effaced the dilation may be completed digitally or instrumentally if the indication is urgent.

Before the 8th week, in experienced hands the rapid method of evacuating the uterus with the curette and a Keith forceps will be found best. The cervix is first dilated with a steel branched dilator till the curette passes rapidly. The major portion of the ovum is brought away with the forceps and the rest, including the decidua, with the curette. The uterus can easily be emptied in ten minutes. The patient should be under an anesthetic, nitrous oxid or ether oxygen vapor. When the pregnancy has advanced beyond the third month, owing to the bulk of the fetus and placental mass, anterior vaginal hysterotomy should be the method of choice.

PTYALISM

Ptyalism, which frequently is associated with the nausea of pregnancy, is of similar origin. Troublesome salivation is comparatively rare.

Treatment.—Treatment is unsatisfactory. The following measures are sometimes of service: A saturated solution of potassium chlorate used several times hourly as a mouth wash; sulphate of atropin, gr. 1/100, once to three times daily per os; the bromids, gr. xxx to cxx daily; tincture of chlorid of iron, m v t. i. d. Salivation is usually most relieved by treatment which subdues the nausea.

ANEMIA

The *anemia* which *is characteristic* in the *latter months of pregnancy* may become *so exaggerated* as to *appear pernicious.* The hemoglobin may fall to 30 per cent., and the red blood cells be diminished to 1,600,000.

Should a pernicious anemia or a leukemia exist prior to the gestation, the condition becomes aggravated by the continuance of pregnancy.

Anemia renders the woman more susceptible to septic infection and diminishes her resistance to autointoxication.

Treatment.—The pregnant woman suffering from anemia should have an abundance of fresh air and a generous mixed diet, in conjunction with the continuous use of such blood makers as the peptonate of iron, Blaud's pill, the arsenate of iron, and Fowler's solution of arsenic. Pregnancy should be promptly interrupted, if these blood diseases are progressing from bad to worse.

PULMONARY TUBERCULOSIS

Tuberculous changes in the lungs progress rapidly during pregnancy and dormant tuberculous processes may be awakened and take on a more florid type as a result of gestation.

Hemoptysis occurs in 50 per cent. of the cases. In the advanced stages, pregnancy hastens the fatal termination. Tuberculosis of the larynx is a very serious complication.

Treatment.—The pregnancy should be terminated in the early months where the disease has reached the second stage, especially in the presence of urgent symptoms of a cardiac nature, persistent hemoptysis, and dyspnea. Only if the pregnancy is near the period of viability should the child receive consideration. Laryngeal tuberculosis in the early months is a positive indication for abortion. Vaginal extirpation of the pregnant uterus is advised by many foreign authorities.

VARICES OF PREGNANCY

The veins in the rectum, anus, broad ligaments, bladder, vagina, external genitals, and of the lower extremities enlarge and

may become varicosed during pregnancy, due to the mechanical obstruction to the circulation by the growing uterus. Varicose veins of the lower extremities are frequently present in the later months of pregnancy, and may rupture, produce a pressure edema, or become thrombotic.

Treatment.—The treatment consists in having the patient sleep in the elevated foot posture and supporting the enlarged veins with bandages or elastic stockings put on before arising from bed. Much standing is obviously injurious. Cardiac tonics improve the general circulation.

PRURITUS VULVÆ

Pruritus vulvæ may be a neurosis or be due to irritating discharges from the cervix, vagina, or to urinary changes.

Treatment.—The patient should be placed in the Sims position, the posterior vaginal wall retracted with a Sims speculum, and the vaginal and vulvar surfaces dusted with subnitrate of bismuth. This should be repeated daily or every two days. Excessive leukorrheal discharges may be removed by alkaline irrigations. Fomentations to the itching parts with plain hot water, or with a 2½ per cent. carbolic solution, give temporary relief. Applications of silver nitrate, gr. xv-℥i, or of cocain hydrochlorate are useful. If the pruritus is of diabetic origin, treatment must be addressed to the cause.

CHAPTER XIII

PATHOLOGY OF LABOR

A labor may be considered as pathological when any one of the factors, i. e., the powers, the passenger, or the passages, is faulty, and is not acting in harmony with the other factors.

A. ANOMALIES OF THE EXPELLING POWERS

The powers may be:

(1) Excessive.
(2) Deficient.

EXCESSIVE: PRECIPITATE LABOR

Cause.—The cause of precipitate labor may be excessive activity of the expelling forces, or deficient resistance, as, in multiparity, large pelvis and small head.

Dangers.—The dangers are for the most part insignificant. The principal risks to the mother are of lacerations, especially in primiparæ, shock, premature detachment of the placenta, and postpartum hemorrhage; to the child, asphyxia from the nearly continuous interruption of the uteroplacental circulation, and the possible accidents of sudden and unexpected birth, such as falling on the floor, precipitation into a water closet, rupture of the cord, etc.

Treatment.—Treatment consists in moderating the expelling forces by regulating the abdominal pressure by the maintenance of the lateroprone posture in bed and, if required, by the use of anesthesia. The patient should be kept in bed from the onset of the pains.

DEFICIENCY: PROLONGED LABOR

Prolonged First Stage: Tardy Dilation

Uterine inertia may be due to:

(1) Feeble pains.
(2) Cramp-like pains.

(a) Simple Inertia Uteri: Feeble Pains.—CAUSES.—The causes are emotional disturbance, full bladder or rectum, impaired muscular tone, frequently seen in the physically undeveloped woman and the physically unfit; or the uterine muscle may become fatigued, as is often seen in primiparæ; or the real cause may be obscure.

TREATMENT.—In the *absence* of *danger* to *mother* or *child*, the treatment should be *expectant*. *Simple inertia uteri calls for no intervention so long as the membranes are unbroken and the patient is in good condition and gets enough sleep and nourishment.* The bladder and rectum should be evacuated frequently, and other causes of inertia removed if possible.

Measures for accelerating the first stage, when intervention is required in the interests of one or both patients, are: keeping the patient up and moving about; a hot sitz bath; a rectal injection of glycerin, ℥ss; the alternate use of hot and cold compresses over the abdomen; pituitrin, one ampule (.02), every 2 hours, or, strychnin, gr. 1/30, every three hours, given hypodermically, to arouse the nervous system, or quinin, gr. v to x; moderate stimulation with wine, whiskey, or other alcoholic stimulants; the faradic current from the upper sacral region to the posterior vaginal fornix; uterine massage, manipulation of the fundus; peeling up the membranes from the lower uterine segment; the vaginal bag against the cervix; the passage of an aseptic bougie between the membranes and the uterine walls; artificial dilation with the hand or with water-bags. *Interference within the passages, however, should generally be withheld if possible.*

(b) Cramp-like Pains.—The uterine contractions are painful, but are inefficient, being more tonic than clonic. There is consequent failure of the normal changes in the lower segment and

cervix, which favor dilation even in the presence of apparently active pains.

CAUSES.—The causes are neurotic influences, peritoneal adhesions, myomata, excessive uterine distention, as in hydramnios or twins, dry labor and the consequent unequable pressure upon the cervix, malpresentation or too firm adhesion of membranes at the lower uterine segment.

SYMPTOMS.—The woman suffers excessive pain, yet the labor makes little or no progress. *Mechanical obstruction must be excluded.* The cervix is rigid, and, if the membranes have ruptured, the caput succedaneum is excessively developed.

DANGERS.—The dangers are of exhaustion in proportion to the severity of the pain and the loss of sleep and nourishment; *in dry labor, pressure-effects in both mother and child and septic infection.* Atony of the uterus is likely to result. Exhaustion predisposes to a slow second stage.

TREATMENT.—Chloral, ʒj, in four doses of gr. xv each, at intervals of fifteen minutes, frequently does good service. Still more effective is opium, gr. j, once or twice repeated, if necessary, at intervals of an hour, or morphia, gr. 1/6, or pantopon and scopolamin, gr. 1/120, to drowsiness. These narcotics may do either of two things: they may regulate the action of the expelling powers by abolishing, in part, the inhibitory influence of pain, or by inducing sleep they may invigorate the natural forces.

The application of a ten per cent. sterile solution of cocain to the cervix is said to be followed by prompt dilation, but such an application subjects the woman to the danger of infection.

Chloroform or ether is very seldom permissible in this stage except as an aid to surgical intervention. Rupture of the membranes is indicated in marked hydramnios, peeling them up in undue adhesion.

In dry labor gradual manual dilation may be practiced under anesthesia, but when time permits the Voorhees, Pomeroy or the Champetier de Ribes balloon may be used to better advantage. When efficiency and rapidity are demanded and the cervix is not obliterated, anterior vaginal hysterotomy should be elected. Gentle traction with forceps may be tried after dilation is nearly

complete. This procedure, however, subjects the woman to great trauma.

Recourse may be had to multiple incisions of the cervix or to "Dührssen's incisions" or vaginal hysterotomy when immediate delivery is required. In the former method numerous shallow incisions are made in the lower border of the cervix with the scissors. The procedure is at once safe, simple, and efficient. For the technique of "Dührssen's incisions" and vaginal hysterotomy the reader is referred to the chapter on obstetric surgery. With a normal head the space gained is sufficient for immediate delivery. *"Dührssen's incisions" are justifiable only as a last resort, when the internal os and cervical canal are completely effaced.* In the writer's practice vaginal cesarean section has replaced both of these methods.

II. Prolonged Second Stage

Causes.—The causes are most of those which operate in the slow first stage. In addition, may be mentioned exhaustion, pendulous abdomen, excessive uterine retraction—retraction ring halfway or more from the pubes to the navel, moulding of the uterus in dry labor, and faulty action of the abdominal muscles.

Symptoms.—The evidence of inefficient pains is obvious. In neglected cases the temperature and pulse begin to rise and the vagina becomes hot and dry. *Obstructed labor from a contracted outlet must be excluded.*

Dangers.—To *the mother* the dangers are exhaustion, and after-rupture of the membranes, pressure-effects, sepsis. Vesicovaginal or rectovaginal fistulæ may ensue from long-continued pressure of the head in the lower part of the birth-canal; in neglected cases extensive sloughing of the vaginal walls may result.

To *the child* the dangers are chiefly from pressure-effects. The fetal mortality is large from intracranial hemorrhage, due to asphyxia or occurring as the direct result of traumatism in instrumental delivery. Children who survive such injuries not infrequently are crippled in mind or body, or both.

Treatment.—*Obstructive causes are excluded* by passing the

hand into the uterus if necessary. The bladder and rectum should be evacuated. Uterine obliquity may be corrected by manual support, by the lateroprone posture, or by a tight fitting abdominal binder.

The help of the abdominal muscles should be summoned to augment the uterine contractions. Quinin, gr. x, strychnin, gr. 1/30, or pituitrin 2 ampules, may be given hypodermically, or alcoholic stimulants, to stimulate the uterine pains.

Hot fomentations may be applied to the hypogastric or the sacral region; thoroughly warming the patient, especially if anemic and weak, may bring on vigorous contractions.

The patient should assume the semirecumbent position or the *squatting posture during the pains*, or sit on the edge of the bed. Ahlfeld's birth-stool may be tried. This consists of two stools so placed as to leave a triangular space between them opening to the front. The woman sits over the open space until the head is about to be born.

Expressio fetus may be employed by applying pressure at the upper fetal pole or to the head only when the latter pole presents. Push aside the intestinal loops and press downward in the axis of the inlet with one or both hands laid flat on the abdomen. The lithotomy position may help.

Ergot in full doses is dangerous to the child and even to the mother. In large doses it tends to cause a persistent uterine contraction. In *doses of ten minims of the fluid extract, repeated hourly, it merely increases the force and frequency of the natural labor pains. Its use is seldom permissible,* NEVER *except in the* ABSENCE OF OBSTRUCTION and in *minute doses such as to produce normal uterine contractions.*

The use of the forceps is indicated when the natural forces are clearly incompetent, or longer delay would jeopardize the life of mother or child. As a rule, intervention is called for when the head has been arrested a half-hour, after two hours in the second stage in the absence of outlet contraction, especially if the head is low down and there is no recession between pains. *Failure of recession between the pains is evidence that the normal tonicity of the soft parts has been destroyed by prolonged pressure of the fetal mass.*

B. ANOMALIES OF THE PASSAGES

I. ANOMALIES OF THE HARD PARTS: DEFORMED PELVIS

Classification of Anomalies in the Female Pelvis.—Schauta's classification as modified by Hirst is, in my opinion, the most convenient for both teacher and student, and is therefore appended.

ANOMALIES OF THE PELVIS THE RESULT OF FAULTY DEVELOPMENT

Simple flat pelvis.
Generally equally contracted pelvis (justominor).
Generally contracted flat pelvis (non-rachitic).
Narrow, funnel-shaped fetal, or undeveloped pelvis.
Imperfect development of one sacral ala (Naegele pelvis).
Imperfect development of both sacral alæ (Robert pelvis).
Generally equally enlarged pelvis (justomajor).
Split pelvis.
Assimilation pelvis.

ANOMALIES DUE TO DISEASE OF THE PELVIC BONES

Rachitic pelvis.
Osteomalacic pelvis.
New growths.
Fractures.
Atrophy, caries, and necrosis of the pelvic bones.

ANOMALIES IN THE CONJUNCTION OF THE PELVIC BONES

Abnormally firm union (synostosis), which is found in elderly primiparæ, particularly at the sacrococcygeal joint and in the joints between the coccygeal bones:

Synostosis of the symphysis.
Synostosis of one or both sacroiliac synchondroses.
Synostosis of the sacrum with the coccyx.
Abnormally loose union or separation of the joints:
Relaxation and rupture

contracted pelves the *narrowing* is *at the brim*, and is most frequently an anteroposterior flattening. Obstruction may arise, however, from old fractures, exostoses or other bony tumors, or a contracted outlet.

Description of Forms

Nonrachitic Flat Pelvis.—This probably is the *commonest variety of pelvic contraction* in the white race, though Williams gives the precedence to the "funnel pelvis." It consists essentially of a shortening of all of the anteroposterior diameters of the pelvis, owing to the fact that the entire sacrum is nearer to the pubes than normal. The *intercristal and the interspinal diameters* have the same value as in the normal pelvis, or may be slightly increased. Their relation to each other is the same as in the normal pelvis or nearly so. The pelvic circumference may, or may not, be diminished. The true conjugate seldom falls below 8 cm., or 3¼ inches. The transverse diameter is approximately normal.

The sacrum is rotated forward; sometimes is smaller than normal. Occasionally there is a false promontory.

In this form of pelvic anomaly the woman is usually of full stature and her general appearance presents no evidence of deformity.

CAUSE.—The deformity may be congenital or acquired. In the latter case it may be due to overwork in early childhood.

INFLUENCE OF SIMPLE FLAT PELVIS ON THE MECHANISM OF LABOR.—The head passes the brim in imperfect flexion, with its long (occipito-frontal) diameter in the transverse of the pelvis and with the sagittal suture level or nearly so. Below the brim the head movements are substantially the same as in the normal pelvis. Spontaneous delivery frequently is possible, *occurring in over 75 per cent.*

Rachitic Flat Pelvis.—Rachitic flat pelvis resembles the nonrachitic flat pelvis, but presents the following distinctive characteristics: The interspinal diameter is equal to, or greater than, the intercristal; the pelvic inclination is increased; the brim usually is more or less heart-shaped; the outlet may be larger than the inlet; the bisischial diameter is greater than normal; the pubic arch is more than 90 degrees; the longitudinal curva-

ture of the sacrum may be greater or the sacrum and coccyx may be straight and flat; the lateral concavity is diminished; the promontory is lower and pushed forward; the symphysis is deeper than normal, and is inclined backward.

The cause is rachitis in infancy.

Rachitic Flat and Generally Contracted Pelvis.—The characters and cause are those implied in its name. The degree of contraction often is extreme.

Justominor Pelvis: Pelvis Equabiliter Justominor.—This, as its name implies, is a generally contracted pelvis. Its diameters are not in all cases uniformly contracted. The conjugate seldom

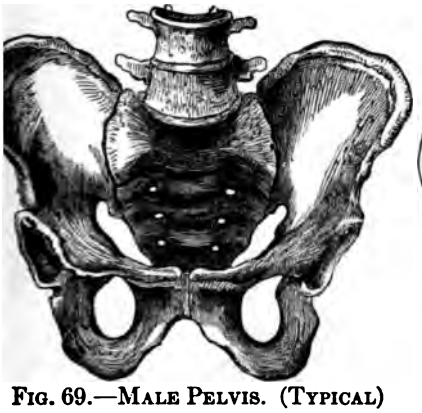


FIG. 69.—MALE PELVIS. (TYPICAL)

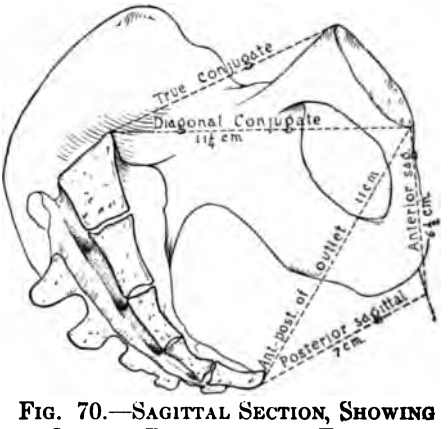


FIG. 70.—SAGITTAL SECTION, SHOWING OUTLET DIAMETERS IN FUNNEL PELVIS. (WILLIAMS)

falls below (8.5 to 8 cm.) 3½ inches. In occasional instances the narrowing is confined chiefly to the outlet. The justominor pelvis is most frequent in women of small stature. Yet its size bears no relation necessarily to the size of the woman's body. This is a common form of contraction. It is due to imperfect development.

By pelvimetry the interspinous, intercristal, external conjugate, and oblique diameters are proportionally decreased.

INFLUENCE OF THE JUSTOMINOR PELVIS ON THE MECHANISM OF LABOR.—There is usually more or less overlapping of the head at the brim, and at the beginning of labor, even in the primipara, the head has not engaged. *Flexion is more pronounced*, but the other head movements differ little from those of normal labor.

Justomajor Pelvis.—This pelvis differs from the normal merely in being uniformly enlarged in all its diameters. It is observed most frequently in women of excessive physical development. A roomy pelvis renders the passage of the head more easy and favors precipitate labor.

Funnel-shaped Pelvis or Male Pelvis.—The typical funnel-shaped or male pelvis is a rare deformity. However, moderate

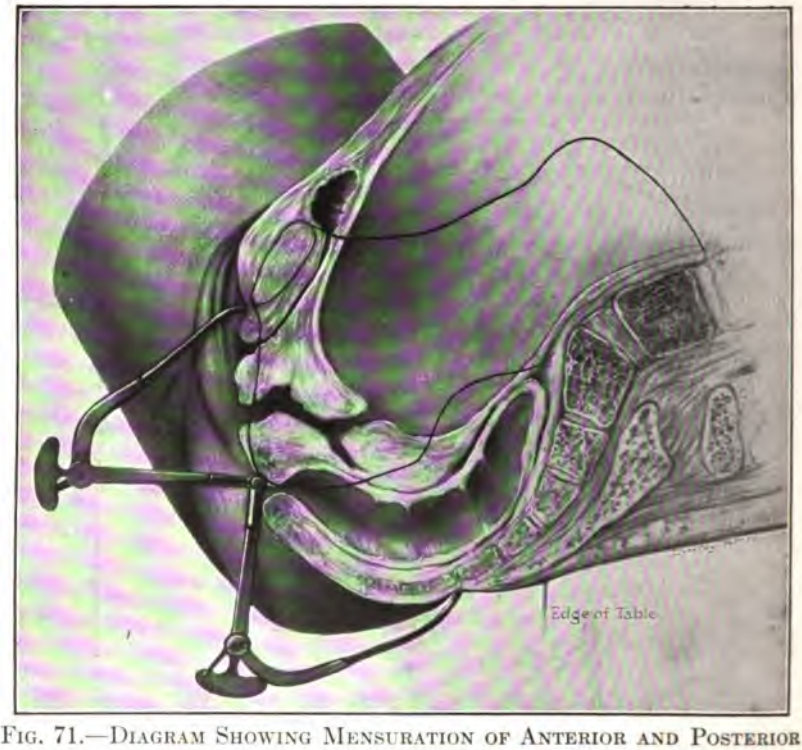


FIG. 71.—DIAGRAM SHOWING MENSURATION OF ANTERIOR AND POSTERIOR SAGITTAL DIAMETERS BY WILLIAMS'S MODIFICATION OF KLIEN'S PELVIMETER. $\times\frac{1}{3}$. (WILLIAMS)

outlet contraction, not associated with general contraction, lumbosacral kyphosis, spondylolisthesis, etc., is the most frequent abnormality observed in white women. According to Williams, 44 per cent. of pelvic contractions are made up of "funnel pelves."

The pelvis is narrowed at its outlet; the tubera ischiorum are approximated, and the anterior-posterior diameter at the outlet

may be shortened. The subpubic angle is narrow, the depth of the symphysis is increased, and the sacrum is long and but little curved longitudinally.

Serious contraction of the outlet may occur in pelves which

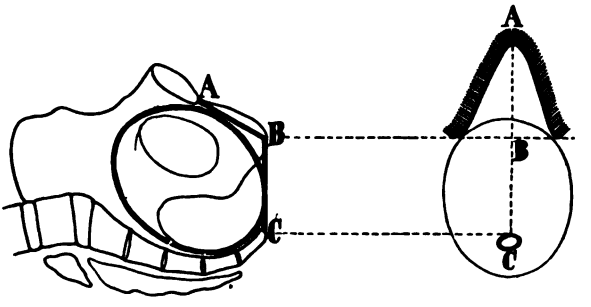


FIG. 72.—A SHORT POSTERIOR SAGITTAL, ARRESTING THE PROGRESS OF LABOR AT THE OUTSET

are otherwise perfectly normal in their external and internal brim measurements. The bisischial or transverse at the outlet is reduced to 8 cm., or less.

INFLUENCE OF FUNNEL PELVIS ON THE COURSE OF LABOR.—An

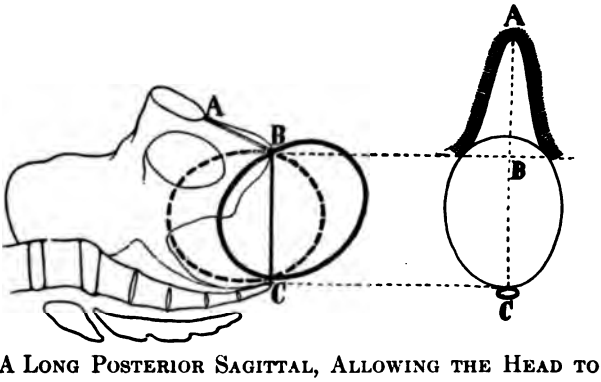


FIG. 73.—A LONG POSTERIOR SAGITTAL, ALLOWING THE HEAD TO ESCAPE

outlet contraction seriously affects the course of labor. When the disproportion is not sufficiently great to give rise to marked dystocia, the head, because of the narrow pubic arch, escapes in the posterior sagittal diameter and extensive perineal tears are the rule.

Klein has shown that mensuration of the transverse and antero-

posterior diameters alone does not furnish sufficient data upon which to form a satisfactory prognosis; we must also determine the width of the pubic arch and the amount of available space between the center of the transverse diameter and the tip of the sacrum. The distance between these points is called the "posterior sagittal" diameter of the outlet. The "anterior sagittal" is measured from the center of the bisischial line to the summit of the subpubic arch (5-6 cm.). In order that spontaneous labor can occur in funnel pelves, the posterior sagittal must be increased in length in proportion as the transverse is lessened and the pubic arch narrowed, as is [illegible] ing table:

Transverse diameter....	8	or sagittal.....	7.5 cm.
" " ..		"	8 cm.
" " ..		"	8.5 cm.
" " ....6 cm		"	9 cm.
" " ....5.5 cm		"	10 cm.

Kyphotic Pelvis.—The up[illegible] of the sacrum is displaced backward, while its lower end [illegible] forward. The sacrum is narrowed, its length increased, its longitudinal concavity diminished, and its transverse concavity lost. Generally the pelvic inclination is diminshed until it is almost parallel with the horizon.

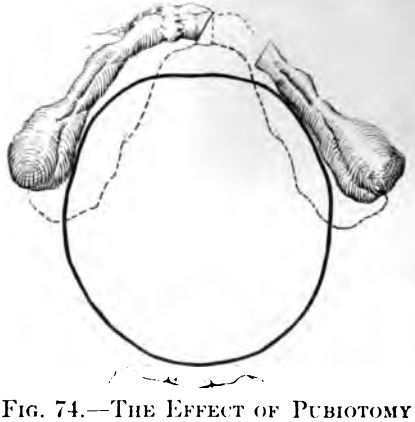


FIG. 74.—THE EFFECT OF PUBIOTOMY ON A CONTRACTED OUTLET. (WILLIAMS)

The transverse diameter is increased in the false pelvis, and gradually diminishes from above downward until the outlet is reached, where the greatest contraction is found. The conjugate is lengthened. The brim is approximately round or oval. The pelvis is funnel-shaped, the ischial spines are approximated, and the anteroposterior diameter at the outlet diminished. The pubic arch is narrow, the symph

THE CAUSE of the deformity is kyphosis in the dorsolumbar, or especially in the lumbosacral region, resulting usually from caries in the body of the vertebra.

INFLUENCE OF KYPHOTIC PELVIS ON LABOR.—The *occipito-posterior position is* much *more frequent* than in normal pelves. *Obstruction is limited to the outlet of the bony pelvis.* Owing to narrowness of the pubic arch it is greater in anterior than in posterior positions of the occiput. Without intervention 25 per cent. of the mothers and half the children are lost. Cesarean section or pubiotomy is required in more than half the cases.

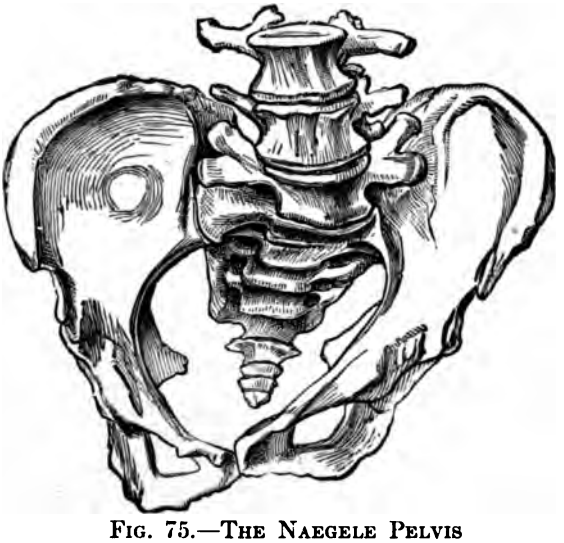


FIG. 75.—THE NAEGELE PELVIS

The Kyphoscoliotic Pelvis.—The kyphoscoliotic pelvis presents a kyphotic deformity of the pelvis of rachitic origin, complicated with the effects of scoliosis of the lower portion of the vertebral column, and the sacral promontory is pushed over to the side. The scoliotic may counteract in part the kyphotic changes.

Scoliotic Pelvis.—Scoliotic pelvis is a pelvic deformity due to scoliosis. Lateral curvature of the lumbar portion of the vertebral column, due to rachitic disease, may give rise to slight asymmetry of the pelvis.

INFLUENCE ON LABOR.—Obstruction usually occurs near the pel-

vic outlet. Delivery by the natural passages frequently is impossible.

Naegele Oblique Pelvis; Ankylosed Obliquely Contracted Pelvis.—There is complete or partial absence of one lateral mass of the sacrum, and generally ankylosis of the corresponding sacroiliac joint, with alteration in the spinal and pelvic curves; thus, the corresponding half of the pelvis is narrow; the opposite side is increased in size. The entire innominate bone on the deformed side is higher than its companion. The shape of the brim is an oblique oval; the symphysis is not opposite the promontory, it is displaced an inch or more beyond the middle line toward the sound side. The conjugate is not shortened. The walls of the pelvic cavity converge below, the sacrum is asymmetrical and turned toward the affected side. The pubic arch is narrow. This variety of deformity is rare (Fig. 75).

Influence on the mechanism of labor is similar to that of generally contracted pelvis.

Obliquely Contracted Pelvis.—Obliquely contracted pelvis is due to a crippled lower extremity. The shape is similar to that of the Naegele pelvis, but the deformity is due to disability of one lower extremity arising from coxitis or other cause in early childhood. The contraction is on the side opposite the crippled member. The sacroiliac joints are sometimes ankylosed.

Robert's Pelvis, or Transversely Contracted Pelvis.—In Robert's pelvis there is complete or partial absence of both lateral masses of the sacrum. The contraction is thus in the transverse diameter. The cavity throughout is narrowed transversely. The conjugate also is somewhat diminished. The subpubic angle is narrow. Spontaneous delivery is impossible. The deformity is exceedingly rare.

Spondylolisthetic Pelvis.—The anomaly consists in a gliding forward of the body of the last lumbar on the first sacral vertebra (the promontory). The inferior surface of the former ultimately rests upon the anterior surface of the latter and becomes firmly united to it. *Shortening of the obstetric conjugate and the antero-posterior diameter at the brim is extreme.* Pelvic inclination often is entirely absent, the plane of the brim being horizontal. The pelvic outlet becomes diminished antero-posteriorly. Extreme lordosis of the lumbar spine necessarily accompanies the deform-

ity, giving the appearance of the trunk having sunk down into the pelvis. The cause is the maldevelopment of the interarticular processes of the last lumbar vertebra. Spondylolisthesis is very rarely met with (Fig. 76).

FIG. 76.—SAGITTAL SECTION OF THE SPONDYLOLISTHETIC PELVIS

Split Pelvis. — The pubic bones are separated or may be united by fibrous tissue. This condition is usually associated with extrophy of the bladder and other genital malformations. It is extremely rare in obstetric practice.

Osteomalacic Pelvis. — In osteomalacia the deformity arises from softening of the bones in adult life when the reproductive organs are functionating, and consequent yielding in the direction of the existing pressures. The softening is due to osteitis and osteomyelitis. The osteomalacic pelvis is sometimes termed the compressed pelvis. In well-marked cases the promontory is pushed downward and forward and the lateral pelvic walls inward, making the pubic portion of the pelvis beak-shaped; the sacrum is convex from above downward and from side to side; the entire pelvic space is greatly diminished and the brim may be almost obliterated; the subpubic arch is narrowed from the approximation of tubera ischiorum (Fig. 77).

FIG. 77.—THE OSTEOMALACIC PELVIS

This is one of the rarest forms of contraction.

Pseudo-osteomalacic pelvis has the characteristics of the osteomalacic pelvis, but is due to rachitic softening after the child begins to walk.

Narrowing of the Pelvis from Bony Tumors.—Obstruction of this form comprises simple exostoses, callus, and displacement of bones due to fracture.

Diagnosis of Pelvic Deformity

Clinical Data.—The clinical data which suggest pelvic deformity are: evidence of rachitis in infancy, such as a history of tardy dentition and of sweats, pigeon breast, curvature of the tibia, of the spine, or other asymmetry of the body, a rachitic rosary, large joints, hypertrophy of second phalanx of the hand, the other two being normal, or very low stature. Disability of one lower extremity dating from infancy is almost surely attended with pelvic contraction. In the case of a primipara, *a pendulous abdomen, or the presenting pole remaining persistently above the brim* instead of having entered it at the commencement of labor, or deformities in near relatives should excite suspicion; in multiparæ, a history of difficult labors.

All primagravidæ should be examined for possible pelvic deformity at about the 35th week.

Pelvimetry.—The only means of exact diagnosis is the measurement of the pelvic diameters. Frequently the pelvis will be found contracted, with no other evidence of abnormality than that afforded by pelvimetry.

The pelvis should be carefully examined by palpation with reference to its *shape* and *symmetry*.

Most essential is the measurement of the *external conjugate*, the *interspinal* and the *intercristal diameters* externally, and of the *diagonal conjugate* and the *diameters of the outlet internally*. The transverse and the oblique diameters at the brim internally are estimated with the hand in the passages. The shape and size of the sacrum, the width of the pubic arch, the presence or absence of bony tumors, and the general conformation of the pelvis are determined by external and internal palpation. The pelvic inclination should also be estimated.

In a limited proportion of cases the value of the external conjugate and transverse diameter at the outlet decides the question whether or not the pelvis is ample. As a rule, with an external conjugate (diameter of Baudelocque) below 17.5 cm. (7 inches), the internal conjugate is small, while if the external conjugate is above 18.5 cm. (7¼ inches), the internal conjugate is ample. Yet exceptionally the internal diameters of the brim may be normal when the diameter of Baudelocque is barely more than 16 cm. (6¼ inches); and, on the other hand, actual contraction may exist when the external conjugate measures 20.5 cm. (8 inches).

A pelvis with an external conjugate below 16 cm. (6¼ inches) is surely contracted; a pelvis with an external conjugate above 20.5 cm. (8 inches) is almost surely ample; between these limits the question must be decided by the internal examination.

Internally, a diagonal conjugate below 11 cm. (4¼ inches) in flat, or of 11.5 cm. (4½ inches) in generally contracted pelves, should be considered abnormally short.

If the pubic arch appears to be narrowed, and the transverse diameter (bisischial) at the outlet is 8 cm. (3¼ inches) or less, the posterior sagittal diameter should always be measured.

In certain types of pelvic contraction the conjugate is not shortened. It should be routine to take all measurements in primiparæ and in women who give histories of difficult previous labors.

Fetometry.—It must not be forgotten that the size and consistency of the fetal head are no less an important factor in the difficulty of delivery than is the capacity of the pelvis. The size of the head must, therefore, also be taken into account. The head measurements cannot be so accurately determined as those of the pelvis. A very close estimate is possible by measuring the occipito-frontal diameter of the head through the abdominal wall with a pelvimeter. The biparietal diameter is obtained approximately by deducting from the occipito-frontal 2 cm. when the latter is less, 2.5 cm. when more, than 11 cm.

It is also useful to try how far the head can be made to enter the brim by crowding it down with one hand over the lower part of the abdomen, while the fingers of the other hand are passed internally to estimate the depth of the descent. The fetal head is the best pelvimeter. An anesthetic allows more accurate estimation.

When necessary for determining the size of the head during labor the half-hand may be introduced into the uterus.

In slight disproportion it is often impossible to determine definitely the prognosis for labor till the labor is well established. *All borderline disproportions should be given the test of labor.*

Management of Labor in Flat Pelvis

When the Conjugate Is 9 Cm. (3½ Inches) or More.—Under these conditions, the spontaneous delivery of a living child is generally possible. The membranes should be preserved by a colpeurynter if required, and full cervical dilation secured. Malpositions must be corrected, and the condition of mother and child carefully watched. The bladder and the rectum should be emptied.

When nature fails, delivery may be effected by:

(1) Forceps with the aid of the Walcher position, provided the head is *engaged* and the child is living and viable. The forceps operation is here much more dangerous to mother and child than in the normal pelvis.

(2) Podalic version when the head is not engaged, and the child is alive and viable and other conditions are favorable, i. e., complete dilation of the soft parts. Yet version in pelvic contraction is attended with a *high fetal mortality*, and should not be elected in the face of the excellent results obtained by pubiotomy.

(3) Craniotomy. This should be elected, if the child is dead, though forceps may be chosen in easy extractions of the engaged head.

(4) Premature labor. The induction of premature labor at the thirty-sixth to thirty-eighth week may be considered if the conditions are discovered in time. The fetal mortality is high in proportion to the degree of prematurity.

In a Pelvis with a Conjugate of 7 to 9 Cm. (2¾ to 3½ Inches).—When the fetus is alive and viable, premature labor, Cesarean section, or pubiotomy is indicated.

Pubiotomy is best restricted to conjugates not below 7.5 cm. (3 inches). Owing to the greater difficulty in the after-care of the patient and tedious convalescence in pubic section, Cesarean section is generally to be preferred.

When the fetus is dead or non-viable, podalic version or craniotomy is to be chosen.

Artificial premature labor at or soon after the end of the eighth calendar month may be considered when the contraction is recognized in time, but the *fetal mortality is high in higher degrees of contraction,* and in our experience the morbidity to the mother is as great as from Cesarean section or pubiotomy.

Spontaneous delivery is rarely possible with a true conjugate of 7 cm. in flat or 7.5 cm. in generally contracted pelves.

Conjugate, 7 Cm. (2¾ Inches) or Less, Absolute Contraction.—At term the Cesarean section or the Porro operation is indicated. When the deformity is known early enough the induction of abortion may be considered, though it is not advised.

The choice of procedure, however, in narrow pelvis, must be determined by the *relative,* not alone by the *actual, size* of the pelvis; the degree of disproportion between the head and the pelvis must decide. In the medium degrees of deformity several factors determine whether a particular head can pass through the particular pelvis under consideration: (1) The degree of contraction; (2) the size and consistency of the head; (3) the variety of parietal obliquity; (4) the position of the occiput; (5) the strength of the expulsive forces.

Management of Labor in Other Pelvic Deformities

The method of delivery must depend upon the kind and degree of obstruction.

The possibility of a living birth by induced labor should be considered. At term version or forceps is competent in a small percentage of cases.

Pubiotomy is applicable when the conjugate is above three inches and there is little contraction in other diameters.

Craniotomy best serves the interests of the mother if the fetus is dead or non-viable.

In the higher grades of disproportion, the Cesarean or the Porro operation is positively indicated, and Cesarean section may be preferred to pubiotomy except when the condition of the mother is bad for abdominal section.

In excessive pelvic inclination, or slight outlet contraction, the

woman should be placed on the side to favor engagement of the head and its subsequent expulsion.

When the pelvic inclination is diminished the liability to injuries of the pelvic floor is greater than in normal conditions.

II. ANOMALIES OF THE SOFT PARTS

Vulvar Atresia.—Vulvar atresia may result from inflammatory adhesions or cicatricial changes of the labia majora, œdema vulvæ, hematoma, thrombus, carcinoma, simple rigidity of the pelvic floor, or rigidity of the hy

Treatment.—A large ematoma may require incision, evacuation of and packing the cavity. Usually nature or for . A rigid hymen may call for single or multiple . .ou , forms of rigidity, as a rule, may be trusted to forceps w aps, episiotomy.

Vaginal Atresia.—Two v f vaginal atresia are recognized, congenital and acquir narrowing may be annular or may involve the whole le the canal. In the annular variety, artificial dilation, multiple incisions, and forceps will generally be required; in complete atresia the Cesarean or Porro operation is the only resource.

Vaginal Neoplasms.—Cystic, fibromatous, or malignant tumors may arise from the vaginal walls and cause a dystocia requiring a section.

Cystocele.—The treatment of cystocele consists in replacing the prolapsed bladder-wall after catheterizing. Evacuation by the catheter being impossible, the bladder may be aspirated through the vaginal or the abdominal wall, and then reposited within the pelvis.

Rectocele is replaceable with the aid of the Sims or the genupectoral position. It is rare that delivery is complicated by prolapse of the vaginal walls.

Rigidity or stenosis of the cervix may arise from atrophic changes in aged primiparæ, from hypertrophy of the portio vaginalis, or from cicatrices following the injuries of previous difficult labors. The dilation is to be left to nature except in the presence of danger to mother or child. Artificial measures, if required, are Voorhees bags, manual dilation, multiple shallow incisions about

the free border of the cervix, or anterior vaginal hysterotomy. Abdominal Cesarean section may become necessary if the resistance is *too* great to be overcome by intravaginal methods.

Cancer of the Cervix.—In cancer of the cervix the induction of premature labor, cervical *incisions through* the healthy tissue with a *thermocautery* knife and extraction with forceps are sometimes possible. The passages should be irrigated repeatedly with an antiseptic solution during and after labor. Mercurials, however, must not be used.

Delivery with the aid of cervical incisions is advisable only when hysterectomy is impracticable. Generally Cesarean section is demanded in the interest of both the mother and the child. It is best done before labor is spontaneously established. The entire uterus should be removed if the disease has not extended beyond the uterus and the condition of the mother permits.

When the disease is detected in the early months total hysterectomy should immediately be performed.

Occlusion of the Os Externum.—The os is reopened by incision from behind forward. If the depression corresponding to the os can be found with the finger, a small opening may be made with a knife and extended with scissors or stretched with the fingers or with a branched steel dilator.

Tumors.—(a) *Vesical calculi* may be displaced, or, this being impossible, removed by vaginal lithotomy.

(b) *Vaginal Tumors.*—Removal, if practicable, is indicated, otherwise Cesarean section or the Porro operation.

(c) *Uterine Displacement.*—Anteflexion, associated with pendulous abdomen, may cause dystocia. This may be corrected with an abdominal binder. *Retroflexion* with the body and fundus incarcerated in the pelvis, may arrest the course of labor and necessitate anesthesia, with the genu-pectoral posture or celiotomy for its relief, or dystocia may be due to adhesions from operations, as ventro suspension and fixation, for the relief of retroflexion. Delivery may be effected by severing the adhesion, allowing the uterus to assume its normal relation, or Cesarean section.

(d) *Uterine Tumors.*—Pedunculated tumors, when easily movable, may sometimes be pushed above the head with the aid of the genupectoral or the Trendelenburg position, or removed with

éraseur or scissors. The Cesarean or the Porro operation may be required

(e) *Ovarian Cysts.*—Generally ovariotomy is indicated immediately on discovery of the tumor. If the tumor is discovered during labor, reposition with the patient in the knee-chest position should be tried. Cesarean section is the only alternative when reposition fails. The tumor is removed at the same time.

DEVELOPMENTAL ANOMALIES OF THE UTERUS

Uterus Unicornis.—One lateral half of the uterus is absent; there is generally but one Fallopian tube. This malformation arises from failure of development in one of Müller's ducts. It is of special obstetric interest from the fact that the uterus sometimes has a rudimentary horn on the defective side in which pregnancy may occur. The condition is then very similar to tubal pregnancy. The rudimentary horn usually ruptures. Pregnancy in the developed horn of a uterus unicornis does not differ essentially from normal gestation.

Uterus Didelphys.—The uterus is bifid, each lateral half forming a distinct organ, representing, however, but one-half of a uterus. The ducts of Müller, instead of fusing as they normally do to form the uterus, do not even come in contact with each other. The vagina may be single or double.

Uterus Bicornis.—The lateral halves are distinct above, united below—the upper part of the uterus is bifid. The ducts of Müller are developed, but are not united in the parts corresponding to the upper portion of the uterus. The uterine cavity is sometimes divided wholly or partially by a median septum. The vagina may be single or double.

Uterus Cordiformis.—The fundus presents an anteroposterior median sulcus.

Uterus Septus.—The uterine cavity is divided, wholly or partially, into two lateral cavities by a median partition. When the septum extends through the length of the uterus the condition is termed uterus septus duplex. When the division is incomplete we have a uterus subseptus. Externally the organ betrays no evidence of the abnormality. In all double uteri pregnancy may occur in either or both lateral divisions. Pregnancy in either

C. ANOMALIES OF THE PASSENGER

OCCIPITO-POSTERIOR POSITION

Ninety per cent. of occipito-posterior positions of the vertex terminate as anterior positions by rotating either above the brim, in the cavity of the pelvis, or at the vaginal outlet. Exceptionally the sinciput rotates to the pubes, and the head is born with the face to the pubic arch. In this position the expelling forces act at a disadvantage; the long diameter of the head does not conform fully to the axis of the pelvis, and labor is impeded. In persistent posterior positions of the occiput the head not infrequently becomes arrested by impaction in the pelvis, unless the child is very small. An impacted occipito-posterior position, if neglected, may become one of the most formidable varieties of fetal dystocia.

An occipito-posterior position of the vertex occurs in about 20 per cent. of vertex positions.

Causes.—The causes of anterior rotation of the sinciput or occipito-posterior positions of the vertex are: imperfect flexion, bringing occiput and sinciput to the pelvic floor at about the same time; defective resistance of the pelvic floor or large pelves and consequent failure of the mechanism which normally shunts the occiput forward; certain pelvic deformities, as relatively small pelvis, or, especially, general contraction, faulty inclination, oblique deformity, and kyphotic pelvis, disturbing the normal mechanism.

Diagnosis.—*Abdominal Signs.*—The dorsal plane is found in the flank, or only its edge palpated; the small parts are in the middle section of the abdomen; the cephalic prominence is marked; the heart-tones are heard over the lateral aspect of the abdomen well toward the back, or are not heard at all; and the anterior shoulder is remote from the median line. The *large majority of right dorsal positions are posterior.*

Vaginal Signs.—After the head has entered the brim the large fontanelle is easily accessible to the examining finger and indicates either an occipito-posterior position or an imperfectly flexed anterior position. The posterior fontanelle is felt opposite the sacro-iliac synchondrosis. Perfect or imperfect flexion is distinguished by the relative situation of the fontanelles to the plane of the

pelvis and, if necessary, by palpating the ball of the occiput and the ears with the hand in the vagina.

Dangers.—The dangers in persistent occipito-posterior position are: *to the mother*, exhaustion, pelvic floor lacerations, the risks of operative interference; *to the child*, those of prolonged labor. The membranes are apt to rupture early and expose the child to pressure effect and dystocia from molding of the uterus. The fetal mortality is 15 per cent. In a relatively large pelvis the malposition is practically unimportant.

Mechanism.—The steps may be outlined as follows:

Descent is a constant factor:
- Flexion
- Rotation — Anterior in 95 per cent. at the brim, in the cavity or on pelvic floor. Posterior: 2 per cent. rotate to front incompletely, 2 to 3 per cent. become impacted, with occiput to the back.
- Extension
- Restitution
- External Rotation

Treatment. (a) *Above the Brim.—Before rupture of the membranes* the patient should lie in the lateral or lateroprone position with the hips elevated on the side toward which the occiput confronts; this favors flexion and engagement, and anterior rotation of the dorsum is thus often possible. The genupectoral position still more effectually helps the normal mechanism, but unfortunately the woman finds the knee-elbow posture difficult and tedious to maintain. Every effort should be made to preserve the membranes until full dilation is effected.

Spontaneous rotation failing, after sufficient dilation, the malposition may be corrected by combined internal and external manipulation. One hand placed on the mother's abdomen pushes the anterior shoulder inward toward the median line, while the fingers of the other, passed into the uterus, push the posterior shoulder of the fetus outward in the opposite direction. In this manner the child's dorsum, as well as the occiput, is brought to the front, and there is no tendency to recurrence of the malposition. *When the head alone is rotated it almost invariably reverts to its former position.*

By many authorities podalic version is preferred, when the

head is arrested at the superior strait, to the foregoing maneuver. Our experience shows that manual rotation is possible under full surgical anesthesia even after the head is partially engaged.

(b) *In the Cavity.*—Anterior rotation of the occiput may be favored by keeping the patient upon the side toward which the occiput looks, or by upward pressure against the sinciput during the pains to promote flexion, or by use of the hand as an artificial pelvic floor, hooking the occiput forward. Should these simple methods fail, we may, under general anesthesia, pass the whole hand into the vagina, seize the occiput between the thumb and fingers, *raise the head out of the pelvis, flex it and rotate it to the front,* while the abdominal hand brings the anterior shoulder forward.

When simpler means fail, the occiput may be rotated to the front with forceps. *This is only a method for the expert.* With a good grasp of the head over the parietal bones, the head is rotated by carrying the handles of the forceps well over to one thigh. *Care must be used to keep the axis of the blades strictly in the axis of the pelvis during the manipulation.* Safe control is assured by *keeping the tips of the blades constantly in the center of the birth-canal.* The head should be rotated through only a small arc of a circle at each effort, thus allowing time for the trunk to follow. Rotation of the trunk may be favored by carrying the anterior shoulder toward the median line by external pressure on the abdomen.

(c) *At the vaginal outlet* it is almost always possible to rotate the occiput into anterior position by backward pressure with the fingers against the anterior temple, combined, if necessary, with forward pressure upon the occiput. Only rarely must the head be delivered in the occipito-posterior position. If the natural forces fail forceps may be tried cautiously.

FACE PRESENTATION

In face presentations the head is extremely extended, the occiput is in contact with the back, while the face looks downward.

Frequency.—The frequency of face presentation is about one in two hundred labors. Mentoposterior positions are more common than anteriors.

Causes.—The extension of the head probably is never primary; it is developed during the labor. The causes are: narrow pelvis, narrowing of the brim by a prolapsed extremity, large child, enlargement of the neck or thorax, coils of cord about the neck, excessive uterine obliquity, multiparity, pendulous abdomen, preternatural mobility of the fetus, owing to small size or to excess of liquor amnii, impaction of the occiput in occipito-posterior position, dolichocephalus.

The preponderance of left mentoanterior positions is due to the right obliquity of the uterus.

Mechanism.—The occipito-mental diameter is in relation with the axis of the birth-canal, but that diameter is inverted, and the head descends with the mental pole first, the trachelo-bregmatic and bitemporal being the engaging diameters. The values of the engaging diameters of the head, when the face is the presenting part, are substantially the same as those in vertex presentation. The difficulty of posterior face births is due, in the main, to the fact that the thickness of the neck and a portion of the chest are added to the diameter of the face, as it presents at the brim, making a total diameter of 16 cm. (6½ inches).

Classification of Face Positions.—

Left mentoanterior—L. M. A.
Right mentoanterior—R. M. A.
Right mentoposterior—R. M. P.
Left mentoposterior—L. M. P.

Mechanism of Mentoanterior Positions: Head Movements.—

1. *Extension.*—This corresponds to flexion in vertex births, bringing the occipito-mental diameter more nearly in relation with the axis of the pelvis, the mental pole leading. Extension is never fully developed until the face has passed the brim.

2. *Rotation.*—Rotation of the chin under the pubic arch unlocks the difficulty of face birth. Failure here is more serious than in vertex presentation. The mechanism of rotation is entirely similar to that in vertex births (*mutatis mutandis*).

3. *Flexion* corresponds to extension in vertex presentation. The lower surface of the inferior maxilla rests on the margins of the ischiopubic rami as pivotal points, and the head is expelled by a movement of flexion, face, forehead, vertex, and occiput sweeping in succession over the perineum.

4. *Restitution.*

5. *External Rotation.*—The explanation of the latter two movements is the same as in vertex births. The birth of the trunk follows the same mechanism as in vertex presentation.

MECHANISM OF MENTOPOSTERIOR POSITIONS.—In typical size of head and pelvis the birth of a persistent mentoposterior position is impossible, since it would necessitate the passage of a diameter of 6½ inches through the pelvis. Anterior rotation takes place in the majority of cases.

Diagnosis.—*Abdominal Signs.*—Abdominal signs to be noted when palpation is possible are the *hour-glass shape of the uterus* and *a very round cephalic tumor filling one side of the pelvis only.* The *cephalic prominence* is on the same side *with the fetal dorsum;* palpation of the back is difficult, as, owing to the extension of the head, the back is more in the middle of the uterus and so out of reach; the cephalic prominence is generally on the same side of the median line with the breech; and a sulcus is found at the junction of the head and back; the heart and small parts are on the same side; the inferior maxilla, with its "horse shoe" like rim, may be accessible to palpation.

Vaginal Signs.—The face does not fill the pelvis as the vertex and its outline is less smooth and uniform. The orbital ridges, nasal bones, malar bones, alveolar processes, and chin may be palpated by vaginal touch if the cervix is sufficiently dilated.

Prognosis.—The prognosis for both mother and child is less favorable than with vertex positions; however, mentoanterior face cases and mentoposteriors that rotate and terminate spontaneously are but little more dangerous to mother or child than vertex births. *The more formidable difficulties of face birth arise chiefly from its complications. A disproportion between head and pelvis favors prolapse of fetal members* (cord, hand, et cetera), and failure of the pains is met with more frequently than in normal presentation, owing to the greater uterine force needed to complete the mechanism. The total mortality is about 4 per cent. of the mothers and 8-10 per cent. of the children. The face of the child at birth usually is much disfigured, owing to the effusion of serum beneath the skin, which may obliterate the features.

The principal dangers to the mother are exhaustion and pressure necrosis; to the child, cerebral congestion from obstructed

circulation in the veins of the neck, due to the grasp of the cervical ring. *Rotation failing, nearly all the children die.*

Treatment.—Nature is competent to effect delivery in most mentoanterior positions as well as in many mentoposterior positions that rotate. In cases seen *before engagement of the face*, however, *or when the head can be pushed above the brim with the aid of the lateral, the knee-chest, or the Trendelenburg posture, as a rule the malpresentation should be corrected.* Anesthesia and posture makes this correction easy. In certain cases of posterior position it will be sufficient to reduce the position to an anterior one. The membranes should be preserved, if possible, until full dilation.

Mentoanterior Positions.—In the absence of complications conversion into vertex, while permissible, is by no means imperative. These cases, if the face is already engaged, may generally be safely conducted as face births. Rotation is favored by keeping the patient on the side toward which the chin points. Should the pains fail, delivery may be effected with the forceps. Since the conversion of a mentoanterior face case into a vertex presentation results in an occipito-posterior position, if this method be chosen, the operation should be supplemented by rotating the fetus into an anterior position *by the methods already described.*

Should the head be relatively large, pubiotomy or section may be elected or if the cord or arm is prolapsed, podalic version generally is demanded, though version in disproportions of the head and pelvis is unfavorable to the interests of the child.

Mentoposterior Positions.—Mentoposterior positions *at brim*, with the face not too firmly engaged, should, as a rule, be converted into vertex presentation by one of the methods described below. Reduction of the position into a mentoanterior position may suffice in the absence of complications. This usually is possible under anesthesia with the hand in the uterus, the trunk being rotated by external manipulation at the same time with the head. In disproportion between head and pelvis, and in prolapse of the cord or an arm, the same rule applies as in mentoanterior positions.

In Cavity.—When the face is too deeply engaged for reduction by displacement, owing to the presence of a spastic uterus or the high position of the retraction ring, rotation may be favored by the lateral posture and by promoting extension, by drawing the chin

downward and forward during the pains with the half hand introduced into the vagina. Recourse to *complete anesthesia,* with the woman in the Trendelenburg position, will frequently allow the operator to displace the head upward and correct the malposition, even after the face has entered the cavity.

Forceps for extraction in mentoposterior positions of the face is one of the most difficult and dangerous of instrumental deliveries, especially for the child; yet in skilled hands the use of forceps as a rotator is sometimes permissible. The technique is substantially the same as in occipito-posterior positions of the vertex.

When the face is immovably fixed, and the fetus is living, delivery is to be made by pubiotomy; when the fetus is dead, by craniotomy.

Methods for Converting a Face into a Vertex Presentation

1. **Schatz Method.**—This consists in pushing the breech forward (toward the feet) with one hand, the chest backward and upward with the other, by external manipulation, and finally crowding the fetus downward in the axis of the pelvis. It is applicable only before rupture of the membranes, and even then is not always practicable unless the fetus is mobile and the abdominal walls are relaxed.

2. **Baudelocque Method.**—(1) The first method of Baudelocque consists in flexing the head by pushing upward with the fingers first against the chin, then the fossæ caninæ, then the brow, with one hand internally, the external hand assisting by forcing down the occiput by suprapubic pressure.

(2) Baudelocque's second method consists in hooking down the occiput with the internal hand, the external hand pushing up the chest. *Anesthesia is generally required for all manipulations.*

3. **Ziegenspeck Method.**—Baudelocque's first method may be combined with Schatz's, with the help of an assistant.

The genupectoral or the Trendelenburg position greatly facilitates the foregoing manipulations.

Thorn Method.—Under complete surgical anesthesia, the lordosis is converted into a kyphosis by combined internal and external manipulation. The whole or half hand corresponding to back of

child is passed into the vagina. The face is lifted out of the pelvis and, if necessary, the occiput may be drawn down with the fingers while the sinciput is pushed up with thumb. At same time the breech is carried in the direction of the feet and upward and back-

FIG. 78. THORN METHOD FOR CONVERTING A FACE INTO A VERTEX POSITION. THE ARROWS INDICATE THE DIRECTION OF PRESSURE AND TRACTION

ward pressure is made upon the chest. An assistant is necessary to carry out the above method.

BROW PRESENTATION

Brow presentation is a partial or semi-extension of the head, the attitude between vertex and face. It is rarely met with, generally undergoing spontaneous conversion into vertex or face. By many obstetricians it is only [illegible] as a distinct presen-

The positions are the same as those of face presentation.

The occipito-mental diameter of the fetal head conforms with the transverse at the pelvic brim, *allowing the brow to descend into the cavity and become arrested.*

Causes.—The causes are substantially the same as in face presentation.

Frequency.—The frequency may be estimated at about 1 in 2,000 labors.

Diagnosis.—*Abdominal Signs.*—The abdominal signs are the same as in face presentation, but imperfectly developed.

Vaginal Signs.—The diagnosis of the presentation is rarely made until the os is sufficiently dilated to permit one to feel the orbital ridges which are within touch on one side, and the bregma on the other side of the presenting part. If the membranes have ruptured and a caput succedaneum has formed, the diagnosis is difficult, as the landmarks are obliterated. *When there is any doubt as to the diagnosis of the presentation, examination should be made under an anesthetic.*

Prognosis.—Delivery in persistent brow cases is impossible except with a relatively large pelvis. The maternal mortality is 1 in 10; the fetal 1 in 3. Rupture of the uterus occurs in three per cent. of the cases.

Treatment.—1. Rectification.—(a) *Conversion into Vertex.*—Before engagement the brow is converted into a vertex by seizing the head, pushing it up, and hooking down the occiput, with the hand in the vagina and with the aid of anesthesia and the Trendelenburg posture. During the manipulation the fundus is supported by firm pressure with the external hand. Pressure upon the occiput, applied through the abdominal wall, helps.

(b) *Conversion into face* may be accomplished by traction on the upper maxilla with the fingers. This is not admissible in mentoposterior positions. Unfortunately rectification fails in from twenty to thirty per cent. of the cases.

2. Version.—Version may be employed for rapid delivery, if indicated in the interest of the mother or child, and if the head is not engaged or the uterus is not firmly contracted. Version should be the method of choice when the pelvis is approximately normal *in multiparæ.*

3. Pubiotomy.—Pubiotomy should be elected in impacted and

irreducible brow presentation if the child is living and viable, and should always have the preference over version in *primiparæ*. If the child is dead, craniotomy is indicated.

In general the principles apply as for the management of face births.

BREECH PRESENTATION

Varieties.—Three varieties of breech presentation are recognized, according to the part of the pelvic pole which presents—breech, knee, and footling. The distinction is of no practical importance, so far as the mechanism is concerned. In certain cases, however, as will be seen, it affects the question of treatment.

Frequency.—Exclusive of premature labors, the frequency of breech presentation is about 1 in 60 births.

Causes.—The causes are: narrow pelvis, tumors of the uterus, placenta prævia, hydrocephalus, multiple fetus, and conditions favoring the mobility of the fetus, such as multiparity, prematurity, lax uterine walls, hydramnios, shape of the uterus possibly, and small fetus.

Mechanism.—The breech, shoulders, and after-coming head each follow a distinct mechanism in their passage through the pelvis. Usually the bisiliac diameter engages in one of the oblique diameters of the pelvis. We have, therefore, four breech positions:

Left sacroanterior—L. S. A.
Right sacroanterior—R. S. A.
Right sacroposterior—R. S. P.
Left sacroposterior—L. S. P.

Rotation in breech is not so pronounced as in head presentation. As the breech descends into the pelvis, the posterior hip first lands upon the pelvic floor, and is shunted downward, inward, and backward to first appear at the vulva, while the anterior hip rotates forward to the pubic arch, where its advance is checked and the posterior is delivered first by a movement of lateral flexion. The shoulders rotate more or less completely. The head rotates as perfectly as in vertex births. In dorsoposterior positions the occiput, as a rule, comes eventually to the front. The nape of the neck resting against the pubic arch, the head is expelled by a movement of flexion around this as a pivot, the face, the forehead, and

the vertex successively sweeping over the perineum. Spontaneous expulsion of the after-coming head, however, is exceptional.

In persistent dorsoposterior positions the head is generally delivered by a movement of rotation about the posterior edge of the vulvar orifice, the mental pole first as in anterior positions. If the chin catches upon the pelvic brim, delivery is accomplished occiput first. In this method of expulsion the lower surface of the inferior maxilla pivots against the pubic bones, and occiput, vertex, forehead, and face sweep in succession over posterior vulvar commissure.

Diagnosis.—*Abdominal Signs.*—(1) The dorsal plane is palpated on the right or left side of the abdomen. (2) The fundal pole is hard, globular, and susceptible of ballottement, with a sulcus between it and the trunk. (3) The anterior shoulder and fetal heart are found above the umbilicus. (4) The lower pole, irregular in shape, is not so hard, and in primiparæ is found above the excavation before labor.

When the head is in the lower uterine segment, ballottement is possible only in multiparæ and with excess of liquor amnii; even then it is imperfect. *In primiparæ, in the absence of pelvic contraction and of obstruction from tumors or other causes, the head, when it presents, is always found engaged in the excavation at the beginning of labor.*

Vaginal Signs.—The vaginal signs are: glove-finger protrusion of the bag of waters (obviously this can be present only after labor has been for some time established), the absence of the hard globular head with its fontanelles and sutures. The detection by vaginal touch of one or both ischial tuberosities and the tip of the coccyx, anus, genitals, on a line bisecting the bisischial line at a right angle; the femora; expulsion of meconium—not diagnostic—sometimes observed in cephalic births.

Frequently both ischial tuberosities may be reached, and from them the femora be traced for a short distance.

A foot or knee may be identified by its anatomical characters.

In differentiating between head and breech a mere casual touch should not be relied upon. Every accessible part of the presenting pole must be searched for minutely, with firm pressure if it is impacted in the excavation, and its bony landmarks are obscured by edematous swelling of the overlying soft structures.

Prognosis.—*To the Mother.*—The *first stage* of labor may *be more tedious than normal.* The second stage often is more rapid. In artificial delivery *laceration of the cervix occurs more frequently* than in vertex births; *in first labors at least laceration* of the *pelvic floor is the rule.* The danger to life is not increased.

To the Child.—The mortality, when the delivery is left to nature, is one in ten, at least in first labors; with skilled management it is but little greater than in vertex births.

The cause of the fetal mortality is asphyxia from impeded blood-supply, due to retraction of the uterus after the birth of the trunk, and from compression of the funis after the head engages. The fetal mortality is increased in dry labor.

Hemorrhages may occur into the lungs, liver, kidneys, and the muscles of the neck. Duchenne's paralysis and injuries to the bones and joints are not infrequent in breech extraction.

Indications of danger to the child at the critical moment in breech delivery are: *irregularity and feebleness of the funic pulse, occasional gasping respiratory efforts, convulsive movements of the limbs.*

Treatment Before Labor.—External version is permissible if it can be done without violence. While conversion into vertex presentation is desirable, the indication for changing the presentation before labor is not sufficiently urgent to justify the risk involved in a difficult external version.

Treatment During Labor.—Delivery of the Trunk.—The danger to the child arises chiefly from the difficulty of delivering the after-coming head before the child perishes from arrest of the uteroplacental circulation by compression of the umbilical cord. Undelivered, the child will almost surely die within eight minutes after the head engages and the uteroplacental circulation is cut off. *The delivery of the after-coming head is facilitated by:* (1) *ample dilation of the passages, the cervix, vagina, and vulvovaginal orifice;* (2) *full flexion of the head, which also tends to maintain the flexion of the arms.*

Cervical dilation is accomplished by preserving the membranes till they reach the pelvic floor and, as a rule, by a slow and gradual delivery of the breech; while flexion is maintained by avoiding traction till the trunk is delivered, or, when traction is unavoidable, by external manipulation so applied to the fundus by a

skilled assistant as to keep the chin firmly pressed against the chest.

Bringing Down a Foot.—When the membranes have ruptured, and the case is seen before the breech has engaged too firmly in the excavation, one foot should be brought down (Pinard's method), *the anterior one should be taken by preference.* This is done as a precaution against arrest of the breech in the pelvis. The leg

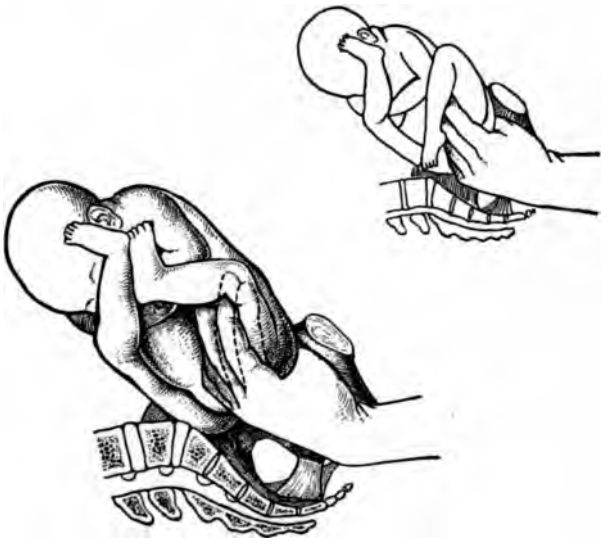


FIG. 79.—PINARD'S MANEUVER FOR BRINGING DOWN THE ANTERIOR LEG

serves as a tractor, should the expellent forces fail. Advantage may be had from breaking up the breech in flat pelvis, large child, or rigid soft parts as found in the old primipara.

DELIVERY OF THE ARMS AND HEAD.—In general, when there is no disproportion between the child and pelvis, the case should be left to nature until the whole breech is born. When this does not occur spontaneously, the patient, as a rule, should be under an anesthetic and on a table. The vulvovaginal orifice should be manually dilated, and the forceps should be ready. A warm, dry flannel or towel should be in readiness for wrapping the child's body as soon as it is expelled, to help to prevent premature efforts at respiration. Watch the pulsation of the funis for warning of dan-

ger to the child. Pull the cord down and dispose of it, if possible, in that part of the pelvis which offers the most room.

Extraction of the Arms. (a) *Arms Flexed.*—The arms should be brought down with the hand passed along the child's abdomen.

(b) *Arms Extended.* 1. Delivery of the First Arm.—As soon as the shoulder-blade can be reached easily, the feet should be

FIG. 80.—MANNER OF GRASPING THE BREECH WHEN TRACTION IS NECESSARY

grasped and the trunk drawn downward in the pelvic axis and carried to the side opposite the occiput. The posterior arm should be brought down first. The free hand should be passed up along the child's back and one or two fingers slipped over the shoulder and along the humerus to the elbow. The elbow should be swept in a circular direction across the face and down. Beware of applying the force at the middle of the humerus and of attempting to

ıg the arm straight down, lest the humerus be fractured or the ılder-joint injured.

(2) Delivery of the Second Arm.—The child's trunk must be ught into the long axis of the mother's body (the position of dorsum is an index of the position of the shoulders), the trunk

81.—The Upper Part of the Trunk Caught by the Partially Dilated Cervix

ed with both hands and pushed upward in the axis of the h-canal to release the head and extended arm from the grasp he pelvic brim; if necessary, the trunk should be rotated to y the undelivered arm opposite the nearest sacroiliac joint. ation is assisted by drawing the delivered arm gently across child's back or by grasping the delivered shoulder. Then, with

the trunk held to the opposite side, the second arm is brought down, the elbow being swept inward across the face and downward, as in case of the first arm. It is seldom that rotation of the head fails by twisting the trunk as above described. Should it do so from the fact that the head has been driven too far into the pelvis, the maneuver recommended by Kehrer may be tried. This

FIG. 82.—MAURICEAU-SMELLIE-VEIT METHOD

consists in pushing the occiput outward with the external hand, while the face is swept inward with the arm by the internal hand.

Extraction of the After-coming Head.—(1) ***Dorsoanterior Positions.***—Seizing the trunk again with both hands, the head is rotated, if necessary, to bring the face opposite one of the sacroiliac joints. *The head must be rotated into one of the obliques at the brim, flexed, and engaged before extraction can be accomplished.*

Smellie-Veit (Mauriceau) Method.—Two fingers of one hand are passed within the passages and held firmly against the fossæ caninæ or the inferior maxilla to maintain complete flexion. Two fingers of the other hand are hooked over the shoulders astride the neck. The child's trunk lies on the operator's forearm. The head is delivered by traction. The natural mechanism must be observed, keeping the long diameter of the head in the oblique

FIG. 83.—THE SMELLIE-VEIT METHOD USED WHEN THE HEAD IS LOW IN THE PELVIS

diameter of the pelvis till past the brim. As the chin approaches the fourchette, a finger introduced into the mouth depresses the tongue for the admission of air. *Expressio fœtus* by suprapubic pressure by a skilled assistant is an important aid in bringing the head through the pelvis (Fig. 82).

Wigand-Martin Method.—Of manual maneuvers this is the most efficient when the operator must work without assistance. The technique is as follows: Two fingers of one hand are placed in the child's mouth or pressed against the fossæ caninæ to control the mechanism, especially to maintain full flexion. With the other hand the head is driven through the pelvis by powerful suprapubic pressure (Fig. 84).

Forceps.—An assistant, seizing the child's feet, holds its body well up over the mother's abdomen *the head having been flexed and engaged.* The forceps is then applied to the head. Though very seldom required, this is the most reliable of all methods of extracting the after-coming head. If the normal mechanism is observed and violence avoided, the danger of maternal injuries is no greater than in manual extraction.

(2) *Dorsoposterior Positions.*—On expulsion of the breech, the

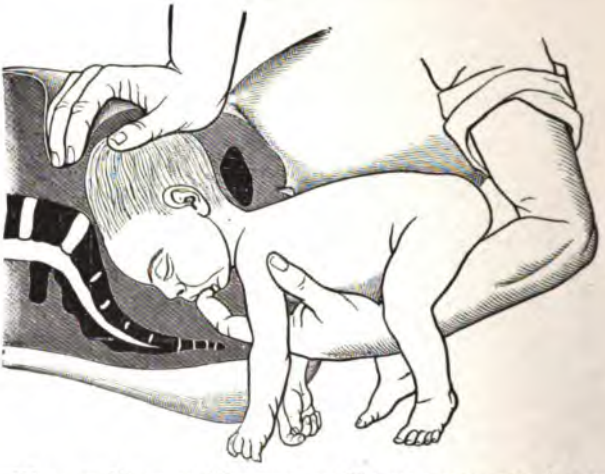


FIG. 84.—WIGAND-MARTIN METHOD OF EXTRACTING THE AFTER-COMING HEAD

occiput should be rotated to the front by gentle torsion of the trunk, the back being kept well to the front, with the aid of external pressure applied over the mother's abdomen by an assistant. Then delivery is accomplished as in primary anterior positions. Rotation failing, delivery may be accomplished by traction and suprapubic pressure, the trunk being carried downward and backward over the perineum. Should the chin catch over the brim of the pelvis, delivery may be made, occiput first, by traction upon the body directed upward and forward over the pubes, aided by suprapubic pressure or by the forceps.

Should the forearm of the fetus be lodged behind the neck, the body should be rotated in the direction *from* the misplaced arm, too much torsion of the neck being guarded against. The

tation of the head may, if necessary, be assisted by external essure. Sometimes the nuchal arm may best be dislodged with e hand in the passages. Having disengaged the arm, one may oceed as in ordinary cases.

g. 85.—The Forceps Applied to the After-coming Head. The body is wrapped in a warm sterile towel and carried over the pubes by an assistant.

In failure of the powers at or above the brim one or both feet ould be brought down, if this is possible without violence. If e breech has sunk into the brim it may, with the aid of postural easures and anesthesia, be dislodged even after partial engage-ent.

When the legs are extended, carrying the feet high up in the uterus, the foot may be brought down as follows: Having introduced the hand into the vagina, two or three fingers are passed into the uterus between the thighs, one thigh is pressed outward; the knee is thus flexed and the foot brought down within reach of the operating hand.

In case of impaction, or failure of the powers with the breech in the cavity, three methods of delivery are available: *traction by finger, fillet, or forceps.* Even with the breech in the midplane, it may be possible under deep anesthesia and with the aid of the Trendelenburg posture to dislodge it and bring down a foot.

The *finger* hooked in the groin is competent when only a moderate amount of force is required, and the breech is on the pelvic floor.

A yard of strong muslin bandage or a soft handkerchief, which has been boiled, may be used as a *fillet.* It is oiled and knotted at one end. The knot is pushed up over the groin with one hand and hooked down on the opposite side of the thigh with the fingers of the other hand. Traction is then applied to the fillet with care to avoid doing violence to the structures of the groin by too great pressure.

In *dorsoposterior positions the fillet is made to encircle the pelvis,* the free ends depending between the thighs. One end is passed over each groin from without inward, and the loop slipped up over the sacrum. Or the fillet may be passed over one groin and be held in place with one hand while traction is made with the other. The latter precaution is necessary owing to the danger of fracturing the femur should the fillet slip and traction be made upon the central portion of the shaft.

In cases not manageable by the finger or the fillet, *forceps* may be applied to the breech. One blade is placed over the sacrum and ilium, the other over the posterior surface of the opposite thigh, or the blades are adjusted over the trochanters, especially in dorsoposterior positions, pressure upon the ilia being avoided. Moderate traction is made and assisted with *expressio fœtus. The forceps is only used to bring the breech within the reach of the fillet or finger.*

The cephalotribe, applied to the breech, may be used to advantage if the fetus is dead.

TRANSVERSE PRESENTATION: SHOULDER PRESENTATION

A transverse presentation is one in which the long axis of the fetal ellipse lies across the long axis of the uterus. Primarily the presentation is oblique rather than transverse. In a large proportion of cases cross presentations are spontaneously converted into longitudinal when labor begins. In persistent transverse presentation the shoulder, or sometimes the arm, becomes the presenting part after labor is established.

Frequency.—The frequency of shoulder presentations has been variously estimated, but may be fairly stated as 1 in 250.

Causes.—The causes of cross-birth, which is a partial inversion of the fetal axis, are practically the same as those of breech-birth or complete inversion. This anomaly is, therefore, observed most frequently in unusual mobility of the fetus, as in multiparæ with large, flabby uteri and pendulous abdomen, twin pregnancy, fetal tumor, myoma of the lower uterine segment, undue pelvic inclination, pelvic deformity, and low attachment of the placenta.

Positions.—Since the child's head may lie either to the right or the left of the mother, and its back may be turned anteriorly or posteriorly, there are four possible positions in cross-births as follows:

Left scapulo-anterior—L. Sc. A.
Right scapulo-anterior—R. Sc. A.
Right scapulo-posterior—R. Sc. P.
Left scapulo-posterior—L. Sc. P.

It should be noted that these positions are named according to the direction of the presenting scapula, or, on abdominal palpation, from the location of the head and the position of the back, *left* if the head is *in the left iliac fossa*, anterior if the fetal dorsum is to the front. When the scapula looks to the left and front the position is a left scapulo-anterior, when to the right and front it is a right scapulo-anterior position, and so on.

Diagnosis.—*Abdominal Signs.*—1. The abdomen is unusually wide from side to side, while the fundus frequently does not rise above the umbilicus. 2. Both fetal poles are absent from the excavation after labor is established.

3 and 4. A third sign is the presence of the head in one or

the other iliac fossa, and a fourth is presence of the breech on the opposite side.

Vaginal Signs.—There is glove-finger protrusion of the bag of waters; the presenting part is smaller, more yielding, and less distinctly rounded than the hard globular head. *Especially significant is absence of any presenting part at the onset of labor.*

After labor is well established the presenting part is a small, rounded prominence; it is distinguished from an ischial tuberosity by the absence of a companion; from it run the humerus, the clavicle, and the spine of the scapula in radiating lines.

The neck is felt on one side of the presenting part, the "gridiron" sensation afforded by the ribs on the other; the axilla can be made out; the elbow is identified by the olecranon; the position is determined by the location of the scapula to the right or left, anteriorly or posteriorly. The axilla and the elbow look toward the feet; the thumb points toward the head.

When an arm is prolapsed the hand is to be distinguished from the foot, and the right from the left hand. On shaking hands with the fetus, the right hand of the examiner fits the right hand of the fetus, and *vice versa.*

Prognosis.—Persistent transverse presentation is almost surely fatal to both mother and child, yet small, premature, or macerated children have been born spontaneously. The risks to the mother are from pressure-effects, exhaustion, sepsis, rupture of the uterus; to the child, from pressure-effects, prolapsus funis and operative delivery.

Spontaneous Delivery.—Very rarely spontaneous delivery takes place by one of the following methods:

(a) *Spontaneous Version.*—The shoulder presentation is converted into a breech or into a vertex birth by the uterine expulsive efforts. Such a change of presentation is common at the beginning of labor. It is favored by having the patient assume the squatting posture, with the thigh of the side toward which the breech points forcibly flexed upon the abdomen. It occurs more frequently in multiparæ than in primiparæ, oftener with a living than with a dead child.

(b) *Spontaneous Evolution.*—The mechanism of spontaneous evolution is as follows: As the child is driven down by the uterine contractions, the head rides over the symphysis and the anterior

shoulder becomes fixed under the pubic arch. The other shoulder is forced down over the posterior wall of the pelvis and is expelled first. It is then followed by the trunk. The head is born last.

Spontaneous evolution is only rarely possible, and only with a small child or large pelvis.

Expulsion with trunk doubled on itself (partus conduplicato corpore) may occur when disproportion between the size of the pelvis and fetus favors, or when the child is dead and macerated.

Treatment.—*Before Labor.*—If the pelvis is approximately normal, the malpresentation should be corrected by external cephalic version. To retain the presentation as longitudinal a tight abdominal binder and lateral compresses should be applied.

During Labor.—The membranes should be preserved; to secure full cervical dilation the bladder and rectum must be evacuated; the capacity of the pelvis, the size of the child, the relative position of the head and the dorsum, the situation of the retraction ring, and the degree of thinning of the lower uterine segment are all to be noted. When the cervix is fully dilated version should be performed, cephalic or podalic, by the bipolar or the internal method, followed by immediate extraction under anesthesia.

If the membranes have ruptured, the degree of cervical dilation, the condition of the uterus, of the patient, and of the fetus, determine the treatment. If the cervix is only partially dilated, and the child is alive and freely movable within the uterus, bipolar podalic version should be tried, a foot brought down and allowed to dilate the cervix before the extraction is completed.

If the condition is complicated with prolapse of the cord, the cervix should be dilated manually or split, and an immediate internal podalic version and extraction made.

Reduction of the malpresentation is often possible, even in the presence of a spastic uterus, with the aid of the genupectoral or the Trendelenburg position and deep anesthesia. In impacted and irreducible shoulder presentation decapitation will be required. Cesarean section should be considered as a possible alternative when the child is alive and the uterus has not been infected.

TREATMENT OF COMPLEX PRESENTATIONS

Head and Hand, or Both Hands.—When possible the hand should be replaced with the aid of anesthesia and the Trendelen-

burg posture. This failing, and the head engaging plus the prolapsed member, delivery may be accomplished with forceps, the arm being placed in the unoccupied side of the pelvis, or, better, if the head is unengaged and the pelvis is ample, podalic version should be performed.

Hand and Foot, or Head, Hand, and Foot.—The fetus may be extracted by one or both feet.

Nuchal Arm.—The diagnosis is made by anesthetizing the patient and introducing the hand into the passages.

In vertex presentation the arm is dislodged with the hand in the uterus by rotating the body *from* the nuchal arm. Rarely version will be necessary.

In head-last cases the nuchal arm is dislodged by seizing the delivered trunk with both hands and rotating the body *from* the misplaced arm. The other arm should first have been delivered. The reduction of the misplacement may be followed, if necessary, by introducing two fingers between the shoulder and the symphysis, and bringing down the arm in the manner practiced in ordinary breech extraction.

In complex presentation, if the fetus is dead, delivery is best accomplished, as a rule, in the interest of the mother, by CRANIOTOMY.

ANOMALIES OF FETAL DEVELOPMENT

Twins

Relative situations of twins are: one above the other, one beside the other, one in front of the other.

Diagnosis.—(a) *Abdominal Signs.*—Several of the following abdominal signs may be observed and a diagnosis made:

(1) Excessive size and tension of the uterine tumor; permanent tension of the tumor, with very limited mobility of the contents.

(2) Excessive width of tumor and a longitudinal sulcus (the latter, however, is not diagnostic).

(3) Suprapubic edema, which is present also in simple hydramnios.

(6) Three or four fetal poles.

(7) One head in the excavation and one in the upper uterine segment.

(8) One head in the excavation and one in the iliac fossa.

(9) Distance from the pelvic pole to the fundal pole over 30.5 cm. (12 inches).

(10) Two fetal heart-sounds at different rates.

(11) Two fetal heart-sounds of the same rate, but in widely different situations and on opposite sides of the abdomen.

(12) Heart tones above the umbilicus when the head is in the excavation.

(13) The demonstration of two fetuses by the X-ray.

(b) *Vaginal Signs.*—A rapidly successive presentation of a head and a breech;

Four extremities offering at the brim;

Two amniotic bags presenting.

Prognosis.—The prognosis in twin births is more serious. The toxemias are more frequent, cardiac complications more serious, operative delivery more common and postpartum hemorrhage and sepsis are more likely to occur. As twin births are premature many infants die of atelectasis and general debility.

Management of Labor in Twin Births.—The management of labor in twin births differs in no wise essentially from that of ordinary labor, save that, owing to the marked overdistention of the uterus, the pains are likely to occur at long intervals and be inefficient. The cord of the first child should be ligated on the placental as well as the fetal side, owing to the possible existence of a vascular communication between the two placentæ. Since the passages are dilated by the birth of the first child, the second birth, except when the first child is undersized, usually is rapid, or, if necessary, may safely be made so. The delivery of the second child, however, should be left to nature except for cause. Changes in the position of the second child frequently occur during, or just after, the delivery of the first; hence the necessity of making an examination immediately on the birth of the first twin, to detect any abnormality in the position of the second. The fetal heart should be watched, and immediate delivery effected if it becomes abnormal. As the overdistention of the uterus exposes the woman to postpartum hemorrhage, extra care will be

needed to secure firm uterine retraction by manipulation and by the use of ergot and pituitrin.

Interlocking Twins

This anomaly, which is exceedingly rare, presents two principal varieties: (a) Both presentations cephalic, both heads offering, one impacted between the head and trunk of the other fetus; (b) One presentation cephalic, one pelvic, the after-coming head of the breech birth being impacted between the head and trunk of the other fetus.

Management.—If it is not possible to disengage by a combined internal and external manipulation, with the aid of anesthesia and the knee-chest or the Trendelenburg position, the first child may be perforated or decapitated.

Double Monsters

There are three varieties: 1. Those with slight separation; 2. Those with moderate separation; 3. Those with extreme separation. The greater the degree of separation the greater the probability of dystocia.

The diagnosis can scarcely be made except by passing the hand into the uterus. This exploration will also determine the degree of separation.

Premature and spontaneous delivery commonly occurs. Usually delivery may be facilitated by podalic version if the diagnosis is made in time to operate early in the labor. Forceps sometimes may succeed. *Resort should be had to embryotomy in difficult cases.*

Hydrocephalus

Hydrocephalus is attended with a serous effusion into the cranial cavity, with consequent enlargement of the cranial vault and thinning of the brain tissue to a thickness of a few millimeters. The effusion is usually found in the ventricles, very rarely in the arachnoid or subarachnoid cavity. The quantity of fluid may be several pints. The cranial bones are imperfectly developed; the sutures and fontanelles are widened and stretched.

Spina bifida, hydroencephalocele, and other anomalies of development frequently coexist.

The etiology is obscure.

Diagnosis.—(a) HEAD-FIRST CASES.—*Abdominal Signs.*—The best diagnostic evidence is afforded by measurement of the head as determined with a pelvimeter through the abdominal walls, or estimated by palpation. Yet mensuration of the head in this manner may be impossible owing to hydramnios. Sometimes the head presents a distinctly fluctuant feel.

Vaginal Signs.—Vaginal signs are: the size, elasticity, and fluctuation of the cranial vault; excessive width of the sutures (the latter, however, is not peculiar to hydrocephalus, nor is it always present);

Fontanelles, as a rule, preternaturally large;

Sometimes a supplementary fontanelle may be noted between the anterior and posterior;

Unnatural prominence of the frontal and parietal bones.

The size of the head cannot be estimated by the usual method of vaginal examination, which explores only the presenting part. Elasticity and fluctuation are not always readily detected when the cranial vault is rendered tense by firm engagement in the pelvic brim. *When there is doubt, the patient should be placed under an anesthetic and the hand introduced into the uterus.*

(b) HEAD-LAST CASES.—In one case in three the hydrocephalic fetus presents by the breech, the *tendency to breech birth being greater the larger the relative size of the head.* The signs of hydrocephalus in breech birth are:

Body wasted;

Head arrested after the birth of the trunk;

Fluctuation;

The size of the head, as determined by measurement or by palpation through the abdominal wall.

Prognosis.—*Mother.*—The maternal mortality is estimated at 25 per cent. from exhaustion, rupture of the uterus, and hemorrhage.

Child.—The mortality is over 80 per cent. Even if the child is born alive it is of feeble vitality, and is destined to probable idiocy. Nearly all die soon after birth.

Treatment.—Rarely the enlargement of the head may not be sufficient to prevent spontaneous delivery.

As a rule, perforation is required. This should be done as soon as dilation is complete. Extraction is best effected with the cranioclast. The forceps is contraindicated because of its liability to slip and do extensive damage to the uterus and pelvic structures.

Aspiration with a small trocar passed through a fontanelle or suture may sometimes be substituted for craniotomy. The life of the child is not necessarily lost by drawing off the fluid gradually, and a living birth may be desired for medico-legal reasons.

In difficult head-last cases the head may be perforated or the spinal canal opened and the cranial cavity catheterized through it. The perforator can be passed safely beneath the skin, entering it over the neck.

Serous effusions into other cavities, if they cause marked dystocia, are to be evacuated by aspiration of the dropsical cavities or by free incision.

Tumors

Hygroma, fibroma, lymphangioma, myoma, sacrococcygeal teratoma, spina bifida, enlargement of abdominal viscera, and other tumors are occasionally met with.

Treatment.—Delivery of the fetus intact being impossible, fluid tumors may be reduced by tapping or by incision, solid, by segmentation.

ANOMALIES OF LABOR ARISING FROM ACCIDENTS OR DISEASE

PROLAPSUS FUNIS

In prolapsus funis a loop of the navel cord slips down in advance of the presenting part of the fetus. As the labor goes on, the misplaced portion of the cord is compressed between the part presenting and the walls of the birth-canal, and without relief the fetus dies usually within five to eight minutes from the interrup-

Prolapse into the unbroken bag of waters is sometimes spoken of as funic presentation.

Frequency.—Prolapse of the cord occurs once in about two hundred and fifty labors. The frequency differs in different climes from 1-165 to 1-1800.

Causes.—Anything which prevents the presenting part from completely and continuously filling the lower uterine segment predisposes to prolapsus funis. These conditions are:

Hydramnios;

Deformed pelvis;

Malpresentation (frequency in head presentation, 1 in 304; face, 1 in 32; pelvic, 1 in 21; shoulder, 1 in 12);

Complex presentations;

Twins;

Small fetus;

Large pelvis;

Multiparity;

Pendulous abdomen;

Uterine myomata;

Low placental insertion;

Rupture of the membranes while the woman is sitting or standing;

Marginal insertion of the cord;

Excessive length of the cord.

Diagnosis.—The diagnosis should present no difficulty. The prolapsed cord may be found in the bag of waters, in the vagina, or protruding through the vulva. Before rupture of the membranes it may be distinguished from fingers and toes by the anatomical characters of the latter. The fetal parts will usually be drawn up out of the way when touched. After rupture of the membranes there is nothing else which presents from cervix which feels like a cord or may be mistaken for it.

Prolapse of the cord must be distinguished from protrusion of a loop of intestine following rupture of the uterus. In the latter there is more or less hemorrhage, the prolapsed loop is larger, the mesentery can be felt, and pulsation is absent. *The prolapsed portion of the cord should be examined for the funic pulse to learn whether the child is living.* Absence of pulsation for fifteen minutes may be taken as evidence of the death of the

fetus. The fetal heart should be listened for over the abdomen.

Prognosis.—The prolapse itself entails no additional risk to the mother; though the conditions which give rise to it and operative measures necessitated by it may do so.

The fetal mortality may be stated at 50 per cent. It is highest in vertex presentations and in first labors. The danger is much increased after the membranes rupture.

Treatment.—Before Rupture of the Membranes.—In Longitudinal Presentations.—Of first importance is the preservation of the membranes if still unbroken. It should be a rule to rupture them in no case intentionally without first examining for possible prolapse of the cord. *For reposition the aid of gravity should be enlisted* by placing the patient in the *knee-chest*, the *lateroprone*, or the *Trendelenburg position*. *In the lateral posture the patient lies on the side opposite that on which the cord came down.* Gravity alone failing, we may attempt to push the cord up between pains, with care to avoid rupturing the membranes, and crowd the lower fetal pole into the brim to guard against recurrence of the displacement till the presenting part has firmly engaged. At short intervals we should listen over the abdomen for the fetal heart.

After Rupture of the Membranes.—In Longitudinal Presentations.—*Reposition should be accomplished at once if the funic pulse can be felt;* if the pulsation has ceased, but the heart-tones are still audible, the presenting pole should be pushed up and the cord replaced after pulsation returns. If manipulation aided by posture fails to replace the cord, bipolar or internal podalic version should be performed promptly.

The mother must not be subjected to the discomfort and the risks of reposition unless the operator is assured that the child is living and viable.

Methods.—(a) *Manual Reposition.*—The patient is placed in the lateroprone, the genupectoral, or the Trendelenburg posture and anesthetized with ether. The operator twists the prolapsed loop loosely into a rope and pushes it up anteriorly, hooking a loop of the cord over an extremity to prevent it from prolapsing again, operating between the pains. Much handling of the cord is dangerous to the child; it enfeebles the fetal heart. *To retain* the cord, the presenting pole should be crowded firmly into the

excavation and held there by manual pressure or with a tight abdominal binder. The patient should lie in the lateroprone position, with the hips elevated, or in the Trendelenburg position. Examination through the vagina should be made from time to time, lest the cord slip down again as the labor progresses.

The strength and rate of the fetal pulse should be ascertained frequently.

(b) *Instrumental Reposition.*—The aid of posture is essential, as in the manual method. An instrumental repositor is substituted for the hand. An English catheter, with a tape attached and loosely looped over the cord, makes an easily improvised and efficient repositor. After complete reposition the catheter may be left in the uterus.

The instrument is armed with a stylet, which is withdrawn after replacing the cord. The same measures for retention are to be used as in manual reposition.

(c) *Reposition with a gauze tampon* has replaced all other methods in the author's clinic. The woman is placed in an exaggerated Trendelenburg posture, and anesthetized. The corner of a yard square of sterile gauze is loosely tied to the prolapsed loop (not interfering with the circulation), which is pushed up with the gauze anteriorly above the presenting part. The gauze acts as a tampon and prevents further escape of the cord.

(d) *Forceps or Breech Extraction.*—Should all attempts at reduction and retention fail, the child may yet be saved by rapid delivery. This is possible in vertex presentation with forceps or by version; in breech cases, by the usual technique of breech extraction. The author has saved two children by Cesarean section, in primiparæ with undilated cervices, in whom the membranes ruptured early, and allowed the cord to prolapse, owing to non-engagement of the head. The cord, meanwhile, should be disposed where it will receive the least pressure, opposite the sacroiliac joint on the side of the pelvis in which there is most room. As suggested above it is sometimes best to resort to version primarily.

In Transverse Presentations.—*Before the membranes* have ruptured, the loop of prolapsed cord may be reposited by postural methods; *after rupture,* by podalic version aided by posture and anesthesia.

INVERSION OF THE UTERUS

The inversion may be partial or complete. It begins usually as a cup-shaped depression at the fundus, which protrudes into the uterine cavity; or the womb may be turned completely inside out. In the vast majority of cases it occurs just before, rarely directly after, the expulsion of the placenta.

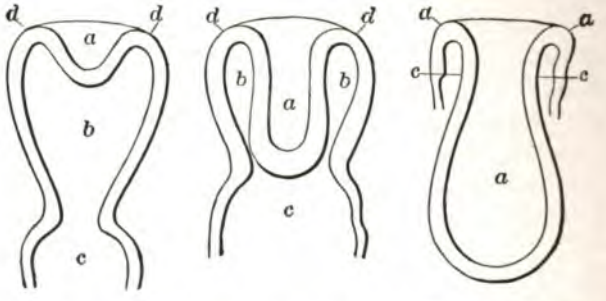


FIG. 86. THREE STAGES OF INVERSION. 1. Cup-shaped depression of fundus. 2. Partial inversion. 3. Complete inversion. *a*, fundus uteri; *bb*, cavity; *c*, vagina; *dd*, mouth of inverted portion.

Frequency.—The frequency of puerperal inversion of the uterus may be estimated roughly at 1 in 100,000 to 1 in 150,000, the rarest of all parturient accidents. In properly conducted labors the accident is well-nigh impossible.

Etiology.—The accident happens with equal frequency before and after the delivery of the placenta. Relaxation of the uterus in the third stage of labor is the primary cause. The relaxed and flabby placental site sags down into the uterine cavity and is seized upon by the contracting uterine muscle and is depressed further downward as a foreign body. Unskilled pressure on the fundus, traction on the cord while the uterus is relaxed, extreme intra-abdominal pressure, an adherent placenta, or a fundal placental seat may contribute to the accident.

Diagnosis.—*Symptoms.*—Complete inversion of the uterus occurs suddenly, and usually is followed by profound shock, pain,

superior strait to one side of the sacral promontory. The hand is held within the uterus till contraction forces it out, when the uterine cavity and vagina should be packed with iodoform gauze until retraction is established.

Another method consists in pressing the fundus upward with the palm of the hand, while two or more fingers indent the lateral wall of the uterus.

When the placenta is adherent the operator should replace all; when it is partially detached he should separate and remove it before trying taxis.

Rigorous aseptic precautions must be observed to prevent infection.

Extreme measures are inadvisable during the puerperium, and attempts at reposition should be deferred for several weeks if not successful within twenty-four hours.

Rarely in irreducible inversion, with persistent hemorrhage, vaginal hysterectomy may be required. An anterior vaginal hysterotomy, begun by cutting the cervical ring, will allow speedy reposition when manual methods fail. The author prefers this to hysterectomy.

RUPTURE OF THE UTERUS

Nature of Accident.—Rarely rupture of the uterus may occur during pregnancy or the puerperium. Spontaneous rupture of the uterus during pregnancy generally begins in the upper segment, and is due to some preëxisting lesion which weakens its muscular walls, such as myoma, fatty degeneration, previous operation scars, et cetera, to cornual pregnancy, or to vesicular mole.

In labor usually the tear begins in the overdistended lower uterine segment, due to some obstruction which prevents the descent of the child through the pelvic canal. It may take any direction and reach any extent within the limits of the organ, but usually runs transversely when spontaneous. The edges are ragged and swollen and the vagina or the bladder may be involved. The portio vaginalis is sometimes torn off. Fissures of the cervix of greater or less depth occur in most labors, and in operative labors, through incompletely dilated passages, may be so extensive as to extend into the uterine body, causing traumatic rupture.

Presenting part absent or receding;
No evidence of fetal life;
Knuckle of intestine in the uterus;
Uterus, firmly contracted, and child forming separate tumors.

The diagnosis is confirmed on examining with the fingers in the uterus.

Prognosis.—This depends on the site, extent and degree of the tear and upon the treatment. In complete rupture the mortality for the mothers is 90 to 95 per cent. from hemorrhage, peritonitis, and septicemia. The fetal mortality is even greater, from complete interruption of the uteroplacental circulation. Under modern methods of treatment nearly 50 per cent. of the mothers may be saved.

Treatment.—1. PREVENTIVE.—The cause of obstruction should be recognized and removed if possible; malpositions should be corrected. In excessive retraction of the uterus, shown by the high position of the retraction ring, immediate delivery is indicated, as a rule, even though it necessitate embryotomy.

2. CURATIVE.—*Incomplete Rupture.*—The child should immediately be delivered by forceps, or, if dead, by embryotomy. Should the dilation not be complete, manual dilation, or vaginal hysterotomy, if required, may be practiced. Small lacerations, with little or no bleeding, may sometimes be treated by drainage, the blood-clots are removed and the rent packed with plain or oxid-of-zinc gauze. The gauze is removed in two or three days. Much hemorrhage or extensive injury requires laparotomy and suture.

In case of doubt, as between complete and incomplete rupture, the question may be decided by manual exploration through a posterior vaginal incision.

Complete Rupture.—The indications are to extract the child and to control hemorrhage. (a) When the fetus or larger part of it is still in the uterus it should immediately be extracted by the natural passages. In vertex presentation delivery is best effected by perforation in the grasp of the cephalotribe or forceps. The placenta is removed manually. Rarely small lacerations in the lower and posterior portion of the uterus may be treated by drainage, when assurance can be had that neither liquor amnii, meconium, nor much blood has escaped into the peritoneum. A

half-inch rubber tube is folded, the limbs of the tube tied together, the bight of the tube perforated in several places and passed just through the uterine rent. Instead of this several strands of wicking or a bundle of gauze ropes may be used. Prolapsed intestine must be reposited. The uterus must be made to contract. The drain is removed in two or three days on cessation of much discharge.

(b) Celiotomy should be done when the fetus is wholly in the peritoneal cavity, has long been dead, or when there has been much hemorrhage into the peritoneum, or when the cervix is not dilatable, or the rupture is extensive, or its site not favorable for drainage. The uterine lacerations are closed by deep suture. The peritoneum is cleansed by sponging or by irrigation with the normal salt solution.

Amputation of the uterus, or total hysterectomy, should be resorted to when necessary to avert sepsis; especially is this advisable if the lacerations are extensive or the uterus is infected.

By certain authorities abdominal section is practiced in substantially all cases of rupture, whether complete or incomplete, and regardless of the amount of hemorrhage.

TREATMENT OF ANEMIA.—If there is much loss of blood the anemia is to be treated, as in other cases, by bandaging the extremities, raising the foot of the bed, by hypodermic, intravenous, or rectal injections of the physiological saline solution, or by direct transfusion and the administration of opium, adrenalin, strychnin, and by other restorative measures.

THE HEMORRHAGES

1. *Placenta Prævia—Unavoidable Hemorrhage*

Definition.—The placenta is said to be previa when its attachment is to the lower uterine segment and its site encroaches upon the zone of the uterus, which undergoes dilation in the first stage of labor.

Degrees of Placenta Prævia.—1. *Partial.*—The great mass of the placenta lies on one side of the lower uterine segment, partially covering the fully dilated os. Marginal and lateral implantation may be included under this variety.

2. *Complete.*—The central portion of the placenta wholly covers the fully dilated os. Full central implantation is rare.

Frequency.—Placenta prævia is observed in about one in one thousand labors. It occurs four to six times more frequently in multiparæ than in primiparæ, and is more often met with in the working classes.

Causes.—Possible causes of misplaced placenta are conditions giving rise to tardy fixation of the ovum, permitting it to drop into the lower uterine segment; e. g., endometritis, enlargement of the uterus, relaxation of the uterus, or multiparity, abnormally

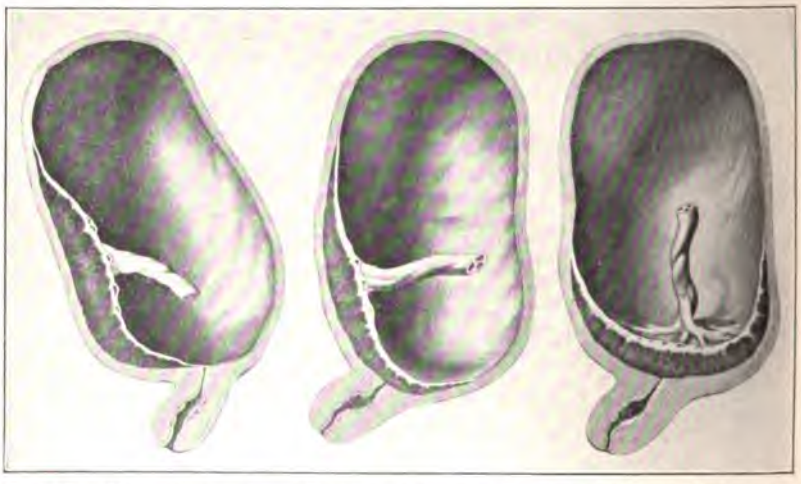


FIG. 87.—RELATION OF THE PLACENTA TO THE INTERNAL OS IN MARGINAL, PARTIAL AND CENTRAL PLACENTA PRÆVIA

low position of the tubal orifice; low fixation of the ovum, due to development of the placenta, in part, upon the decidua reflexa; reflexal placenta is believed to be a cause, yet pregnancy with a reflexal placenta seldom goes to term.

The *cause of hemorrhage during labor is the separation of the lower margin of the placenta, exposing and opening the sinuses in the placenta site, which takes place as soon as canalization of the cervix begins.* In central and partial placenta prævia the hemorrhage *may begin* early in pregnancy. Hemorrhage before

(3) There is a bogginess of the cervix, vaginal vault, and the lower uterine segment.

(4) The characteristic stringy feel of the detached surface of the placenta may be noted on examination through the cervical canal; the uneven surface of the cotyledon and a gritty feel distinguish it from blood-clots which are more friable. It should be borne in mind that the portion of placenta over the cervix may be only an adventitious cotyledon.

In marginal placenta prævia the edge may be felt, especially if detached.

Prognosis.—Without intervention the maternal mortality in cases that go to the later weeks of pregnancy is one-third to one-half, including deaths from the sequelæ. Two-thirds or more of the children are lost.

The maternal mortality results from hemorrhage, shock, sepsis, rupture of the lower segment, and thrombotic affections; the fetal from asphyxia, the effect of the maternal hemorrhage on its blood-supply, from prematurity and operative causes. The mortality for both mother and child obviously must vary, however, with the degree of hemorrhage. Maternal deaths from placenta prævia are rare before the seventh month. The danger to life increases as gestation advances by reason of the increasing size of the blood vessels and the progressive loosening of the placental attachment. Postpartum hemorrhage is common.

Hemorrhage begins earlier in partial than in complete placenta prævia, since the small free portion of the placenta in the former slides more readily than does a placenta implanted all about the os.

With skillful treatment the maternal mortality in placenta prævia is less than 5 per cent., and the fetal mortality is greatly reduced.

In 143 cases of previal placenta collected by Chrobak, miscarriage occurred in 4 per cent., premature labor in 5 per cent., term delivery in 1 per cent.

Treatment.—(a) Before Viability.—Generally the pregnancy should be terminated as soon as a positive diagnosis of a previal placenta is made. *Exceptionally the treatment may be expectant,* provided the patient is in a hospital under constant observation. Partial or complete rest must be enjoined according to the amount

of bleeding, and a general regimen prescribed very similar to that pursued for the arrest of threatened abortion or premature labor. *If the hemorrhage is copious,* the *placenta prævia complete, or the fetus dead, the uterus should be immediately emptied.*

(b) AFTER VIABILITY.—*Induction of labor is indicated immediately the diagnosis is made,* simple cases excepted.

Management of Labor.—The principal indications in the management of labor with placenta prævia are the control of hemorrhage and the securing of dilation of the cervix. Hemorrhage under control, urgent measures are not necessarily required, but the obstetrician should remain with the patient until she is delivered.

Rupture of the membranes and the application of a firm abdominal binder may suffice in simple cases of marginal placenta prævia. If uterine contractions are efficient, or can be made so by stimulation, the bleeding usually is controlled in the lesser degrees of vicious implantation by the engagement of the presenting part. The presenting pole acts as a tampon.

If the cervix is sufficiently dilated, *forceps,* with very moderate traction, may be tried in marginal cases if required to hold the head in the lower uterine segment as a tampon. After dilation, delivery may be effected by forceps if the patient's condition demands it.

Before dilation of the cervix, the vaginal tamponade is a useful measure when there is little or no dilation of the cervix, less than two fingers, as it not only controls hemorrhage but hastens the dilation of the cervix. It is best placed with the woman in the Sims or the genupectoral posture, and with the aid of a speculum. The best material is sterilized gauze in strips; it may be used plain or impregnated with a nontoxic antiseptic such as oxid of zinc. *To pack solidly it must be wet.* More than enough to completely fill the vagina should be used, and the protruding portion held under the pressure of a firm T-bandage. The external genitals should be cleansed, but the vagina, if healthy, requires no antiseptic cleansing before placing the tamponade. The dressing is removed in six or eight hours. It may be renewed if the dilation is not sufficient for delivery, or resort may be had at once to bipolar version.

A more efficient means of hemostasis and dilation is the dilat-

ing *water-bag* in the cervix, Braun's, Pomeroy's, Voorhees', or the Champetier de Ribes. A sterile Voorhees or de Ribes bag may be introduced through a cervical canal admitting two fingers. The membranes *should be ruptured* so that the bag may rest against the fetal surface of the placenta and cause it to act as a tampon.

Bipolar podalic version is a measure of the greatest value for controlling the hemorrhage. It is especially indicated in case of much bleeding with little dilation (external os must be up to two fingers) and before rupture of the membranes. With one or both feet down the fetus serves as a conical cervical plug. Bipolar version can be done as soon as two fingers can be passed through the cervix. The edge of the placenta is pushed aside and the fingers passed through the membranes. Even after sufficient dilation it is seldom necessary to pass the entire hand into the uterus. After version the child *should not* be extracted until the dilation is complete. The delivery must be effected very slowly and with extreme care to avoid shock. Usually it is better, if possible, to leave the expulsion to nature. A dead or nonviable fetus should be delivered with the least possible tax upon the mother—craniotomy.

Manual dilation and immediate extraction of the child, recently advocated by eminent authority, *must be regarded as a questionable procedure when the woman is exsanguinated or much exhausted.* It exposes the woman to greater danger from trauma, embolism, and sepsis. The writer is opposed to the procedure.

Extraction of the child by *perforation of the placenta* in central or nearly central implantation is better than detaching the edge and passing the hand around it.

Cesarean section promises little better results than the recognized obstetric methods. It may be chosen in very exceptional cases, as in previal placenta in old primiparæ, at full term, with large child, having little previous hemorrhage, mother in good condition, with rigid soft parts.

Other Methods.—Separation of the placenta from the lower uterine segment (Barnes) permits retraction of the part thus uncovered. The area of detachment should be not less than 11.5 cm. (4½ inches) in diameter.

This procedure is not to be recommended except in simple cases of partial placenta prævia. Cragin advocates the introduction of the No. 4 Voorhees bag into the lower uterine segment, in an

extraovular position, against the maternal surface of the placenta, without rupture of the membranes. This secures dilation and tampons the bleeding surface and permits retraction of the lower segment. Delivery should immediately follow the expulsion of the bag.

Complete separation and extraction of the placenta may sometimes be practiced in case the child is dead or not viable. *If the patient's condition is bad, a firm cervical and vaginal pack may be placed to control hemorrhage till she has rallied sufficiently to permit extraction of the child.*

PRECAUTIONS.—*Full dilation of the soft parts* should always be secured before extraction is attempted. *Too precipitate and violent interference is to be avoided, especially if there has been much hemorrhage.* It is largely responsible for the high death-rate of placenta prævia.

Shock, infection, and postpartum hemorrhage are especially to be guarded against. Ergot should be given for several days after labor.

TREATMENT OF ACUTE ANEMIA.—Treatment is often required after the delivery to combat the effects of the excessive blood loss. The principal measures are: Elevation of the foot of the bed; bandaging the extremities (autotransfusion), continued for thirty minutes; hot applications to the feet; opium, gr. ij, p. r. n., or preferably a hypodermic injection of morphia, gr. ¼ to ½. The injection of normal salt solution (9/10 of 1 per cent., approximately, gr. iij, ad ℥÷ into a vein, into the rectum, into the cellular tissue between the scapulæ, or behind the mammary glands between the gland and pectoral fascia, is a most valuable measure. A readily improvised apparatus for intravenous infusion is made with a glass funnel, a few feet of rubber tubing, and a cannula of glass or metal. Apparatus and solution should be sterilized by boiling, and the latter be filtered. The salt solution should be slowly injected at the temperature of 100° F. One-half to one pint may be used intravenously.

The postmammary injection is simple, safe, and scarcely inferior in efficiency to intravenous infusion. For this or other subcutaneous injections a coarse aspirating needle attached to a fountain syringe may be used; all must be sterile. One quart or more of the solution may be given in this manner.

Enteroclysis with the physiological saline solution, together with suitable nutrient enemata, helps materially in refilling the vessels. Eight ounces of the solution may be given every four hours.

Liquids by the stomach must be given in small quantities, and often beginning with 3j, at intervals of a minute or two. Plain hot water, brandy, or whiskey and hot water are good restoratives. The use of nutrient fluids may be begun after a few hours. *When the hemoglobin is below 30 per cent. direct transfusion should be practiced.*

2. *Accidental Hemorrhage*

This term applies to bleeding resulting from the partial or complete separation of a normally seated placenta occurring in

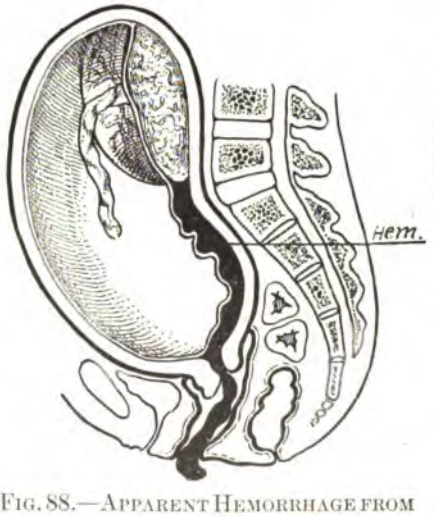


FIG. 88.—APPARENT HEMORRHAGE FROM PARTIAL SEPARATION OF PLACENTA

FIG. 89.—CONCEALED HEMORRHAGE BEHIND PLACENTA

the later months of pregnancy or at the beginning of labor. For this condition Dr. R. W. Holmes has suggested the name *ablatio placentæ*.

Varieties.—(a) *Apparent*, in which the lower margin of the placenta is detached and the blood separates the membrane from the uterine wall, and is discharged by the vagina (Fig. 88).

(b) *Concealed,* in which the effused blood collects in the uterine cavity. Either of the following conditions may obtain:

1. The placenta may be detached at the center, and the margin remain adherent (Fig. 89).

2. The placenta may be detached at one edge, partially lifting the membranes beyond the margin;

3. The placenta may be detached at one edge, partially lifting the membranes beyond the margin, when the overlying membranes may rupture and allow the blood to escape into the amniotic sac;

4. Separation of one edge of the placenta and of the adjacent membranes may take place, and the lower segment of the uterus be occluded by the fetal head and so prevent the escape of blood from the uterus (Fig. 90).

FIG. 90.—CONCEALED HEMORRHAGE, HEAD OCCLUDING ESCAPE OF BLOOD

Causes.—The causes are:

The loose attachment of the placenta, normal to the last weeks of pregnancy;

Violent muscular effort;

Violent uterine contractions;

Short cord;

Excessive distention of uterus;

External violence, as blows or falls;

Disease of deciduæ;

Placental disease;

Nephritis;

Toxemia;

Acute infectious diseases.

Diagnosis.—*Apparent Variety.*—Accidental hemorrhage usually occurs before labor begins or in the first stage. It is necessary to distinguish it from rupture of the uterus and from placenta prævia. The former occurs later in labor and is attended with recession of the presenting part, with diminution of the uterine tumor, and the development of a new abdominal tumor. The latter is readily recognized or excluded by a physical exam-

ination. Bleeding from low implantation of the placenta may easily be mistaken for accidental hemorrhage.

Concealed Variety.—The principal signs are:

Extreme pallor; shock of some degree; persistent tension of the uterus, while the rhythmic contractions become weak; a node or boss forms on the uterine surface at the site of the retroplacental blood collection, or the uterus becomes atonic and is distended by the accumulation of blood. The uterine tumor may be boggy, or tense, especially in the upper segment; the fetal parts are obscured to palpation; there may be continuous pain and tenderness in certain cases from distention of the perimetrium; *bloody liquor amnii may be detected by pushing up the presenting part and allowing a portion of the liquor amnii to escape;* the fetal heart-tones are feeble and irregular, or absent.

Together with these signs are the signs of internal hemorrhage, viz., collapse; pallor; surface, especially of extremities, cold and clammy; excessive perspiration; respiration irregular; sighing; sobbing; yawning; pulse rapid, thready, and compressible; thirst; jactitation; tinnitus aurium; dyspnea; nausea; dimness of vision; syncope.

It should be remembered that a concealed hemorrhage may coexist with an insignificant apparent hemorrhage.

Differential Diagnosis.—Ablation is distinguished from acute hydramnios by absence of unusual pallor in the latter; from placenta prævia, by physical signs, and by absence of persistent uterine tension and pain in previal placenta. Rupture of the uterus rarely occurs before the end of the first stage of labor. A ruptured ectopic gestation should be distinguished by bimanual examination, especially by the lesser development of the uterus.

Prognosis.—*Apparent Variety.*—In this form the prognosis is not so grave for the mother as in concealed hemorrhage, but frequently is fatal to the child.

Concealed Variety.—For the mothers the mortality is 50 per cent., from shock due to hyperdistention of the uterus and operative causes, from blood-loss before, and during, labor, from postpartum hemorrhage, and the sequelæ. The fetal death rate is 90 per cent. or more, chiefly from asphyxia, due to interruption of the uteroplacental circulation. Prematurity is sometimes a contributing cause.

The prognosis varies considerably in the experience of different observers, and depends to no small extent upon the treatment pursued.

Treatment.—The chief indication is to evacuate the uterus as speedily as possible, so that the uterine muscle will contract and close the bleeding sinuses. If the bleeding is slight no immediate intervention may be required except to rupture the membranes. The patient should be kept under close observation, and in bed. Chlorid of calcium, gr. xx, every three hours, is useful by promoting coagulability of the blood. A very tight abdominal binder and an icebag upon the lower abdomen may help.

Generally in either variety of hemorrhage the cervix should be dilated manually. After full dilation the delivery is rapidly completed by forceps or version, or in dead or nonviable fetus by embryotomy. Firm compression of the uterus is maintained manually by a skilled assistant during delivery. Precautions should be taken against postpartum hemorrhage.

When the cervix resists manual dilation and immediate delivery is urgently demanded, vaginal Cesarean section may be performed. In exceptional cases an abdominal Cesaro-hysterectomy may be demanded.

The effects of blood loss are combated as in other hemorrhages.

3. *Postpartum Hemorrhage*

Postpartum hemorrhage may occur during the third stage of labor, or in the first twenty-four hours post partum from relaxation of the uterine muscle, from injuries to the cervix, vagina, and vulvovaginal orifice, from ruptured vessels and tumors in the parturient tract, from relaxation of the uterine muscle.

Definition.—By postpartum hemorrhage is meant hemorrhage occurring shortly after the birth of the child and having its origin at the placental site. The accident can seldom happen in well-managed labors. Bleeding from laceration of the passages does not come within the meaning of this term in its technical sense. To distinguish excessive from the physiological flow, it is necessary to remember that normally the blood loss at the birth of the child varies from two or three ounces to a pint.

Causes.—The causes are imperfect ligation of the uterine ves-

sels in consequence of inertia uteri or atony from exhaustion or from overdistention of the uterus, badly managed third stage, excessive use of chloroform, precipitate labor and sudden expulsion of the child, nephritis, hemophilia, full bladder, or a rectum

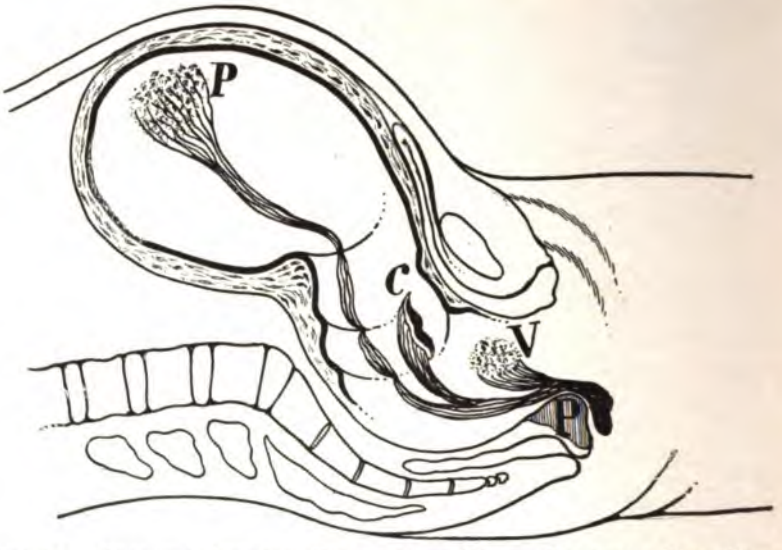


FIG. 91.—DIAGRAM SHOWING POINTS FROM WHICH BLEEDING MAY COME. P. Placental site; C. cervix; V. vagina; P. perineum and pudendum

packed with feces. A partially detached placenta, the retention of blood coagula or of fragments of secundines tend to prevent full uterine contraction and closure of the vessels. Uterine neoplasms may have a like effect. Bleeding after labor ceases physiologically:

1. Because of the increased coagulability of the blood.
2. Owing to the irregular tearing of the vessels in the placental site as the placenta is separated.
3. Because of the ligation of the uterine sinuses by retraction of the uterine muscle fibers.

Diagnosis.—*Danger Signals.*—A history of hemorrhage in previous labors; an overrapid pulse, above 100; imperfect retraction, detected by palpation over the abdomen; the uterine tumor remaining relaxed; or the presence of other recognized

causes of hemorrhage, such as nephritis, hemophilia, long-continued chloroform narcosis, et cetera, are danger signals.

Signs.—The bleeding may occur before or after the expulsion of the placenta. The signs are: a sudden outpour of blood, an atonic uterine globe, which is difficult to outline through the abdominal wall, with the systemic effects of acute hemorrhage, as shown in the pulse, color, and respiration of the patient.

It must not be forgotten that the absence of external bleeding does not alone forbid the diagnosis of hemorrhage. *Excessive bloody flow, with firm uterine contraction, does not proceed from the uterine cavity; it comes from laceration of the cervix, vagina, or vulva.*

Treatment.—PROPHYLAXIS.—The preventive treatment must be addressed to the uterine retraction. The uterus should be watched, with the hand continuously on the abdomen, from the birth of the child and for at least a half hour after the placenta is delivered. Care should be taken that no fragment of placenta is left in the uterus. Friction may be used if required to provoke normal contractions. *Too early resort to Credé's manipulation may cause imperfect separation of the placenta, and produce hemorrhage from partial separation of the placenta.* In persistent inertia, ergotole 5ss, and pituitrin, 1-3 decigrams, injected hypodermically, and repeated, p. r. n., is a valuable prophylactic. It is often indicated after chloroform anesthesia, and in all conditions which predispose to hemorrhage. It is a wise precaution to give ergot on birth of the head when there is reason to fear postpartum hemorrhage. It is the abuse, not the proper use, of ergot that has brought it into disrepute in certain quarters.

REMEDIAL MEASURES.—(a) *In moderate hemorrhage,* the remedial measures are: manipulation, ergot, pituitrin, and the hot intrauterine douche.

Bleeding may be controlled by *manipulation* of the uterus with one or both hands over the abdomen; or conjoined manipulation with one hand over the abdomen and two or three fingers of the other hand in the posterior vaginal fornix, forcibly anteflexing and compressing the uterus; or, *by lifting the uterus out of the pelvis, constricting the lower segment, by grasping it and compressing it against the sacral promontory, while the fundus is pressed against the vertebral column,* in conjunction with the

fluid extract of ergot, or ergotole and pituitrin, 3ss, best injected into the muscle of the thigh, or a *hot intrauterine douche*, continued for not more than two minutes, at a temperature of 118° F.

(b) *Severe hemorrhage* can be checked with the gloved hand in the uterus, compressing it against the abdominal aorta; the acetic acid douche, the uterine tamponade, or the Momberg compression belt; *compression and kneading* of the uterus, with one hand in the cavity and the other on the abdomen; *hot intrauterine douche*, temperature, 120° F., containing three per cent. of *acetic acid*, U. S. P.

A most efficient means of control of severe postpartum hemorrhage is a *firm* [illegible] with sterilized strip-gauze about four inches wide. [illegible]ays be used in hemorrhage not promptly controlled by [illegible]ures. One or two sterile roller bandages may be [illegible] obstetric bag ready for immediate use. The [illegible] a douche, as he has found that *bleeding which is* [illegible] *by manipulation, ergotole, and pituitrin can not be* [illegible] *t by the intrauterine tampon.*

To tampon the uterus the patient is placed in the lithotomy position, the cervix caught with a volsella and drawn well down. The gauze is carried into the cavity of the uterus with a uterine dressing forceps over the palmar surface of the gloved hand as a guide. Lacking instruments, the packing may be placed, though less satisfactorily, with the fingers alone. It should be removed cautiously by withdrawing a little at a time, within twelve to twenty-four hours.

Momberg's compression belt consists of a rubber tube, which is placed around the waist above the fundus uteri, and tightened until the femoral pulse can not be felt; such forcible compression of the aorta cannot be made without danger.

Additional measures are the following: application of the child to the breast as a reflex excitomotor; compression of the abdominal aorta with the hand on the abdomen; flagellation of the lower abdomen with a wet towel; faradism to the uterus, one electrode within the uterus and one over the abdomen or the upper sacral region, or, better, from the standpoint of asepsis, both electrodes over the abdomen, one on either side of the uterus;

swabbing the entire uterine cavity with tincture of iodin.

Hemorrhage from a lacerated cervix is best controlled by suture. The first stitch should be passed just above the angle of the tear. Vaginal hemorrhage may also be arrested by suture-ligature. The resulting anemia is treated as in other cases.

Secondary Postpartum Hemorrhage

Definition.—By secondary postpartum hemorrhage is understood hemorrhage from the placental side occurring within the postpartum month later than six hours after labor.

Causes.—The usual causes are retention of membranes, placental fragments, or blood-clots; congestion of the uterus from misplacement, dislodgment of thrombi from the uterine sinuses, uterine fibromata and polypi, or other causes; getting up too soon; violent emotion.

Treatment.—The patient should be kept in bed and the causes removed, if possible. Uterine displacements should be corrected. Hot vaginal douches, two or three gallons at a temperature of 120° F., are often effective. These measures failing, the uterine cavity may be digitally explored for retained fragments of placenta and packed with gauze; the packing to be removed in twelve to twenty-four hours.

SEPARATION OF THE SYMPHYSIS PUBIS

Rarely rupture of the symphysis pubis may occur spontaneously, owing to the excessive relaxation of the joint which sometimes develops in the later months of pregnancy. It is more frequently the result of unskillful use of forceps. The vagina and bladder are sometimes lacerated. Tears of the anterior soft parts may extend into the peritoneum.

Diagnostic Signs.—The diagnostic signs are: intense pain referred to the joint; mobility of the pubic bones upon each other; the presence of a sulcus between the bones, and locomotion impeded on getting up. The mobility of the bones is readily made out by forcibly flexing and extending the thighs and by rotating one knee outward, the patient on the back, or by requiring the patient to rock the body from side to side while standing.

Treatment.—Keeping the patient in bed and immobilizing the joint for from four to six weeks by the use of a firm pelvic bandage of Z. O. plaster encircling the pelvis, if begun directly after labor, may generally be trusted to bring about union of the bones. Neglected cases may be treated by vivifying the joint surfaces subcutaneously and applying the bandage for four weeks, the patient maintaining a recumbent position in a hammock bed. Suturing the bone with silkworm-gut, catgut, or silver wire is seldom advisable.

ECLAMPSIA

Eclampsia is the result of an acute toxemia occurring in the pregnant, parturient, or puerperal woman.

Definition.—Puerperal eclampsia is synonymous with puerperal convulsions. The convulsions are epileptiform in character, and attended with loss of consciousness and followed by coma. They occur most frequently toward the close of pregnancy, or during the labor, or in the first few days of the puerperium. Convulsions in child-bed from hysteria, epilepsy, or cerebral lesions, independent of the toxemia of pregnancy, are not included under this term.

Frequency.—The frequency is variously estimated at about 1 in 500 cases of advanced gestation. The disease, however, appears to be more prevalent at certain times and in certain localities. Eclampsia is three times more frequent in primiparæ than in multiparæ, and ten times more so in multiple than in single pregnancies. Hydramnios seems to be a predisposing factor. It is observed oftenest in very young and in very old primiparæ. Moderate albuminuria, if persistent, is more likely to be followed by eclampsia than when the albuminuria is extreme.

Etiology.—The primal cause of the convulsions is a profound toxemia, which is probably metabolic in origin, with secondary lesions of the kidneys and imperfect elimination by these and other emunctories. The toxemia is analogous to that of hyperemesis, and is characterized by striking lesions in the liver similar to those of acute yellow atrophy. Vomiting and eclampsia probably are not identical in origin as some authorities have assumed. Toxins in the maternal blood are conveyed first to the liver, where they are oxidized and converted into substances fit for elimination

by the kidneys. If the liver fails in its functions, incompletely oxidized waste products will circulate in the maternal blood, which are irritating to the kidneys, the central nervous system, and the capillaries everywhere. The kidney complication is usually secondary, and may be nothing more than acute insufficiency, or it may be a degenerative lesion, or an acute parenchymatous nephritis. Sometimes an acute supervenes upon a chronic nephritis. Some degree of hepatic degeneration is always present in the post mortem findings in eclamptic patients. These vary from thrombosis of the perilobular veins to necrosis in the lobule. In some cases the degeneration reaches the grade of acute yellow atrophy. While a small proportion of cases display no renal insufficiency prior to the eclampsia, some form of renal disease is discovered post mortem in a large majority of eclampsias, evidencing the increased load put upon the kidneys in their attempt to eliminate the maternal toxins. In more than 4/5 of all eclamptics albuminuria or other signs of a kidney breakdown are present. In 368 cases examined post mortem, nephritis was present in 46 per cent.; in 54 per cent. there were degenerative processes; the latter doubtless were, in part, secondary to the eclamptic seizure (Prutz). Schmorl, in 73 cases, found parenchymatous and fatty degeneration of the secreting epithelium of the kidney in all but one. Apparently the immediate cause of the convulsions is spasm of the arterioles and consequent anemia of the brain, induced by the toxic material in the blood. Reflex irritation from the uterus is a potent coöperating factor in precipitating the eclamptic attack.

Premonitory Symptoms and Signs.—The premonitory signs and symptoms are:

(1) An increased blood pressure of 150 mm., or more;

(2) Scantiness of the urinary output, with diminished elimination of the total solids;

(3) Edema, especially of the face;

(4) General lassitude and muscular weariness;

(5) Headache, generally frontal, suboccipital rarely;

(6) Nausea and other digestive derangements, as flatulence and constipation. Functional inactivity of the liver is a usual accompaniment of pregnancy;

(7) Contracted pupils;

(8) Visual disturbances, amaurosis, et cetera.

(9) Persistent epigastric pain;

(10) Albuminuria. This is an early danger sign of toxic irritation in about 75 per cent. of the cases, and is often apparent before other evidences of toxemia are observed;

(11) Deficiency of urea and of other urinary solids;

(12) Tube casts in the urine.

Differential Diagnosis.—Generally puerperal eclampsia is to be distinguished from hysteria and epileptic convulsion by the urinary examination and by the history.

Clinical Phenom *anger signals* always pre-
cede the occurrence of c izure. The patient either
complains of severe ar dache or some visual dis-
turbance, which is p y the convulsive paroxysm
in which the eyes l rently upon some distant
object. Consciousnes The spasms begin in the
facial muscles, then The convulsion is at first
tonic, then clonic. Fo ient is asphyxiated, owing
to the tonic spasm of the r muscles. A few seconds
later the breathing becomes stertorous. Froth oozes from the mouth and nostrils. The tongue usually is bitten during the convulsive seizure, and the frothy discharge is blood-stained.

The duration of the convulsion is usually one or two minutes. The interval between the attacks may be a few minutes or several hours.

Coma follows the eclamptic seizure, generally subsiding within a half hour. The coma, as a rule, deepens after each successive convulsion, owing to increasing edema of the meninges or cerebral congestion. Usually the pulse is rapid, often reaching 140 or more during the attacks. The temperature in different cases varies from normal or subnormal to 105° F., or more. The temperature rises with each repetition of the convulsion. The pyrexia probably is of toxic origin. *Generally labor begins on the occurrence of convulsions*, if not already established, when the patient is attacked near term. This is not the rule, however, when the seizures occur in the midtrimester before any cervical effacement has taken place.

Prognosis.—The prognosis is the more grave the earlier the attack in pregnancy or labor. The danger increases with the num-

ber of convulsions. Recovery is exceptional after fifteen or twenty seizures, and *seldom occurs after a temperature of 105° F. A small and feeble pulse is a bad prognostic. Profound coma, complete suppression of urine, marked icterus, high temperature, 105° F., or paralysis, indicate an unfavorable prognosis. A normal or subnormal leukocyte count is a fatal prognostic. A high count, if persistent, is favorable. Impairment of the mental faculties sometimes follows. Psychoses result in about 6 per cent. of eclamptic women.*

The toxemia of pregnancy in women pregnant for the first time, after forty years of age, is almost invariably fatal if the pregnancy is allowed to go to the later months.

Pregnancy in primiparæ, the subjects of nephritis before conception, is uniformly fatal if not interrupted before term (Tyson).

The maternal mortality of eclampsia varies from 25 to 39 per cent. from exhaustion, asphyxia, sepsis, cerebral hemorrhage, edema of the lungs. The percentage of deaths from eclampsia may be roughly estimated as follows: convulsions beginning before labor, 39 per cent.; during labor, 25 per cent.; after labor, 19 per cent. The fetal death-rate is from 50 to 80 per cent., mainly from asphyxia. The toxic material is transmitted to the fetal blood, and a certain proportion of children die after birth from this cause, usually from convulsions.

Treatment. —*The treatment of this toxemia* should be based on the following principles:

(1) The products of metabolism requiring elimination should be minimized;

(2) The elimination of metabolic products should be favored;

(3) The high blood-pressure should be reduced;

(4) If the toxemia does not show improvement under the preceding principles of treatment, or if a convulsion occurs, the uterus should be emptied.

(5) All methods of treatment should be avoided which will reduce the resistance of the patient or seriously damage any of her organs.

PROPHYLACTIC.—A milk-diet limits the toxemia. In marked toxemia it should be given to the exclusion of all other food, at least for a time. Farinaceous food and fish may be allowed to a limited extent as the symptoms improve.

Free catharsis by salines and diaphoresis by hot air baths, hot packs, and the use of sweet spirits of niter render important service by supplementing the crippled elimination.

Water is essential for diuresis; it may be given hot or half-cold, plain or mildly alkaline; from four to eight pints may be taken daily, or a pint of normal salt solution may be injected behind each breast every four to six hours. Colonic irrigation with hot normal salt solution, using a double cannula, is an efficient diuretic measure. Fifteen to twenty gallons may be used. It may be repeated once or twice daily.

Dry cups follow ions over the kidneys are useful.

Nitroglycerin in fu ble, not only as a diuretic but as a direct anti-

Fluid extract of quibb), miij to mvj, t. i. d., or enough to hold th ty, is an efficient prophylactic. Veratrum alw lood pressure.

Chloral, 3j to 3ij mid of sodium in similar doses, is one of the mo for subduing the reflexes.

To summarize: (1) Elimination through the skin is induced by sweating, by the hot-air bath, or the hot wet pack; (2) through the urinary tract, by physical rest and the ingestion of large quantities of water; (3) through the intestinal tract by saline cathartics and colon irrigations, while (4) the blood-pressure may be reduced with veratrum, chloral, and nitroglycerin.

Iron is frequently indicated. Basham's mixture is a suitable preparation.

Marked nervous manifestations, or scanty urinary secretion, not promptly relieved by dietetic and medicinal measures, call for the induction of labor.

Remedial.—The principal reliance for controlling the convulsions is on the combined use of ether-oxygen inhalation, veratrum viride, or nitroglycerin, catharsis, diaphoresis, active diuresis by hypodermoclysis, and the prompt evacuation of the uterus. For veratrum, chloral may sometimes be substituted.

Ether-oxygen Inhalation.—Pending the action of other remedies the patient should be placed at once under ether-oxygen, nearly, or quite, to the surgical degree. Ether-oxygen by inhalation is an almost certain anti-eclamptic. Its use is always im-

perative during operative interference. Yet prolonged narcosis is dangerous; one or two hours usually should be the limit.

Veratrum Viride.—Fluid extract of veratrum viride (Squibb), m x to m xx, is to be injected subcutaneously with morphia sulphate, gr. ¼, which increases its efficiency. If, at the end of a half hour, the pulse is not below 60, another ten minims should be injected. In order to use veratrum viride efficiently, the blood pressure should be taken before and after the administering of each dose. A convulsion is substantially impossible while the circulation is sufficiently under the influence of veratrum to hold the pulse-rate below 60, and the blood-pressure to 120 mm., or less. The patient should be required to maintain the recumbent posture while using the drug in large doses. Tumultuous action of the heart ensues immediately on rising. Collapse under veratrum is successfully combated by the use of morphin hypodermically, or by whiskey administered in similar manner, or by the bowel.

Veratrum, by its effect as a vasomotor relaxant, not only controls convulsions, but it acts as a diuretic and a diaphoretic.

Morphin.—The addition of morphin, gr. ¼, to the veratrum adds to the efficiency of the treatment. The combination of morphin with veratrum is especially recommended when the pulse is feeble.

Chloral is best given by the rectum in a teacupful of milk. The dose may be 5ss hourly till 5j or 5ij have been given. Or the drug may be introduced into the stomach through a tube, after washing out the stomach. One drachm in 100 drachms of water may be exhibited in this manner.

Catharsis.—For catharsis, calomel, and salines, elaterium, gr. ¼, or croton oil, m j to m ij, may be employed.

Diaphoresis.—The free action of the skin is to be maintained by the same measures as suggested in the prophylactic treatment.

Diuresis.—Valuable measures for this purpose are hypodermoclysis, the injection of a pint of normal salt solution,[1] behind each breast every four hours, or enteroclysis, or the irrigation of the

[1] The following saline solution increases the quantity of the urine and of the urinary solids (Jardine).

℞—Sodii acetat .....
Sodii chlorid ..... āā 3ij
Aquæ 0ij

bowel with a hot normal salt solution every four hours. Fifteen to twenty gallons may be used for colonic irrigation, using a double current cannula, as a Kemp cannula. The use of the saline solution, if carried too far, may overload the right heart.

Other Measures.—Other anti-eclamptic measures of repute are: nitroglycerin, gr. 1/50 to 1/25, hypodermically, p. r. n.; amyl nitrite, m.v., by inhalation; the inhalation of oxygen; the application of ice to the head and the carotids; in marked cyanosis, venesection, taking sixteen ounces of blood. Zweifel ruptures the membranes as the first thing in the treatment. Lumbar puncture for withdrawal of cerebrospinal fluid has yielded no definite good results.

Prompt Evacuation of the Uterus.—Where it is decided to empty the uterus, the pregnancy should be terminated in such a manner as will not reduce the resistance of the patient, or seriously damage any of the organs. The method to be employed depends: *1st, on the patient's general condition; 2nd, on the period of pregnancy; 3rd, on the condition of the cervix.* Labor usually sets in on the occurrence of eclampsia. Measures are indicated to accelerate the labor if it has already begun, or to induce it if not spontaneously established. Convulsions cease in more than 60 per cent. of cases after delivery. Recourse may be had to manual or hydrostatic dilation of the cervix, multiple incisions, or to vaginal Cesarean section in extreme cases. Vaginal hysterotomy finds its largest field in the midtrimester or the first two months of the last, where the cervix is rigid and no effacement has taken place.

It should be stated that the induction of labor for the prevention of eclampsia is opposed by certain obstetric authorities. Its wisdom, however, either as a prophylactic or a curative measure can scarcely be questioned when other therapeutic measures have failed.

Precautions.—A cork or a folded napkin may be held between the patient's teeth during the convulsive attacks to prevent biting the tongue. If the tongue obstructs respiration it should be drawn forward. It is sometimes useful to remove the mucus from the throat with a swab held in the grasp of forceps.

Cardiac Supports.—If cardiac supports are called for, whiskey and strychnin are to be given p. r. n. Inhalations of oxygen are

useful. The subcutaneous injection of the normal saline solution acts as a stimulant as well as an eliminant.

Restoratives.—During convalescence the anti-eclamptic and the eliminant treatment are to be continued for two or three days, as required, and later iron and general tonics are indicated as restoratives.

DIABETES MELLITUS

Sugar is found in the urine of women shortly before childbirth in about four per cent. of cases, commonly in the form of lactose, seldom as glucose.

Diabetes is a serious complication of pregnancy and the puerperal state. It is dangerous to the mother and even more fatal to the child. Sometimes the disease is aggravated by pregnancy and may end in death during, or soon after, the puerperium. The prognosis is better in diabetes developed during pregnancy than in cases in which there was preëxisting diabetes. Hydramnios is often present. Abortion occurs in at least one-third of the cases. Half the children born alive perish soon after birth, and those who survive are likely to be undersized and poorly developed. Fortunately diabetes is rarely encountered in childbed.

Treatment.—In true diabetes the pregnancy, as a rule, should immediately be terminated. For anesthesia ether-oxygen vapor is preferable to chloroform, since it induces less acetone. The less used the better for the prognosis. A morning-hour and a sugar-free period, if possible, are to be chosen. Bicarbonate of sodium should be given for several days before operation till the urine is alkaline.

CARDIAC DISEASE

Most valvular heart lesions are aggravated by the extra tax put upon the heart in the later months of gestation. They cause abortion or premature labor in more than 20 per cent. of pregnancies so complicated.

Advanced cardiac disease is a dangerous complication of labor. Engorgement of the right heart and edema of the lungs often supervene. The danger is greatest at the close of the third stage, when a large volume of blood is abruptly thrown on the venous

side from the uterine sinuses, overloading the right heart, producing cyanosis and pulmonary edema. Statistics show that multiple lesions are attended with the greatest mortality. Mitral incompetence, or especially *stenosis of the mitral orifice* is almost equally fatal. Next in gravity is aortic incompetence. Yet the prognosis depends mainly upon the condition of the cardiac muscle. Tuberculosis and nephritis are grave complications of heart disease.

Treatment.—A woman with uncompensated valvular disease of the heart should not marry, at least should not become pregnant.

During pregnancy, among the more important measures in matter of treatment are the avoidance of overexertion and excitement, together with regulation of the bowels and the use of cardiac tonics and physical rest as the symptoms may require. Strychnin, and, in broken compensation, strophanthus and digitalis serve the latter purpose. Other measures failing, the pregnancy should be terminated by the easiest method for the woman. Premature delivery is oftenest demanded in multiple lesion or in mitral stenosis, and in the presence of nephritis or tuberculosis.

During labor the heart should be relieved as far as possible of the strain of labor by the use of artificial aids for delivery, such as forceps as soon as dilation is complete. Ether-oxygen vapor, preceded by ¼ gr. of morphia hypodermatically, should be used in preference to chloroform as the anesthetic, and this only during the severer pains. Of great value in combating venous engorgement in the third stage of labor are amyl nitrite by inhalation and nitroglycerin by hypodermic injection. Alcoholic stimulants may help. *Resort may be had to phlebotomy* in the presence of any cyanosis or other evidence of right heart engorgement, yet this can scarcely be required if proper use is made of the vasodilators. Ergot may be withheld, and moderate genital bleeding encouraged. *Excessive blood loss is dangerous.* Cardiac supports will usually be needed during the puerperium. Lactation is contraindicated.

CHAPTER XIV

PATHOLOGY OF THE PUERPERAL STATE

PUERPERAL INSANITY

The mental disorder may begin during pregnancy, though it occurs more commonly during the puerperal period. In the puerperium the onset occurs most frequently in the first or second week, seldom after five or six weeks. It is more often observed in primiparæ. The psychical disorder very commonly takes the form of melancholia, sometimes of mania.

Frequency.—Puerperal insanity occurs in about one in 400 puerperal women.

Causes.—Causes most frequently assigned are hereditary predisposition, bad mental hygiene, violent emotional disturbance, eclampsia, anemia, exhaustion, autointoxication, sepsis. Of these the predominating cause is sepsis. Recent investigations go to prove that in more than 80 per cent. of cases the puerperal psychoses originate in autointoxication or in septic infection.

Prognosis.—The *prognosis* is *better* in the *maniacal* than in the *melancholic form.* It is *not so good in lactational insanity as in cases beginning during pregnancy.* A *marked heredity* is *unfavorable.* The outlook is good in cases following eclampsia. Recovery may be expected in 60 to 80 per cent. of septic cases.

The mortality does not exceed 5 to 10 per cent. of all cases. Nearly 70 per cent. recover their reason.

Treatment.—If proper nursing can be had, home treatment is, in mild cases at least, better than the asylum. The writer believes in institutional treatment, where the proper mental and physical hygiene may be had. In the puerperal forms nursing should be suspended. Iron, in the form of pil. Blaud, one or two t.i.d., or arsenate or iron, gr. 1/10 t.i.d., is indicated for the anemia. The hypodermic injection of the hydrobromate of hyoscin, in doses of gr. 1/100 to gr. 1/25, two or three times daily, is a useful

sedative in maniacal forms. Chloral, the bromids, chloralamid, or paraldehyd, 5ss to 5j, may be required as sedatives and hypnotics. Chloral, however, is contraindicated in marked anemia. Morphin, gr. ⅛, is sometimes permissible. Intestinal fermentation and septic infection are to be treated as in other cases.

GALACTORRHEA

This term applies to an excessive secretion of milk, which persists after weaning. The quantity may reach several quarts daily. The quality is thin disease may affect one or both breasts. It often s impairment of the general health, producing a nia.

Treatment.—Trea the use of a compression breast-binder, and re . Potassium iodid, gr. x to xv, t.i.d., and full ct of ergot, may be tried. The topical use of ay be of service. Coffee diminishes the secretion of purgatives is essential. Tonics and general rest. s are especially indicated.

MASTITIS

Frequency.—Mastitis occurs in 5 to 6 per cent. of nursing women. It is met with oftener after first than subsequent labors, nearly 68 per cent. occur in the former. It is commoner in blondes than in brunettes.

Causes.—The predisposing causes of mammary infection are bad general health, lowering the resisting power; ***milk stasis, injuring the vitality of the epithelium of the lactiferous ducts;*** lesions of the nipples, opening avenues for absorption.

The exciting cause is sepsis. The pus-producing organisms may gain access to the gland through nipple lesions, such as fissures, through the milk-ducts, or exceptionally by the blood-channels from remote septic foci. Staphylococci albi are found in the milk of healthy nursing women, in 80 to 94 per cent. of cases.

Types of Inflammation.—(1) *Subcutaneous.* (2) ***Glandular,*** *or parenchymatous mastitis,* which is, in the majority of cases, a lymphangitis. (3) *Subglandular, paramastitis.* Two or all of

Diagnosis.—The *subcutaneous form* presents the characters of ordinary phlegmon; it is usually a single pustule and found near the areolar.

The *glandular form* is characterized by *more pain* and *more constitutional disturbance than the subcutaneous;* marked engorgement usually precedes the inflammatory trouble; it is generally ushered in *by a chill,* and there is more or less elevation of temperature; it is often multiple; the gland is indurated, its surface reddened.

The Subglandular Form, or Postmammary Abscess.—In subglandular suppuration the temperature is persistently high, the pain is deep-seated, the gland is not indurated, it is lifted off the chest and floats on the underlying fluid. The constitutional disturbance is severe. The diagnosis may be confirmed by passing an exploring needle beneath the gland.

Treatment.—*Prophylactic Measures.*—Prophylaxis consists in: (1) Care of the nipples—cleanliness and avoidance of fissures; (2) management of the engorgement by resting the breast or, in simple engorgement without inflammation, by massage. The breast should be stroked gently from the apex toward the base; the amount of liquids ingested should be restricted. Hypersecretion may be relieved by saline cathartics, or in nonnursing patients by the topical use of oleate of atropin. Engorged breasts should first be painted with a sterile solution of equal parts of pinus canadensis and glycerin, and then be supported firmly with a compression binder. A pad of sterile cotton wool is placed under the binder over each breast to distribute the pressure evenly. An opening in the center of each pad relieves the nipple of injurious pressure. The use of a compress as tight as can well be borne is of great value as a prophylactic and a curative measure. The Murphy binder, made of a straight piece of muslin with a deep notch cut for each arm, and a shallow one in the center for the neck, is recommended. A skilfully applied roller bandage is most suitable when but one breast requires compression. Tonics, especially quinin, are useful. The aseptic management and curative treatment of nipple lesions are an essential part of the treatment.

Abortive Measures.—Absolute rest of the gland for one or two days by taking the baby off the breast, restriction of liquids, saline cathartics, the application of pure ichthyol locally over the in-

flammed area, covered with sterile rubber tissue, and quinin, gr. v to x, twice daily, are the principal abortive measures.

Treatment of Suppuration.—The pus-cavity should be opened early and freely, with antiseptic precautions. The incision should radiate from the nipple, the areola being avoided, and pass through the entire thickness of the breast to the chest wall, which allows for retro-mammary drainage.

The writer frequently incises a parenchymatous mastitis before evidence of suppuration appears, making a radial incision through gland substance in line with the lactiferous tubules, and thus prevents destructive suppuration of the gland itself. The finger should be passed into the cavity and all septa broken down. Counter-openings often are necessary for satisfactory drainage. *Drainage should not be carried through healthy areas of the gland, but behind the gland.* The abscess cavity is to be thoroughly cleansed and disinfected. A drainage-tube should be left in each opening; antiseptic dressings and compression applied to obliterate the cavity. The cavity should be cleansed antiseptically once or twice daily, and the dressing renewed.

Treatment of Sore Nipples.—The nipples are to be cleansed after each nursing with an aqueous solution of boroglycerid, 1-8.

Excoriation is sometimes relieved by the following:

℞ Amyli glyceriti
Bismuthi subnitratis ..... āā ℥ss.

The nipples should be cleansed with the boric acid solution after nursing and the bismuth mixture reapplied.

A 2 per cent. aqueous solution of carbolic acid is a good antiseptic nipple lotion.

Should these measures fail, *the nipple should be rested for twenty-four or thirty-six hours, or the child should nurse through a glass nipple shield.* The rubber nipple should have a sufficiently large opening to deliver freely. After nursing a gauze compress, wet with a saturated boric acid solution to which glycerin has been added in a proportion of 1 : 8, should be applied. Equal parts of sterile castor oil and bismuth subcarbonate may be used instead of the glycerine lotion.

Pain during nursing is relieved by applying, five minutes be-

fore nursing, a 1 or 2 per cent. lotion of eucain hydrochlorid previously sterilized by boiling. Or a saturated alcoholic solution of orthoform may be used. This should be washed off immediately before nursing.

Fissures may be lightly touched once a day with a stick of nitrate of silver, first penciling with the eucain solution.

Penciling with a 1 per cent. solution of silver nitrate is efficacious, and has the advantage over the solid stick of being practically painless.

An argyrol solution, ʒj to ʒj, may be substituted for the nitrate.

Painting the affected surface with compound tincture of benzoin, or with ichthyol, several times daily, is useful; or the fissures may be cleansed with a 1 per cent. bichlorid of mercury solution, and, after drying with sterile cheesecloth, painted with thiol collodion, 10 per cent. The opening of the milk ducts must not be closed. A nipple shield may be worn till healing has taken place.

PUERPERAL INFECTION

Puerperal infection is primarily a wound infection, due to the entrance of infective organisms into wounds of the genital tract. It is identical with that of surgical practice. The synonyms, puerperal fever, puerperal septicemia, metria, et cetera, are misleading, as they do not convey the fact that the several localized infective processes post partum are distinct pathological entities, and should be classified according to the anatomical distribution of the lesions.

Frequency.—In preantiseptic times puerperal fever was a common affection in childbed. The mortality from this cause in hospitals was from 2 to 6 per cent., and so-called epidemics with a death rate of 10 per cent., or even more, were of frequent occurrence. To-day, in well-managed maternities, less than a fourth of 1 per cent. of puerperal women die from septic infection.

Bumm found a morbidity of 20 per cent., assuming 100.5° F. as the normal limit of temperature.

In general private practice, *owing to imperfect asepsis, together with a tendency to undertake operative delivery, often in the absence of any absolute indication, before complete dilation*

of the passages is obtained, the morbidity and mortality are relatively high. There is about 1 per cent. of septic deaths, and a large proportion of women who survive infection are seriously, often permanently, crippled in health from the morbid process. From 15 to 20 per cent. of women dying during the child-bearing age die of puerperal fever. Under a strict asepsis there should be practically no deaths from puerperal infection in family practice, and the morbidity does not exceed 10 per cent.; even that is usually of a mild type. The disease is observed more frequently in primiparæ than in multiparæ.

Etiology.—*The cause is the introduction of septic germs into the wounds of the birth-canal during labor or the puerperium. Conditions which impair the resisting powers, as hemorrhage, trauma, and toxemia, act as complicating causes.* The puerperal state at best is one of lowered resistance.

Bacteriology.—The organisms most constantly concerned are the streptococci; staphylococci are frequently found. The bacterium coli commune, the gonococcus, the bacillus of diphtheria and certain other microörganisms are occasional factors in the pathogeny. Putrefactive bacteria generally are present. Putrefaction of the lochia produces a soil favorable for the development of pathogenic organisms. The putrefactive bacteria act solely, others largely, by the effects of their chemical products, toxins. *Most puerperal infections are mixed infections.*

The sources of the infecting organisms are the lochia of puerperal fever patients, a secretion from suppurating wounds, erysipelas, diphtheria, and in certain cases scarlet fever or typhoid fever, owing to complications involving the presence of wound-infection germs, also cadaveric and other dead and decomposing animal matter. Gonorrhea is frequently a complicating source. The term self-infection—autoinfection—is applied to infection from pyogenic organisms primarily present in the genital tract. Infection from the latter source is very rarely possible.

Puerperal infection is contact infection. Vehicles of infection are the hands of the obstetrician or the nurse, instruments, utensils, cloths, germ-laden dust, copulation just before, or during, labor, et cetera.

The avenues of invasion are the obstetric wounds of the vulva, vagina, the cervix, and corpus uteri, and even intact surfaces of

the genital mucous membrane. Systemic infection and that of the uterine adnexa spring most frequently from the cavity of the uterus, especially from the placental site.

The channels of diffusion usually are the *lymphatics, less frequently the veins.* Through the former we get parametrial exudates, peritonitis, etc. When the infection travels through the veins, thrombo-phlebitis and bacteremia result.

Special Manifestations.—The most common lesion is putrid or septic endometritis; this may be followed by salpingitis; oophoritis; metritis; parametritis; perimetritis, or pelvic peritonitis; diffuse peritonitis; uterine lymphangitis, and phlegmonous lymphadenitis—generally accompanied with peritonitis; phlebitis—uterine, periuterine, and crural; colpitis; pure septicemia; acute ptomain poisoning—putrid intoxication; sapremia; pyemia; cystitis; ureteropyelitis; pneumonia; pleurisy; pericarditis; endocarditis; nephritis; arthritis; subcutaneous phlegmons, and others. Each lesion has a distinct symptomatology and physical signs.

Diagnosis.—General Symptoms of Infection.—Usually the first symptoms appear on the second or third day after labor; *rarely later than the third,* except when the lesion is due to a mixed infection in which the gonococcus is present, since the obstetric wounds have by that time begun to granulate, and the granulation layer (leukocytic zone) acts as a barrier to the invasion of the pyogenic organisms. In the majority of cases the disease begins insidiously. The attack is sometimes ushered in by a more or less pronounced chill.

The most conspicuous early symptoms are rapid pulse, 100 to 140; rise of temperature, 102° to 104° F., faulty involution of the uterus, and fetid lochia—yet sepsis often occurs without fetor. *The bad odor is due to the presence of putrefactive bacteria or of the colon bacillus, and is often absent at the onset of sepsis in the most virulent forms of streptococcic infection.* A complete blood count, blood culture, and intrauterine culture should be obtained in every suspected infection. Malarial pyrexia should be excluded by quinin or better by microscopic examination of the blood for plasmodia malariæ. Pneumonia, typhoid fever, fecal retention, emotional, mammary, and other nonseptic causes of high temperature should also be excluded.

is the lesion most constantly present in puerperal sepsis. It may be of the putrid or septic variety. The uterus is more than normally sensitive on palpation over the lower abdomen; the cervix is more patulous than normal for the time, especially in the putrid type; the uterine lochia are often foul, and the bloody flow is usually prolonged. Generally, owing to a greater or less degree of *accompanying metritis,* the uterus is somewhat boggy, tender on pressure, and involution is faulty and retarded. *A relaxed uterus favors spread of the infection through the patent lymphatic channels.*

The septic process may be limited to the endometrium, the organisms not penetrating beyond the granulation zone, which is well developed in the milder forms of endometrial inflammation. When, for any reason, that protection fails, the sepsis becomes widespread and the systemic disturbance proportionately greater. Occasionally in profound general sepsis the endometritis may be insignificant, owing to early and rapid migration of the offending organisms into other structures. Usually, however, when the uterus is the seat of a putrid or a mixed endometritis, a thick layer of necrotic material is found lining the uterine cavity. Beneath this, separating the infected area from the more or less normal underlying tissue, is *a thick layer of leukocyte and small round tissue cell infiltration*—a *reaction zone.*

In septic endometritis, the protection zone is thinner and not so well defined, which allows the microörganisms to pass through the decidua and along the lymphatics beyond the uterus.

Metritis.—This originates in a lymphangitis of the uterine walls. It is generally secondary to an endometritis, sometimes to infection of a cervical laceration. After-pains are severe and prolonged. The uterus is large, boggy and tender to the touch. Portions of the muscularis may slough—dissecting metritis.

Parametritis and Perimetritis.—Parametritis frequently follows infected tears of the cervix, or is secondary to puerperal endometritis. There are pain and tenderness at the seat of inflammation, because of the marked inflammatory edema of the parametric tissues, moderate tympanites, frequently nausea; the lochia are scanty; *an exudate is found in one or both broad ligaments by abdominal or bimanual examination; the uterus is more or less*

fixed, sometimes displaced; fluctuation generally may be made out at the seat of the exudate if pus forms. Abscess results in less than 20 per cent. of cases of parametritis. The pus collection may be in the broad ligament, extraperitoneal, or it may be intraperitoneal and encysted, the result of a circumscribed peritonitis and agglutination of surrounding structures, or of walling off by exudate.

Diffuse Peritonitis.—Peritonitis is responsible for the largest number of deaths in puerperal infections. The route by which the pyogenic organisms reach the peritoneum is almost invariably the lymphatics. *There are exquisite abdominal pain, tension, and tenderness* in the early stages generally; later the tenderness may partially, or wholly, disappear if the infection is very virulent. Tympanites usually is extreme. There are vomiting of greenish fluid, diarrhea, and finally collapse. The termination is almost surely fatal within a week.

Phlegmasia alba dolens, milk-leg, sometimes results from parametritis. The inflammatory process, extending by the lymphatics along the courses of the great blood vessels of the thigh, gives rise to periphlebitis. Most frequently the process is primarily a thrombophlebitis of the pelvic veins. The left uterine vein is most commonly involved.

The period of invasion varies from two or three to four weeks after delivery, and is almost always preceded by evidences of poor uterine retraction, as metrorrhagia, temperature, and a large uterus. The attack is sometimes ushered in with a chill, and is always attended with pain and swelling in the affected limb. The pain is first felt in the groin and usually extends throughout the length of the thigh and leg within a few hours. The *limb becomes swollen, tense, hard, white, glistening. The affected veins may sometimes be felt on palpation, as hard, irregular cords.* They are frequently nodular, owing to the formation of thrombi. The fever is at first of a remittent, then an intermittent type. Resolution generally begins after about two weeks. The duration of the disease may be many weeks; abscess-formation or gangrene sometimes supervenes. There remains more or less edema on standing or walking, with impairment of muscular power. In a certain proportion of cases the disability may last for months or indefinitely. A possible termination is sudden death by pulmonary

embolism from the detachment of a fragment of blood-clot. Recurring chills are a signal of metastatic affections. The disease may extend from one limb to the other.

Colpitis.—The usual evidences of vaginal inflammation, catarrhal, phlegmonous, ulcerative, or diphtheritic, are present. In ulcerative vaginitis the labia often are edematous. In the phlegmonous form abscess may result. Membranous exudates are grayish white and are very rarely due to a true diphtheria, usually to infection with pyogenic organisms.

Pure septicemia, or bacteremia, is *characterized by fever and cardiovascular depression,* with absence of appreciable organic lesions; cocci may frequently be isolated in the blood; the countenance is sallow, sunken, and anxious. Occasionally there is delirium or coma; diarrhea and vomiting of dark grumous ejecta frequently are observed. It runs a rapid course, often terminating within two or three days.

Pyemia.—Pyemia originates most frequently in infection of the mouths of the veins at the placental site. The phlebitic process may be limited or diffuse. By the breaking down of infected thrombi, septic emboli and metastatic abscesses in various parts of the body may result. Septic pneumonia and septic endocarditis are common complications.

Pyemia is distinguished by irregularly recurring chills, marked irregularity of the temperature, and metastatic development of purulent foci. The duration may be many weeks. Often it progresses to a rapidly fatal termination.

Cystitis is attended with vesical tenesmus and increased frequency of urination. In the acute stage the tenesmus is almost constant, and is not relieved by emptying the bladder. Pain is sometimes excessive, and there is usually some elevation of temperature. The urine is cloudy and of feebly acid reaction; sometimes it is fetid.

Ureteropyelitis.—In ureteropyelitis there is frequent desire to urinate, with pain and tenderness along the inflamed tract and tenderness on pressure at the vertebrocostal angle. Pressure on the ureter through the vagina by conjoined manipulation elicits pain and desire to urinate. The urine is acid and contains pus and blood. The temperature is very high in the acute

In most cases of puerperal infection several of the lesions above described coexist.

Prognosis.—As a rule, the earlier the attack the more unfavorable the prognosis. It is gravest in acute putrid intoxication, diffuse purulent peritonitis, streptococcic bacteremia, and pyemia. Generally the prognosis *is best when the septic process is distinctly localized and there is extensive exudate formation.*

Treatment.—PROPHYLACTIC.—To prevent infection, rigorous asepsis of the hands, instruments, utensils, and of everything that comes in contact with the genitals during labor and the puerperium should be enforced. *The external genitals, lower abdomen, and inner surfaces of the thighs should be cleansed antiseptically before internal examinations.* The vagina and cervix should be disinfected before, and during, labor for cause. *Examination by the vagina during labor should be made as seldom as possible, sterile rubber gloves being worn.* In many cases vaginal examinations may, when, for any reason, more than ordinary care is required, be omitted altogether. *All preventable injuries of the passages should be prevented.* Under modern methods of prophylaxis there should be practically no mortality from puerperal infection in private practice.

The principles of treatment may be summarized as follows:

(1) The destruction of the infecting organisms or the diminution of their infective powers at the site of the primary infection.

(2) Stimulation of the resisting powers of the patient.

(3) The destruction of organisms already in the blood stream by the production of antibodies.

(4) The consideration of operative measures.

REMEDIAL.—*Vaginal Exploration.—Essential as a preliminary to treatment is a careful digital and speculum examination* to determine (1) whether the infection is confined to the genital canal; (2) the site of the local lesion, whether in the uterus or beyond the uterus—when the infection is in the genital tract the primary focus may be in the vagina, cervix, or uterus; when outside, in the parametrium, peritoneum, pelvic veins, or in the blood-stream. Vaginal ulcers and necrotic or pseudodiphtheritic patches on the vaginal wall or the portio should be touched once or twice daily with tincture of iodin, a 50 per cent. chlorid of zinc solution, or with strong carbolic acid.

Before interference within the passages, *as rigorous an antiseptic preparation is required as for a major surgical operation.* The examinations and treatment should be conducted on a table, and sterile rubber gloves should be worn for protection of both physician and patient.

In the absence of appreciable lesions below the body of the uterus the probable seat of infection is the endometrium.

Intrauterine Exploration.—A well-contracted uterus with a closed cervix is not to be explored. When the cervix is open the cavity of the uterus may be explored with the finger to determine the presence or absence of placental fragments and shreds of membrane. An intrauterine culture of the uterine lochia may be obtained with a Döderlein tube. This will help to define the prognosis, and the findings may have some bearing on treatment.

When the finger demonstrates that the uterine cavity is empty, the interior of the uterus may be left alone or be firmly packed with sterile gauze which has been soaked in the pure tincture of iodin, the excess of iodin having been squeezed out before using it as a tampon. This pack is left in the *uterus* for *twenty minutes, and then withdrawn*, and no further intrauterine instrumentation or medication resorted to. *In all pelvic inflammation occurring post partum, the maintenance of the patient in a high Fowler position will favor postural drainage*, which diminishes the source of infection. The free use of ergot helps to maintain a contracted uterus and thus offers a barrier to bacterial invasion.

Curetting.—Curetting is indicated only in the presence of gross necrotic material *in pregnancies before the eighth week, never in acute streptococcic infection.* Better than the curette for clearing the uterus is a Ward placental forceps or the finger.

The curette has been a large factor in the death-rate of puerperal sepsis. The mortality in curetted cases is from 22 to 59 per cent. The mortality in wholly neglected cases of streptococcic infection probably would not exceed 10 per cent. The writer, for the past two years, has treated all cases of sepsis *without intrauterine exploration*, except to make a uterine culture, using the high Fowler position, fresh air and sunlight, an icebag over the uterus, stimulation, supportive treatment, and vaccines, with a mortality of only 2 per cent.

Systemic measures are ordered mainly with reference to elim-

ination and support. Something may be done in combating general infection. Tonics, stimulants, forced feeding, and fresh air are of first importance. Strychnin, gr. 1/40 to 1/20, hypodermically, every four hours, and brandy to the extent of a pint or quart daily is to be given; instead of brandy, whiskey, or an equivalent of wine, may be preferred. To realize the full benefit of the alcohol, it should be pushed, if possible, to the point of intoxication. Large doses of sodium citrate, gr. xx-xxx, in lemonade, several times a day, help to maintain the alkalinity of the blood.

The subcutaneous injection of a pint of the normal salt solution, or of artificial serum, two or three times daily, is sometimes of great service as a stimulant and an eliminant as well. The addition of acetate of sodium, 5j to Oj, increases the diuretic effect. Enteroclysis and the free use of water by the stomach are useful aids as eliminants.

Plenty of pure air is essential. Oxygen inhalations may be used.

On the first rise of temperature, two or three bowel movements should be secured by large enemata. It is inadvisable to use hypercatharsis; a daily enema is sufficient.

Antipyretics.—The temperature should be reduced by tepid sponging, tepid packs, or the use of a cold coil.

The coal-tar antipyretics serve only to mask the symptoms, and are depressing and otherwise injurious. Quinin is useless in purely septic fever except in small doses, gr. ij or iij, t. i. d., as a tonic. Even for the latter purpose it is inferior to strychnin.

Narcotics.—An occasional opiate in small doses, morphin, gr. 1/8, or codein, gr. 1/4, may very rarely be required in case of extreme nervous excitement or sleeplessness, but should be withheld, if possible.

Other Measures.—Five per cent. nucleinic acid solution, mv-xx, given by the stomach, for hyperleukocytosis, may be repeated every 3 to 6 hours.

Collargolum, in 1 or 2 per cent. solution, may be used; dose, per rectum, 5ij-viii, morning and evening; the bowel is washed out before each injection; intravenous dose, 5j-iv of 2 per cent. solution every 12 to 48 hours.

Vaccines have a definite field, and are valuable adjuncts to the therapeutics of puerperal infections. Mixed vaccines of poly-

valent strains used early positively increase the leukocyte resistance. Autogenous vaccines are of most value in subacute and chronic infection. The leukocyte count is the best index of the value or valuelessness of vaccines.

Antistreptococcic serum, 100 c.c. every 12 to 24 hours, may be given hypodermically; but is of little value for the reason that the infection usually is a multiple infection.

Treatment of Peritonitis.—The treatment of peritonitis consists in the employment of the Fowler position, the cold coil or icebags to the abdomen, large enemata to secure a bowel evacuation daily, the withdrawal of all food by mouth for 48 hours, and the continuous use of the Murphy drip. A moderate use of opium may rarely be permitted for control of extreme pain and restlessness.

Definite pus collections should be evacuated promptly as in other conditions, preferably by vaginal incision and drainage.

Treatment of Parametritis.—Hot vaginal douches, several gallons at a temperature of 110° to 120° F., may be given two or three times daily. Local antiseptic and general tonic measures are indicated as in other septic conditions. If an abscess forms it should be evacuated early and drained by the vagina or by extraperitoneal abdominal incision. Operation by the vagina generally is safest, and it best effects drainage. This route should be chosen except when the pus cavity cannot safely be reached from below. In the latter event the incision should be made just above Poupart's ligament and parallel with it, and the pus collection reached extraperitoneally.

Treatment of Phlegmasia Alba Dolens.—The limb should be kept at rest in a horizontal position. Ichthyol and lanolin, 1 : 4, applied twice daily over the entire limb, and covered with rubber tissue, usually yield good results. If required for a few days, pain may be subdued by the local application of oleate of morphia. After the application the limb is enveloped with a single thickness of muslin wrung out of hot water, and this is covered with oiled silk.

Massage is to be avoided during the active stage of the disease; it may cause embolism. Should abscesses form they should be treated by early and free incision, followed with thorough cleansing and drainage. The patient may leave the bed when the swel-

ling subsides and the fever has long since ceased. From that time the affected limb should be supported by a flannel bandage or an elastic stocking. The support should be continued so long as much swelling occurs on standing or walking.

TREATMENT OF PYEMIA.—The general treatment is essentially the same as in septicemia. Metastatic pus foci should be opened and drained if accessible.

TREATMENT OF CYSTITIS.—A mildly alkaline water should be drunk freely as a diluent. The bowels must be kept freely open, and the diet should be nonstimulating. Sweet spirits of niter, four to six times daily, helps to relieve pain. Urotropin, gr. vi to viii, in a full glass of water, three times daily, is most useful.

TREATMENT OF URETEROPYELITIS.—Water is to be used freely by the stomach or by high rectal injections to flush the septic tract by increased secretion of urine. Salol in doses of five grains every three hours, or urotropin, as in cystitis, are the best antiseptics for the urinary tract. Vaccines in mixed polyvalent strains of the colon, streptococcus, and staphylococcus, have had a decided beneficial effect in pyelitis cases.

SUDDEN DEATH IN CHILD-BED

Among the principal causes of sudden death in childbed, those most frequently encountered are shock, syncope, apoplexy, advanced cardiac disease, acute pulmonary edema, pulmonary embolism, and thrombosis. The latter two are the most frequent. Phlebitis, varicose veins, prolonged labor, anemia, hemorrhage, sepsis, cancer, and syphilis predispose to embolism and thrombosis.

CHAPTER XV

OBSTETRIC SURGERY

INDUCTION OF PREMATURE LABOR

Indications.—The indications for the induction of premature labor are certain cases of narrow pelvis, in which the delivery of a living and viable child is thus possible; flattening between 7.5 and 9.5 cm., or equivalent contraction of other forms; fetal death; habitual death of the fetus in the last month of gestation from other causes than syphilis; toxemia of pregnancy, drug, and dietetic measures failing; dangerous cases of placenta prævia after the period of viability, and accidental hemorrhage; certain cases of hydramnios, with danger to mother or child; also cardiac lesions in which the compensation has been broken during pregnancy, and rare cases of tuberculosis and chorea.

1. Pelvic Contraction.—Here the most difficult problem is to fix the proper time for interference. Operating too soon, the interests of the child, too late, those of the mother, are imperiled. The most reliable data for deciding the question are afforded by careful measurements of the pelvis and of the fetal head. The operator should crowd the head into the pelvic brim, with one hand over the abdomen while the other is passed internally to learn how far and with how much freedom the head descends. The examinations should be repeated at intervals of one or two weeks. The labor should be brought on as soon as the head is found to enter the pelvis with difficulty.

The operation is seldom to be chosen in preference to its alternatives, Cæsarean section and pubiotomy, in pelvic contraction. While its maternal death-rate is nearly nil, the fetal mortality, except in operations within two to four weeks of term, is prohibitive.

2. Habitual Death of the Fetus.—Operation should be done a week or two before the usual period of fetal death. The strength

and frequency of the fetal heart, and the vigor of the fetal movements, must be watched closely as the fatal period approaches.

3. Toxemia.—The pregnancy should be terminated on the appearance of grave symptoms, especially if the fetus has reached the full period of viability, and medical and dietetic treatment have failed.

4. Hemorrhage.—In placenta prævia, after the period of viability, and in accidental hemorrhage, it should be the rule to induce labor as soon as the diagnosis is established. In previal placenta, with much hemorrhage, the uterus should be emptied before viability.

5. Hydramnios.—Here interference is called for when the life of the mother or child would be jeopardized by longer continuance of the pregnancy, owing to the pressure effects of the growing tumor.

Methods.—Catheterization of the Uterus: *First Step.*—The first step consists in separation of the membranes from the lower uterine segment by means of a uterine sound or with the finger. *The operation must be aseptic.*

Detachment of the membranes with the sound may be done with the woman in either the left lateral or dorsal recumbent position. For the use of the hand the dorsal position is best.

Second Step.—The second step consists in the insertion of one or more No. 12 English bougies, or a sterile rectal tube, between the membranes and the uterus.

No anesthetic is required. Usually the bougie or rectal tube is most readily passed with the aid of the Sims position, the Sims speculum—exposing the cervix, which is drawn forward and held with a volsella. The bougie is sterilized by boiling or steaming, the proximal end is cut off, and a stylet inserted. To facilitate introduction the bougie is bent to nearly a right angle at about three inches from the distal end, giving it a large curve. Great care must be used to avoid rupturing the membranes. The instrument is then pushed up gently and in the direction in which it passes most easily. After it has entered between the membranes and the uterine wall, the stylet is drawn down about one inch. The flexible tip of the bougie finds its way readily with little risk of perforating the membranes. The bougie fully in place, the stylet is withdrawn. A second bougie may be inserted

if it can be pushed into place without too much difficulty. Bleeding is probable evidence that the instrument has passed behind the placenta. The hemorrhage may occasionally be excessive. It is then best to withdraw the instrument and pass it in another direction. A light tampon of gauze may be packed in the vagina, but it is not required to support the bougie. The instrument is

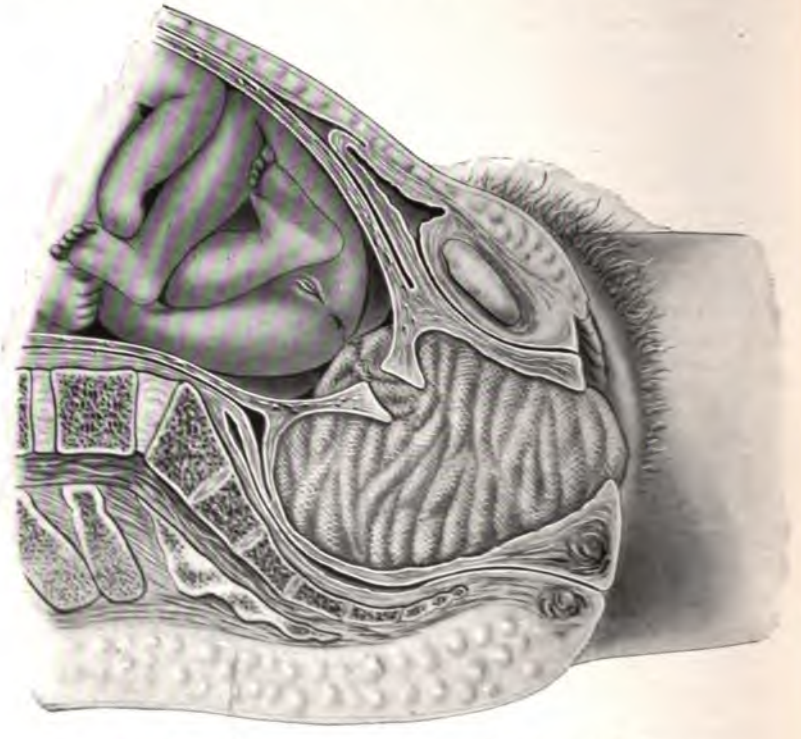


FIG. 92.—VAGINAL AND CERVICAL PACK IN POSITION

left to be expelled with the child. Labor usually is established within twenty-four hours. This method is not suited to cases in which immediate delivery is called for.

CERVICAL TAMPONADE.—With the aid of the Sims posture and a Sims speculum, the cervix and vagina are packed firmly with zinc oxid or borated strip-gauze. Saturating the gauze with glycerin adds to its efficiency. The pack is removed after 12 or 24

hours. It may then be renewed or dilation be completed manually or instrumentally (Fig. 92).

The cervical tampon is a useful measure for beginning dilation when time permits.

MANUAL DILATION OF THE CERVIX.—Manual dilation should never be attempted unless the cervix canal is obliterated. The woman is placed in the lithotomy position under an anesthetic. The usual aseptic preparation is carried out.

The operator then lubricates his gloved hand well with aseptic glycerin. Coning the fingers, the hand is introduced into the

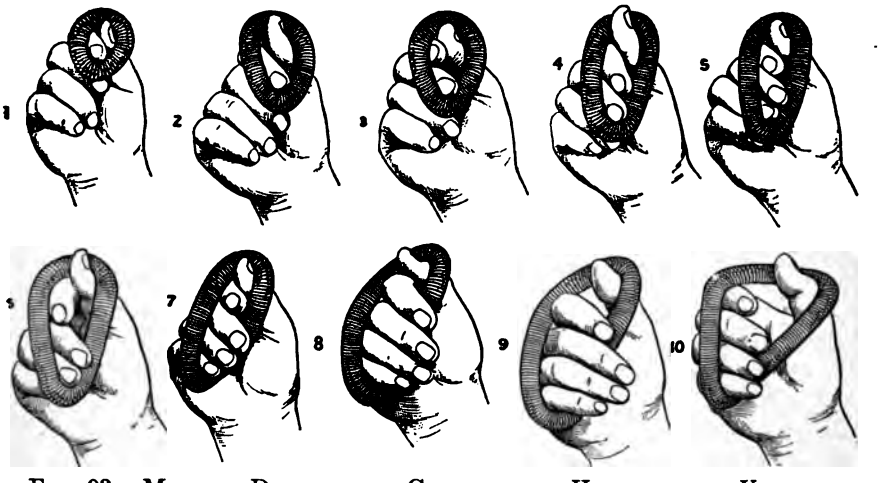


FIG. 93.—MANUAL DILATION OF CERVIX WITH HAND IN THE VAGINA, FINGERS IN THE CERVIX. (After Harris)

vagina. One finger is passed through the cervix. After a time the cervix relaxes till a second finger can be passed, then one finger after another until the whole hand is introduced. The fist is then slowly and cautiously closed in the grasp of the cervix. By this time the dilation is sufficient for the passage of the head, and, at the same time, active uterine contractions have been established (Fig. 93).

The dilation must be done with the least possible muscular effort to prevent cramping of the hand. To prevent laceration of the cervix, extreme care must be used, taking plenty of time for each step. *The danger of tearing is greatest in the latter part of*

the dilation. The uterus is steadied by counter-pressure over the fundus, lest by pushing the uterus upward the vagina be exposed to too great strain.

Should the indications warrant, immediate extraction may be undertaken by version or forceps. Delivery is thus possible within fifteen minutes to two or three hours, according to the rigidity of the cervix and the difficulty of extraction.

When the cervical canal is too small to admit the finger easily, the dilation may be commenced with a branched steel dilator.

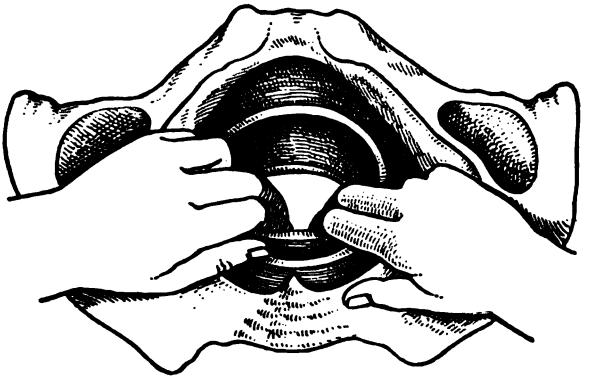


FIG. 94.—TWO HAND DILATION OF EFFACED CERVIX. (After Edgar)

Or, if time permits, a cervical and vaginal tampon may be placed and left for twenty-four hours. By the end of that time the cervical canal will be found sufficiently expanded to receive the finger.

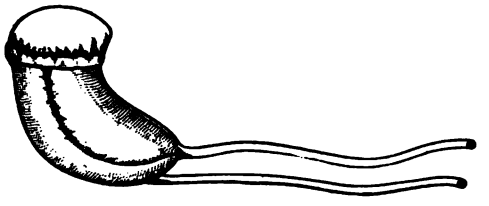
Edgar dilates by hooking one or two fingers of one hand in the cervix anteriorly, and one or two fingers of the other hand posteriorly, and pulling in opposite directions (Fig. 94).

Artificial delivery by rapid dilation of the cervix is dangerous except at the hands of a skillful operator, and is to be reserved for emergencies. The writer prefers vaginal hysterotomy. No important injury need result from lacerations of the cervix if properly sutured at the close of labor, but the tear may extend into the lower uterine segment and even into the peritoneum.

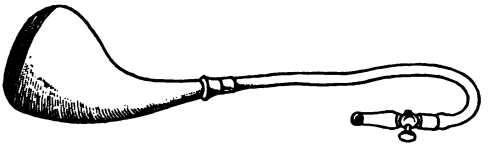
INSTRUMENTAL DILATION.—*Water-bags* (Champetier balloon, Voorhees, or Pomeroy bags).—*Dilation of the cervix by means of*

r-bags is tedious, but generally safer, and is to be preferred n the indication for delivery is not too urgent.

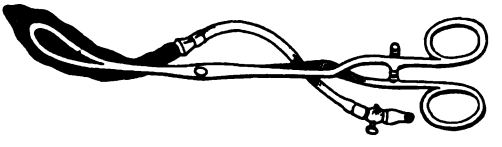
BRANCHED STEEL DILATORS.—Dilation may best be commenced



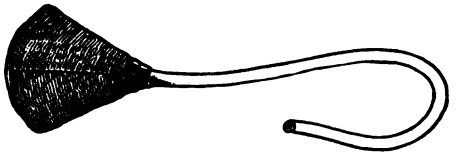
Pomeroy Bag



Champetier de Ribes Balloon



Balloon in the grasp of Bag Forceps



Voorhees Bag

FIG. 95.—WATER-BAGS

the Hegar graduated sounds of the kind commonly employed ynecologic practice. The risk of infection is less than with onged use of water-bags and cervical packs. When the indi-on is urgent, the dilation may be completed rapidly with the

Bossi dilator or some of its modifications. As a rule, dilation once established, it is better completed with the hand. *Instrumental and manual dilation are dangerous, and always produce more or less cervical injury.*

Multiple Incisions.—Manual dilation may be supplemented, when required, by several shallow incisions made at different points in the circumference of the external os.[1]

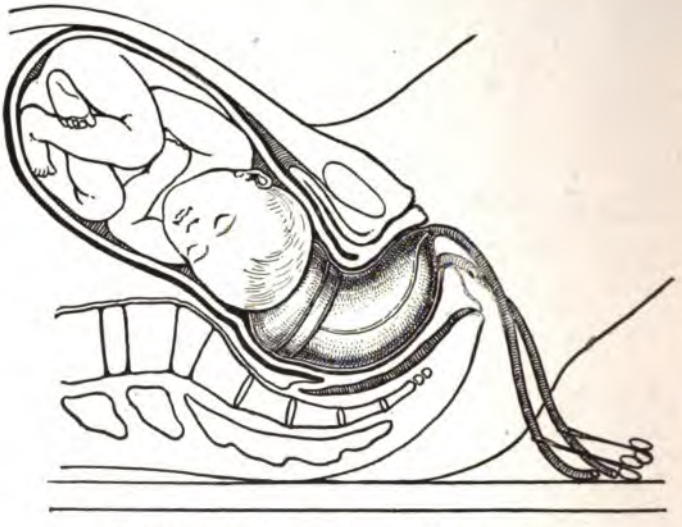


Fig. 96.—Pomeroy Bag in Position

Vaginal Cesarean Section should be the method of choice where it is necessary to rapidly terminate the pregnancy, and the cervix is undilated and rigid.

Care of the Child.—Generally in case of premature children the use of an incubator will be required. In hospital practice, an Auvard's, Credé's, Rotch's, or Marx's apparatus should be provided. For use in private practice an improvised incubator may be made out of a box 30 inches long by 20 x 20 inches, of wood or metal. It should have a removable cover and a false bottom. The child is placed in the upper chamber and hot bottles or a metal water tank heated by an alcohol lamp in the lower. Air admitted

[1] Multiple incisions are generally replaced in present-day obstetrics by vaginal hysterotomy.

to the lower chamber flows into the upper through several half-inch perforations at one end of the false bottom, escaping by similar perforations at the opposite end of the top or cover. A thermometer in the upper chamber should register constantly about 90° F. A glass window in the top of the incubator permits observation of both child and thermometer. The usual period of incubation is from one to three months. Meantime the child is removed from the warm chamber only for nursing, bathing, and changing of clothing.

Recourse must be had to gavage, feeding through a soft stomach-tube, when the child is unable to nurse the breast or bottle, or to be fed from a spoon. Better than the stomach tube is feeding through the nares by means of a narrow-pointed spoon. By incubation and gavage 20 per cent. of children born at the sixth month may be saved. The viability is correspondingly greater in more advanced stages of gestation.

INDUCTION OF ABORTION

Indications.—1. *Toxemia of Pregnancy, with Grave Symptoms Not Yielding to Other Measures.*—Medicinal and dietetic measures failing, the uterus should be emptied before the occurrence of serious symptoms. In grave toxemia, as a rule, evacuation of the uterus is the only method of treatment.

2. *Chronic Nephritis.*—In chronic nephritis the termination of the pregnancy is demanded because development to viability and the birth of a living child are exceedingly rare, and the child, if born alive, is puny and feeble. The mother's life, too, is seriously jeopardized by the continuance of the pregnancy. Even if she survives the pregnancy and the labor, grave injury will have been done to the crippled kidneys.

3. *Extensive Vesicular Degeneration of the Chorion.*—The diagnosis established, and no evidence of fetal life being discovered, the uterus should be evacuated promptly.

4. *Irreducible Retroversion of the Gravid Uterus.*—The retroverted gravid uterus is very rarely irreducible before the third month. Before resorting to abortion, the usual measures for reduction, with the woman in the Sims or genupectoral position, should have had a fair trial. The writer on two occasions has

made an abdominal section for the reposition of an irreducible gravid uterus; both pregnancies proceeded to term.

5. *Absolute Contraction of the Pelvis.*—The termination of the pregnancy in the early months is demanded, on election of the mother, especially in conditions unfavorable for celiotomy. These are extremely rare. The patient should generally be allowed to go to term and be delivered by Cesarean section. This applies to contraction of the soft parts and to obstructing tumors, as well as to deformity of the bony pelvis.

6. *Pernicious Anemia, or Leukemia.*

7. *Chorea.*—Chorea, as a complication of pregnancy, is generally an intractable disease and sometimes dangerous to life. The maternal mortality is variously estimated as from 6 to 25 per cent., the infantile at 10 per cent. Spontaneous abortion or premature labor occurs in 30 per cent. of cases.

8. *Death of the ovum* calls for evacuation of the uterus immediately the diagnosis of death of the fetus can be established positively.

9. *Chronic Heart Disease.*—In advanced cardiac disease the heart suffers impairment, owing to the extra tax to which it is subjected in the later months of pregnancy, and the life of the patient is seriously jeopardized at labor.

10. *Tuberculosis.*—Frequently pregnancy in tuberculous women is prejudicial; labor is attended with a considerable mortality. Abortion is indicated in cases in which the condition of the lungs has obviously grown worse during gestation.

Methods.—1. Detachment of the Ovum and Tamponade of the Cervix.—Abortion may be induced by partially detaching the ovum with a uterine sound aseptically, or by the use of the cervical and vaginal tamponade, with plain or boric acid gauze, as already detailed under induction of premature labor, or these procedures may be employed conjointly. The tampon is renewed after twelve to twenty-four hours. The strictest asepsis must be observed.

2. Immediate evacuation of the uterus with the curette is the method preferred by the writer when the pregnancy has not advanced beyond the second month. The patient is placed under an anesthetic in the lithotomy or in the Sims position. The usual antiseptic preparation is carried out.

The cervix is now dilated sufficiently to admit easily the largest curette to be used, care being taken to avoid lacerating the tissues.

When gestation has not advanced beyond the second month, the ovum may be broken up and the larger portion of it brought away with a Keith forceps; the remaining fragments and the decidua are then removed with the curette.

The curetting is best done with a sharp curette. The operator knows, by the peculiar grating sound and by the harsh feel, when the instrument has reached the uterine wall. The ovum and the decidua have a smooth or spongy feel, and give out no sound as the curette is drawn over them. The sharp curette does its work with much lighter pressure than the dull instrument, and, therefore, with less injury by bruising; with proper care it will not cut too deeply.

A half drachm of fluid extract of ergot or ergotole may be given hypodermically as a precaution against hemorrhage. *In aseptic conditions no pack is required and no vaginal dressing.*

When the contents of the uterus have become necrotic the cavity should be packed with gauze which has been soaked in the tincture of iodin. This pack may be left in situ for twenty (20) minutes, and then withdrawn. The patient should then be placed in the Fowler position to secure perfect uterine drainage.

When the gestation has advanced much beyond the second month, the dilation may be begun with the steel dilator and completed with the fingers, or sufficient cervical opening may be obtained by a vaginal hysterotomy. The fetus is brought down and extracted by seizing the feet, and the secundines delivered by conjoined manipulation. For manual evacuation, the patient should be in the dorsal recumbent position.

For the protection of the physician, it is a rule of practice never to induce abortion except with the approval of competent counsel.

ABNORMALLY ADHERENT PLACENTA

The existence of abnormal adhesion of the placenta may be assumed, as a rule, when the after-birth cannot be delivered entire by ordinary external and internal manual methods within two hours after the birth of the child. *Mere retention, however, by*

partial closure of the retraction ring, must not be mistaken for adhesion.

Etiology.—The etiology is not definitely understood. The cause of pathological adhesions of the placenta resides probably in a diseased condition of the endometrium antedating the pregnancy and resulting in deciduitis and placentitis. The decidua serotina may be almost entirely absent, and the chorionic villi be in direct contact with the uterine muscle. It should be remembered that an abnormally retained placenta is, as a rule, at least partially adherent, and that the adhesion is very seldom pathological except in persistence. Unnaturally firm adhesion of the kind which is attributable to inflammatory causes is extremely rare.

Treatment.—The treatment is separation and extraction of the placenta with the hand in the uterus. The patient should be placed in the lithotomy position upon a suitable table. A rigid asepsis must be observed. The separation is begun at the portion already detached. Care must be taken that no fragments remain. After evacuating the uterus, a hot intrauterine douche of a 2 per cent. solution of creolin, or of hot saline solution may be given. Thirty minims of fluid ergot should be injected hypodermically.

The removal of an adherent placenta with the naked hand, even though carefully disinfected, is always attended with serious risk of infection. A safeguard against infection in intrauterine manipulation is the boiled rubber glove with gauntlet. For years the writer has employed the following method, i. e., firmly packing the uterus, plus the placenta, with washed iodoform gauze, on the removal of the intrauterine pack, in 24 or 36 hours, the placenta may be expressed without difficulty.

FORCEPS

The Instrument.—The obstetric forceps consists of two crossed arms locking at the point of intersection. Each arm has four parts, handle, shank, lock, and blade. The blades are shaped to grasp the fetal head as with a pair of hands. They are also curved in conformity with the direction of the birth-canal. For lightness, as well as for wider distribution of the pressure, the blades are fenestrated. When the instrument is locked the handles fall

nearly together, affording a convenient grasp for the operator's hand in applying traction. A forceps for general use should be about 38 cm. (15 inches) long, and should have a moderate pelvic curve and an elliptical cranial curve, 17 to 18 cm. (about 7 inches) long, and 7.5 cm. (3 inches) in width externally, at the widest part. The space between the tips of the blades when the instrument is closed should be 1.3 cm. (about ½ inch). To admit of sterilizing by heat it is best made wholly of metal.

It should be thoroughly cleansed with soap, hot water, and a brush after using; should always be sterilized, best by boiling in the soda solution, immediately before using. It should be kept free from rust and well polished, and the nickle plating must occasionally be renewed.

Mechanical Action.—The essential function of the forceps is traction.

Its use as a lever, by means of a pendulum motion during extraction, is a mechanical gain, but is liable to injure the maternal soft parts.

The use of forceps as a rotator is considered under treatment of occipito-posterior positions of the vertex and of face presentation.

Compression of the head with forceps is attended with danger to the child, and but little mechanical advantage for extraction. In most seizures compression of one is compensated by elongation of another transverse diameter. *More may be gained by slow delivery, permitting time for molding of the head under the pressure of the pelvic walls.* The pressure of the blades should be kept at a minimum, and, if possible, should be light enough to leave no marks upon the child.

Indications for Forceps.—1. *Forces at Fault When the Head Is Engaged or Engagable.*—The use of the forceps is indicated in cephalic presentation in which the natural powers are clearly inadequate, and generally—not always—when the head has remained stationary for a half hour after two hours in the second stage.

2. *Passages at Fault.*—Forceps is indicated in the following conditions:

Flattening, to not less than three and one-half inches, in the true conjugate, or equivalent obstruction;

Partial obstruction in the soft parts.

The forceps is permissible only after the head has engaged, or can be made to engage. In most instances pubiotomy, or Cesarean section, is better than a very difficult forceps extraction.

3. *Child at Fault.*—Among the indications for forceps presented by the fetus are:

Arrested occipito-posterior position;

Arrested face presentation in anterior position;

Moderate hydrocephalus;

After-coming head;

Impacted breech;

Fetal pulse above 160 or below 100.

Complicated Labor.—Forceps are often required in emergencies arising from other causes than faulty mechanism, and in which immediate delivery is indicated in the interest of mother or child. This indication may be present before the head engages. Under this heading may be mentioned certain cases of accidental hemorrhage, prolapsus funis, rupture of the uterus, and eclampsia, for rapid delivery; or of placenta prævia to hold the head down as a tampon.

Contraindications.—The contraindications are: *Head incapable of engagement, pelvic contraction below 3½ inches,* c.v., fetus dead, head hydrocephalic, macerated or perforated, *cervix not fully dilated and undilatable.*

Danger of the Forceps Operation.—(a) *To the Mother.*—Possible injuries, especially in unskillful use of forceps, are: In the low operation, vaginal lacerations and injuries to the pelvic floor; in the high operation, contusion and laceration of the cervix, or even the body of the uterus, shock and sepsis. Separation of the pelvic joints has resulted from the use of excessive and misdirected force.

(b) *To the Child.*—Brain injuries, and especially rupture of cerebral vessels by compression, are not infrequent. Permanent mental and physical infirmities and even death sometimes result from difficult forceps delivery. Temporary paralysis of the facial nerves frequently occurs. Duchenne's paralysis may result from the effect of stretching the nerve trunks that enter into the brachial plexus. *An uncleanly and unskilled forceps delivery is a dangerous operation for both patients, especially in high applications.*

Preparatory Measures for Application of Forceps.—The pa-

tient is usually placed on the bed, *or better on a table,* in the dorsal recumbent posture—the American obstetric position.

In difficult high forceps operations the Walcher position may be utilized as follows: The patient lies flat on her back on the table, with the hips overreaching the edge, and with the thighs hanging in extreme extension. In this position, owing to nutation of the sacrum, there is a perceptible lengthening of the anteroposterior diameters of the pelvis at the brim. On the other hand, at the outlet of the bony pelvis, the lithotomy position offers the greatest advantage, tilting the lower end of the sacrum backward.

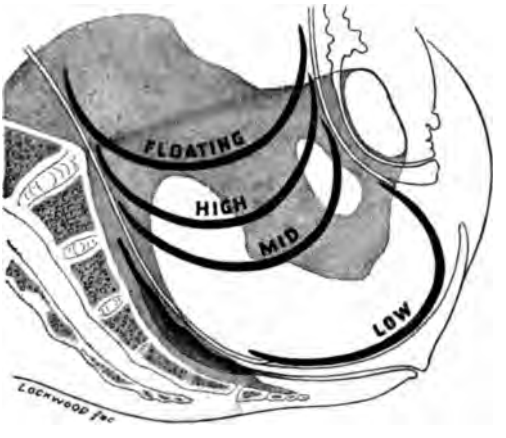


FIG. 97.—DIAGRAM SHOWING THE RELATIVE POSITION OF THE HEAD IN THE SEVERAL FORCEPS OPERATIONS

The woman should be anesthetized and the hips brought close to the edge of the bed or table. *The bladder and rectum must be empty. The fetal heart must be examined before,* and *occasionally during, the operation. The abdomen, the thighs,* and *the external genitals must be cleansed and disinfected* as for a major surgical operation. The vulvovaginal orifice must be dilated. *The cervix must be fully dilated, the membranes ruptured, the head engaged or engagable, and the position and posture accurately known.* No vaginal antisepsis is required except after recent uncleanly contact or in the presence of a pathological vaginal secretion, purulent, greenish, yellowish, or ill-smelling. The instrument must be aseptic and the operator's hands covered with sterile gloves. The

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Danger of the Forceps Operation.—(a) *To the Mother.*—Possible injuries, especially in unskillful use of forceps, are: In the low operation, vaginal lacerations and injuries to the pelvic floor; in the high operation, contusion and laceration of the cervix, or even the body of the uterus, shock and sepsis. Separation of the pelvic joints has resulted from the use of excessive and misdirected force.

b *To the Child.*—Brain injuries, and especially rupture of cerebral vessels by compression, are not infrequent. Permanent mental and physical infirmities and even death sometimes result from difficult forceps delivery. Temporary paralysis of the facial nerves frequently occurs. Duchenne's paralysis may result from the effect of stretching the nerve trunks that enter into the brachial plexus. A [illegible] ***forceps delivery is a dangerous*** [illegible] ***in high applications.***

Preparatory Measures for Application of Forceps.—The pa-

the head and the wall of the birth-canal, following both the pelvic and the cranial curves, hugging the head. After the blade has entered the passages the handle usually may best be held in the full hand. No force must be used. The right blade is introduced in similar manner, the left hand serving as a guide. The blades are then adjusted in the best possible grasp as nearly over the transverse diameter of the head as possible. The blade is pushed sidewise into position by the use of one or two fingers against the posterior edge of either rim of the fenestra. In high applications the handles should be sunk as far backward as the perineum will permit. If the arms do not lock readily the blades should be readjusted till they do. The locking must never be forced. The operator should guard against pinching the skin or hair of the vulva in the lock of the instrument. Before making traction a reëxamination should be made to see that the blades are correctly applied.

Extraction.—The handles are held lightly near the lock, with care to avoid compression of the head.

The traction should be intermittent—a pull and a pause. The pull should coincide with a pain, if possible, and should last one minute. Each traction should be reinforced with *expressio fœtus,* applied by an assistant. In the intervals of traction the instrument should be unlocked to relieve pressure on the head and allow the head to mould.

Guard against Slipping.—The blades should be readjusted to a better grasp if they begin to slip. When the head cannot be caught primarily over the parietal eminences it may be necessary to change the grasp as the head rotates in course of descent. The force used must be such only as can be applied with the arms without bracing the feet.

Line of Traction.—The force must act in the direction of the birth-canal. In order to do this, at the brim, the handles are grasped with one hand, and with the other downward pressure is applied upon the shanks near the lock (Fig. 99). With forceps of moderate pelvic curve, a straight pull on the handles answers after the head reaches the pelvic floor.

Until the head rests on the pelvic floor, the direction is practically a straight line parallel with the posterior surface of the symphysis pubis. Then the line of traction turns almost directly

forward. The handles are swept upward until the anterior edges of the blades hug the ischiopubic rami as closely as possible without crushing the intervening soft parts.

When there is doubt as to the line of traction, the operator should let go the handles at frequent intervals; *the direction in which they point will be that in which the pull should be applied.*

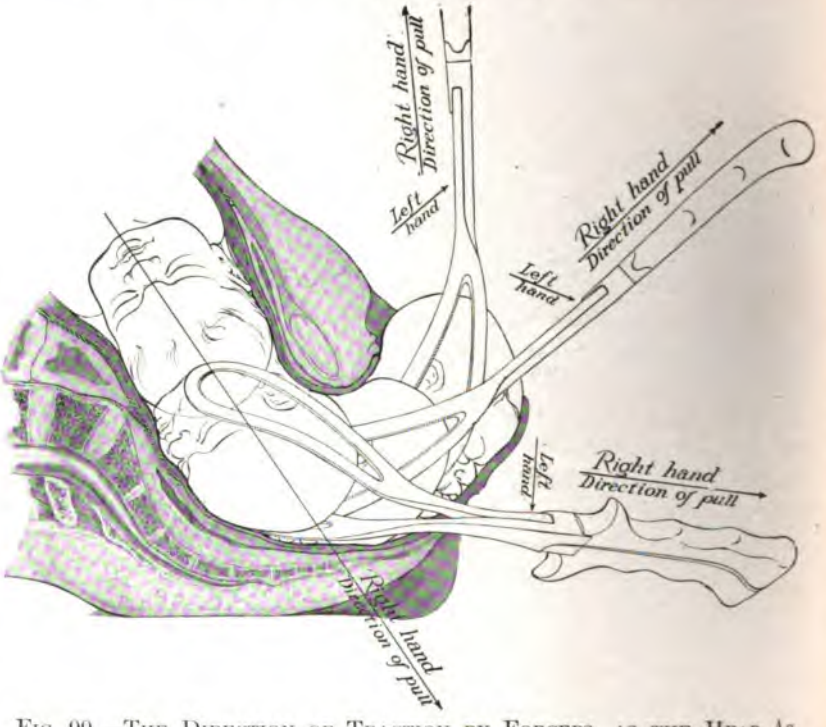


FIG. 99.—THE DIRECTION OF TRACTION BY FORCEPS, AS THE HEAD ASSUMES ITS DIFFERENT RELATION TO THE BIRTH CANAL

Force.—The force required varies from ten to fifty pounds. Time is an important element in a safe forceps extraction. It is a familiar principle of mechanics that the resistance of a moving body increases as the square of the rate of motion. This is not altogether inapplicable in the forceps operation. At least half an hour should be taken for a low forceps delivery, more for a high operation.

Perineal Stage.—The instrument may, or may not, be removed

during the passage of the head over the perineum. Beginners may succeed better without forceps.

A half hour or more should be given to the perineal stage of delivery except when prompt extraction is demanded in the interest of the child.

Removal of the Forceps.—When the blades are removed before the birth of the head the right blade[1] is removed first, the

FIG. 100.—FORCEPS TO THE FACE AT THE PELVIC OUTLET

handle being carried well up over the opposite groin, and the soft parts protected with two fingers placed between the ischiopubic ramus and the anterior edge of the blade; the left is then withdrawn in corresponding manner.

Occipito-posterior Positions.—Here the forceps operation is a dangerous and difficult one. Persistent posterior positions of the occiput imply imperfect flexion. The beginning traction should, therefore, be made in a somewhat forward direction, with a view to increasing flexion.

[1] That on the mother's right.

For the technique of rotation with forceps, the reader is referred to the chapter on occipito-posterior positions.

Face Presentation.—In mentoposterior positions, as a rule, the use of forceps is not permissible. In arrested anterior positions of the face the traction should be directed forward to carry the chin under the pubic arch (Fig. 100).

Breech Presentation.—Here the blades are applied over the trochanters, or one over the posterior surface of one thigh, the other over the opposite ilium and the sacrum. Application over the iliac crests is unsafe, owing to the danger of injuring the child's abdomen by the pressure of the blades, and even of serious injury to the bones.

AXIS-TRACTION FORCEPS

The Instrument.—The axis-traction forceps is a plain forceps with the addition of traction rods, one attached to the heel of each

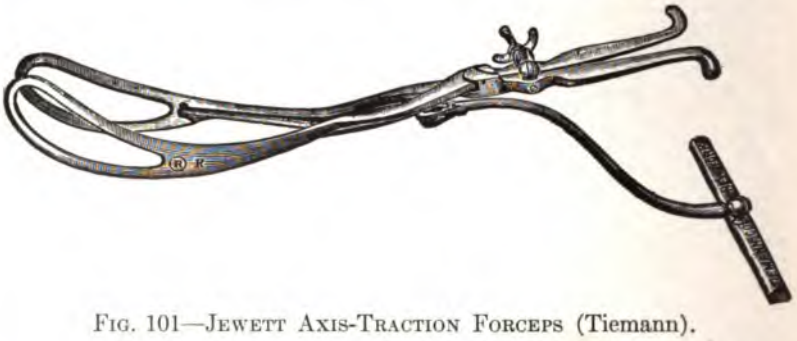


Fig. 101—Jewett Axis-Traction Forceps (Tiemann).

blade by a movable joint. The lower ends of the traction rods are bent backward and attached by a universal joint to a cross-bar, which serves as a traction handle (Fig. 101). By this construction the pull is directly in line with the axis of the blades, and, therefore, with the axis of the birth-canal.

Advantages.—It reduces the traction force to a minimum by applying it in the line of descent, and hence to the best mechanical advantage. It permits the normal movements of flexion and rotation as the head descends.

Position of Patient.—If the patient lies on a table, the position is dorsal recumbent; on a low bed, the lateroprone is better.

Application.—The blades are adjusted to light pressure and may be held with the fixation screw. The latter is seldom necessary.

Traction.—The pull is applied at the traction bar. The handles of the forceps serve to indicate the line of traction, which is regulated by keeping the traction rods nearly parallel with the forceps handles. The traction force should seldom, if ever, exceed fifty pounds. It is sometimes advisable in high operations to protect the pelvic floor during traction with a Sims speculum or other perineal retractor. The extraction is best conducted by using the tractors throughout the delivery.

Choice of Instrument.—The obstetrician will best depend solely on one forceps, and that the axis-traction forceps. This answers all purposes for forceps operations.

VERSION

Version, or turning, consists in partial or complete inversion of the long axis of the fetal ovoid by manual intervention, substituting the cephalic or pelvic pole for a less favorable presentation.

Cephalic version causes the head to present.

Podalic version causes the feet to present.

The term *pelvic version* applies when any of the elements of the pelvic pole of the fetus is substituted for some other presenting part. In its restricted sense it refers to a version which causes the breech to present, an operation which is seldom, or never, called for.

Indications.—The indications for (a) cephalic version are: breech presentation, if the conditions are favorable (external method before labor), and shoulder presentation.

The indications for (b) podalic version are: flattening of the pelvis not below 9.5 cm. (3¾ inches), c. v.; and equivalent contraction of other forms (*version should never be considered as an elective procedure in contracted pelvis, but rather an emergency procedure;* certain cases of placenta prævia; prolapsed funis not otherwise manageable; certain face cases before engagement;

irreducible occipito-posterior positions before engagement; most complex presentations; shoulder presentations when cephalic version is impossible; certain emergencies demanding rapid delivery, when the *head is not engaged*. The dead child may generally be delivered by podalic version in contraction to 7.5 cm. (3 inches), c. v., though perforation is preferable.

Contraindications.—The contraindications to version are *firm engagement of the head; undilated passages; high position of the retraction ring; persistent contraction of the uterus, especially in dry labors.* Internal version should be undertaken only after the os is fully dilated dilatable. The absence of liquor amnii, while not tion, greatly embarrasses the operation.

Dangers of Versi *er.*—In external and in bipolar version the d insignificant. Rupture of the uterus has occur s.

In internal versio of uterine rupture and increased risk from sepsis tion following version increases the danger of lac of shock.

To the Child.—The dangers to the child in internal version are possible fracture of the bones, compression of the spine, and the usual risks of ordinary breech-birth.

Operation.—*Most essential is an exact knowledge of the capacity of the pelvis, the size of the fetal head,* and *the presentation and position of the fetus.* A thorough examination should be made after the patient is anesthetized. For internal version the cervix must be fully dilated or easily dilatable. If immediate delivery is intended, the vulvovaginal orifice must be thoroughly dilated and the usual preparations for a breech extraction should be made. The operation is best conducted on a table. Two assistants besides the anesthetist should be had if possible.

A. EXTERNAL VERSION

External version is applicable, as a rule, only before labor or just after the pains are established. It is permissible when it can be done without violence.

Method.—With the hands placed upon the abdomen, one over each fetal pole, the poles are pushed in opposite directions, *the*

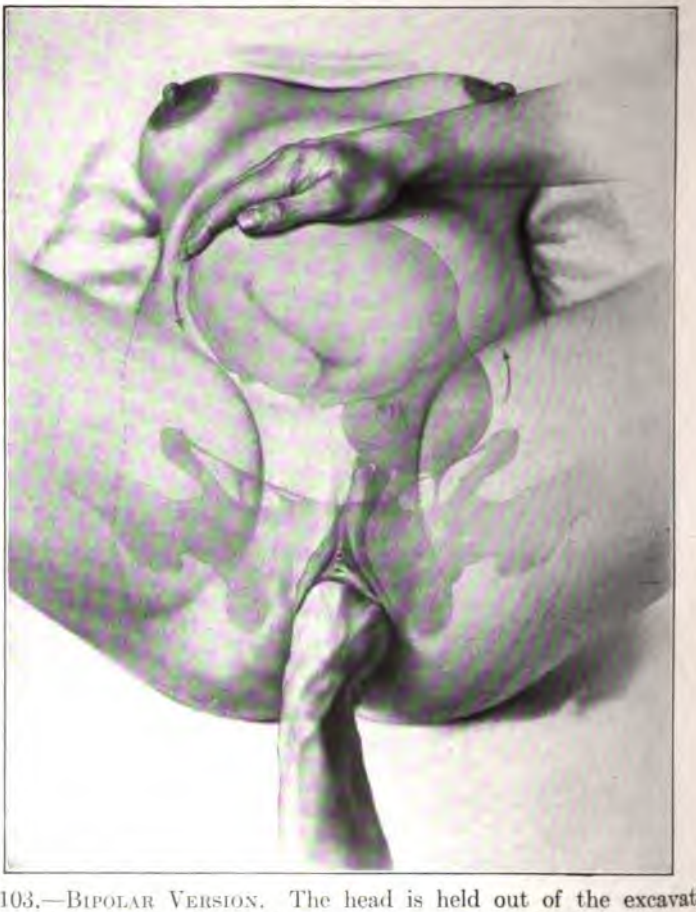
ead toward the occiput and the breech toward the feet. The manipulation is practiced between the pains. During the pains ne fetus is held to prevent reversion to the former presentation.

IG. 102.—BIPOLAR VERSION. The hand is placed in the vagina, and the fingers are passed through the cervix, displacing the head in the direction of the occiput

inally, after the version is complete, a binder and lateral compresses are applied over the abdomen to prevent recurrence of the alpresentation.

B. BIPOLAR VERSION

Advantages of the bipolar over internal version are: *A minimum of traumatism and shock,* because of the presence of the



G. 103.—Bipolar Version. The head is held out of the excavation, while the breech is being carried in the direction of the feet with the external hand

quor amnii; *less danger of infection,* as only two fingers enter e uterus. The fact that it may be done early in the first stage labor is a distinct gain in placenta prævia. The bipolar should preferred to the internal method when practicable.

Method.—As a rule, anesthesia is necessary. The bladder and rectum must be empty. The patient is placed in the dorsal recumbent position. The manipulation is conducted between the pains. A strict asepsis is imperative. The operator wears rubber gloves. The hand is placed in the vagina and one or two fingers are passed through the cervix, and the other hand is placed over the opposite fetal pole externally. With the external hand, the breech is pushed toward the side on which the feet lie (Fig. 102). With

FIG. 104.—BIPOLAR VERSION.—Displacing the shoulder as it presents

the internal hand the head is tossed out of the excavation into the iliac fossa toward which the occiput points (Fig. 103); the trunk is pushed along in the same direction, inch by inch, till a knee presents. The knee is drawn down and the foot extracted (Fig. 105). The other foot also may be brought down if easily accessible. The labor is henceforth to be conducted as in spontaneous breech cases. The operator should cease manipulation during uterine contractions.

A bipolar manipulation is applicable in cephalic version also.

C. INTERNAL VERSION

Method.—The patient is placed in the lithotomy position under an anesthetic. In difficult cases the knee-chest, lateroprone,

or the Trendelenburg position may be utilized. *The cervix and vulvovaginal orifice should be completely dilated.*

The clothing of the operator is covered with a sterile rubber apron and gown. The passages, their approaches, and the opera-

FIG. 105.—BIPOLAR PODALIC VERSION COMPLETED; BREECH ENGAGING IN THE BRIM

tor's hands must be surgically clean. The operator should wear rubber gloves with gauntlets.

One hand is passed into the uterus over the abdom child, palmar surface toward the child. Either foot

are seized and the fetal ovoid is inverted by traction. The other hand of the operator may be used externally to steady the fundus or to assist the rotation of the child by pushing up the cephalic pole. If a hand is within reach, it is snared and held down sufficiently to prevent extension. A prolapsed arm should be pushed above the brim. The operator relaxes the hand and desists from manipulation during the pains. To prevent cramping of the hand the manipulations should be carried out with the least possible muscular effort.

The completion of the birth is managed as in ordinary breech extraction.

OBSTETRIC SURGERY OF THE ABDOMEN

CESAREAN SECTION: CELIOHYSTEROTOMY

Definition.—Cesarean section is an operation for extraction of the child by section through the abdominal and the uterine walls.

Historical Note.—This operation antedates the Christian era. The earlier Cesarean sections, however, were postmortem operations, done a few minutes after the death of the mother to save the child. The earliest Cesarean section upon the living subject, of which we have any knowledge, was performed in the year 1500.

Possibilities of the Modern Operation.—Timely operations under the modern (Sänger) method and in favorable conditions should save not less than 95 to 98 per cent. of the mothers, and the chances for the children should be as good as in spontaneous births. The maternal mortality is much higher in operations delayed till the woman is exhausted by long labor and by attempts at delivery by other means, especially if exhaustion is complicated with sepsis. The fetal death-rate also is increased in late operations.

Indications.—With a living and viable fetus, the woman in operable condition, the head being of average size, Cesarean section is indicated in flattened pelves when the conjugate is below 7.5 cm. (3 inches), and in other forms of contraction in which there is equivalent disproportion between the head and the pelvic space; generally, with dead fetus, when the conjugate is below 6.3 cm. (2½ inches), and in cancer of the cervix, when delivery per vias naturales is impracticable.

In lesser grades of obstruction, 8 to 8.5 cm., Cesarean section may be chosen in preference to its alternatives, pubiotomy, induced premature labor, and even very difficult delivery by forceps or version if all conditions are favorable.

When the degree of obstruction is such that the delivery of a living child is impossible by other means, 7 cm. or less, c. v., the indications are said to be *absolute*. When other operative methods are practicable in a given case, and the Cesarean operation is elected, it is said to be done on the *relative* indication. Section has also been suggested as the best method of delivery in certain cases of eclampsia, complicated by undilated and rigid cervix, as well as in certain cases of central placenta prævia in primiparæ.

The preferred time for operating is a few days before the expected date of labor. Operation at an appointed time before labor permits better preparation, the patient's condition is better, the uterus retracts as well as in operation during labor, and drainage is all-sufficient or can be made so. There is a distinct advantage in operating before rupture of the membranes, since there is less traumatism, the child is more certainly viable, and extraction is easier.

In border-line cases of pelvic contraction the labor may be permitted to go on about an hour into the second stage. If the head does not engage, Cesarean section may be performed with little or no prejudice to the woman's chances by reason of the delay, provided internal interference has been withheld.

Preparatory Measures.—If necessary, the patient's strength should be reinforced by tonics and hygienic measures. The bowels are opened by enemata the day before operating.

The bladder is emptied and the rectum again washed out immediately before the operation.

Instruments are sterilized by boiling for ten minutes in 1½ per cent. solution of washing soda.

Operator and assistants carry out the usual aseptic precautions required in capital operations.

The abdomen is prepared as follows: A few hours before operation, after a total bath and change of linen, the entire abdomen is scrubbed for ten minutes with green soap and hot water, a soft brush or absorbent cotton wrapped in gauze being used as a scrub. The entire surface is then shaved with a sterile razor, the

suds rinsed with sterile water, and the surface dried with a sterile towel. The soap and fat may then be removed with ether.

When the skin has dried, the entire abdomen, from the pubes to the ensiform, is painted with tincture of iodin, allowed to dry, and covered with a sterile towel which is held in position with an abdominal binder.

Immediately before the first incision the field of operation is given a second coating of tincture of iodin, which is allowed to dry.

In emergency cases the antisepsis must be as complete as the limited time permits.

The temperature of the room should be 75° to 80° F.

The patient is placed in the horizontal position and the body and extremities are wrapped warmly with clean flannels, except the operative field. The clothing about the field of operation is covered with dry sterile cloths or towels, and finally a laparotomy sheet, provided with an opening to expose the field of operation, is spread over the patient and top of table.

A sheet of Murphy's adhesive rubber dam over the entire abdomen next the skin is a valuable precaution against infection. The incision is made through it.

Assistants.—The first assistant stands on the left of the patient, opposite the operator. Another gives the anesthetic; a third stands opposite the operator and holds the uterus firmly against the abdominal incision; while a fourth assistant stands ready with two Keith clamps to clamp and cut the cord and to resuscitate the child.

Instruments.—The instruments needed are: scalpel; straight scissors; two thumb-forceps; six to twelve hemostatic-forceps; needle-holder and needles; a long catch-forceps for holding sponge compresses; a large, thin-walled rubber tube, 1.25 meters (about four feet) long, as a constrictor for the neck of the uterus (this is seldom, if ever, necessary); a steam sterilizer for sterilizing cheesecloths, towels, etc.; twelve No. 2 chromated catgut sutures for the deep uterine suture; a long No. 1 plain catgut suture for the superficial uterine suture; a plain, continuous 0 catgut suture for suture of the parietal peritoneum; twelve No. 2 catgut sutures for closing the fascia, or a single continuous catgut, 18 inches long; twelve silkworm-gut sutures, etc.

Summary of the Conditions of Success.—The conditions of success are: elective operation; aseptic technique; deep uterine sutures, three to the inch; superficial or half deep sutures; maintenance of the natural temperature of the abdominal contents; the least possible handling of peritoneal surfaces; hemostasis; operation completed within thirty to forty minutes.

Steps of the Operation.—(1) Median incision of the abdominal wall;

(2) Protection of the abdominal incision from soiling with moist gauze pads, while an assistant, making upward lateral pressure on the abdomen, holds the uterus firmly against the abdominal wound;

(3) Median incision of the uterus;

(4) Extraction of the child and placenta;

(5) Closure of the wounds and application of the abdominal dressing.

Technique of the Operation.—Fluid extract of ergot, m xx, is injected into the thigh muscles just as the anesthesia is begun. The operator assures himself that there is no loop of intestine between the uterus and abdominal wall, beneath the field of incision. Should a coil of intestine be found there, it is pushed above the fundus.

An assistant holds the uterus in central position. The skin incision extends one-third above and two-thirds below the level of the umbilicus. It is best made through the right rectus muscle. The external layer of the rectus sheath is divided, the muscular bundles separated with handle of scalpel and the fingers, and the deep layer of the sheath and the peritoneum divided after lifting them with tissue forceps. Bleeding vessels are controlled by gauze sponge pressure, or held by catch-forceps before opening the peritoneum.

A short longitudinal median incision is made in the uterine wall beginning at the fundus (Fig. 106), avoiding the membranes if still unbroken. This is extended downward with fingers, scissors, or scalpel to a total length of about six inches.

The hand is thrust through the membranes and the child is extracted by the head or the feet, whichever is most accessible.

In case of anterior implantation of the placenta, usually the

The cord is clamped at two points with catch-forceps, cut between them, and the child is passed to an assistant.

The uterine incision may be made wholly at the fundus in the

FIG. 106.—CESAREAN SECTION. The uterus is firmly held against the abdominal incision, while a short median incision is made in the uterus wall

sagittal plane (Müller) or transversely, extending between the Fallopian tubes (Fritsch), but these incisions offer no material advantage.

The uterus slips out of the abdomen as the child is extracted, and the intestines are kept back with hot sterilized towels placed over the upper part of the incision. The coverings help also to protect the peritoneum from soiling. The uterus is wrapped in

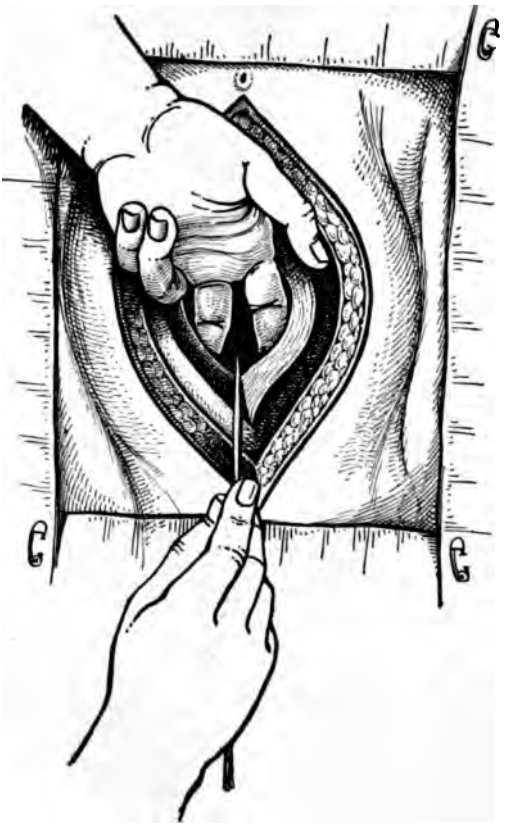


FIG. 107.—CESAREAN SECTION. Enlarging the uterine incision

hot moist cloths. As a rule, it is better not to wholly eventrate the uterus.

The placenta, if not spontaneously separated, may be peeled off by grasping it with one hand like a sponge. If the cervix is not sufficiently open for drainage, a large rubber tube or gauze strip is passed down through it and withdrawn from below.

Irrigating or mopping the uterine cavity is unnecessary. Asepsis is promoted by leaving it as nearly as possible untouched.

The peritoneum is sponged dry with the least possible friction or handling.

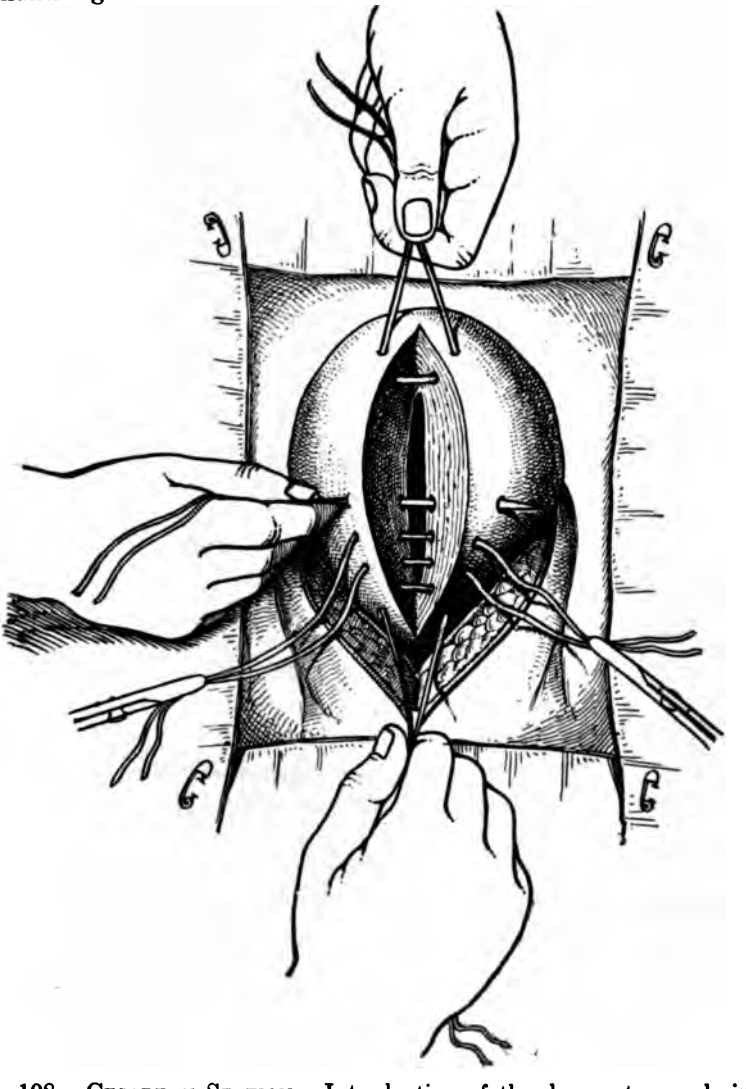


FIG. 108.—CESAREAN SECTION. Introduction of the deep sutures, closing the muscular coat of the uterus. (Author's method)

The uterine wound is closed with deep No. 2 chromated catgut sutures at intervals of 1 cm. (about ⅓ inch). They are given a wide sweep laterally through the muscular wall, falling short of the decidua.

The peritoneal coat of the uterus is closed with a No. 1 con-

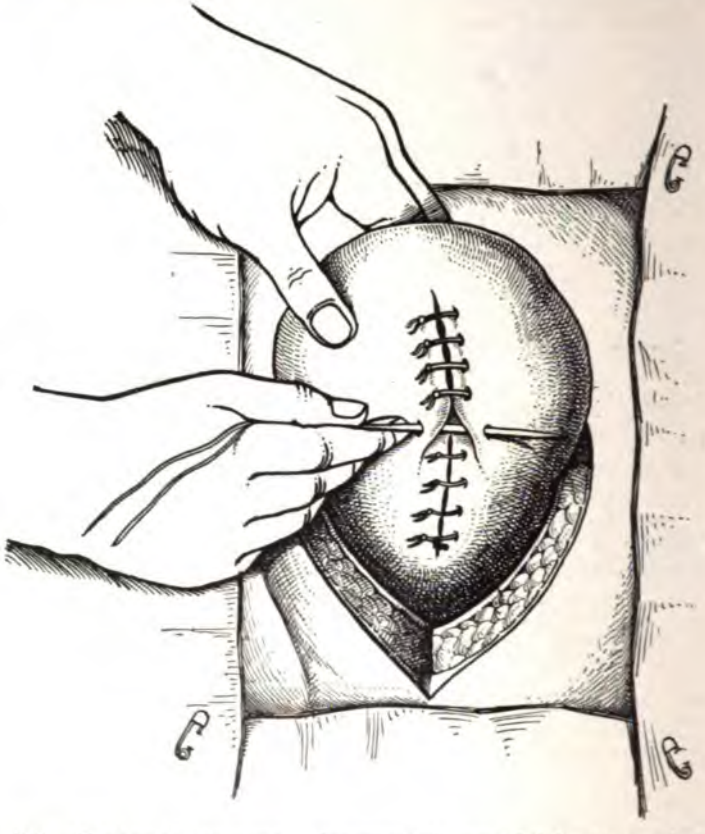


FIG. 109.—CESAREAN SECTION. Interrupted superficial sutures between the deeper ones. (Author's method)

tinuous plain catgut suture, forming a welt over the deep suture line. The hemorrhage is inconsiderable and usually ceases with the introduction of the first sutures—a hypodermic of ergotole should be given before beginning the operation, and one of ergotole and pituitrin on the delivery of the child. Retraction of the uterus

is ensured by manipulating it, if necessary, through a hot towel, or by faradism.

When there has been much blood loss, a quart or two of warm sterilized 0.9 per cent. salt solution may be left in the peritoneum.

The parietal peritoneum is closed with a plain running No. 0 catgut suture.

Interrupted silkworm-gut sutures are then passed at intervals of 2 cm. (about ¾ inch) through all but the peritoneum, from within outward.

The fascia is brought together with interrupted No. 2 plain catgut sutures, or with a continuous suture.

The silkworm-gut sutures are now tied. The abdomen is cleansed, and the wound covered with a dressing of several thicknesses of dry sterile cheesecloth; over this is placed a thick compress of sterile absorbent cotton. The dressings are secured with strips of zinc oxid adhesive plaster, and all held in place by a Scultetus binder.

After-treatment.—One quart of normal salt solution is injected into the bowel before the patient leaves the table. Whiskey, ℥ij, and black coffee, ℥iv, are added to the injection, if required. The bed is warmed with hot-water bags. Keeping the head warm by wrapping in flannel helps to combat shock.

An eighth grain of morphin, or twice as much codein, may be given subcutaneously in case of much pain or restlessness. As a rule, this should not be repeated and none is needed after the first night.

The bladder should be emptied every eight hours, but the catheter should be withheld if possible.

After the first night, if all goes well, the child is put to the breast as in normal cases.

Feeding is begun with light liquid food as soon as it can be retained, within twelve to twenty-four hours usually.

The bowels are opened with enemata on the third day after operation, sooner should evidence of infection appear.

The silkworm-gut sutures are removed by the fourteenth day.

After ten days usually the patient may sit up in bed while taking her meals and for use of the bed-pan, and may leave the bed after the fourteenth day. A firm abdominal supporter may be worn for six weeks after operation.

Postmortem Cesarean Section.—In case of sudden death of the mother in the last month of gestation, the child usually may be delivered alive by abdominal section, if extracted within five minutes after the mother's death. It is stated on good authority that in exceptional instances the child may survive in utero for several hours after death of the mother. The child has been saved in only a small percentage of postmortem Cesarean sections.

Extraperitoneal Cesarean Section was suggested by Frank in 1907 for infected cases. This procedure is done through a transverse incision in the abdominal wall just above the symphysis, and the peritoneum is separated from the posterior surface of the bladder and anterior face of the uterus; this is sewn to the parietal peritoneum, exposing the lower uterine segment, through which the incision in the uterus is made, and the child and placenta delivered. The experience of American obstetricians is not favorable to the extraperitoneal method.

PORRO OPERATION: CELIOHYSTERECTOMY

Definition.—A Cesarean section, supplemented by supravaginal amputation of the uterus and removal of the tubes and ovaries.

The operation is named after Edward Porro, of Pavia, Italy, who was first to perform it, in 1876.

The mortality is substantially the same as that of the Cesarean operation.

Indications.—The indications are myomata of the uterus; disease of the uterus or appendages requiring their removal; marked puerperal osteomalacia; probable uterine infection; uncontrollable hemorrhage after Cesarean section; vaginal atresia obstructing drainage.

Steps of the Operation.—(1) Long abdominal incision, falling one and one-half inch short of the symphysis; (2) eventration of the uterus; (3) placing the cervical constrictor, a thin-walled, finger thick, rubber tube; the loop is passed over fundus, ovaries and tubes being held up, and constrictor left temporarily loose; (4) packing hot towels about the cervix to protect peritoneum from soiling with blood and liquor amnii; (5) incision of the uterus and extraction of the child and placenta; (6) tightening

and tying of constrictor; (7) transfixion of the cervix by passing two knitting needles or hatpins through the constricting rubber tube and the cervix; (8) amputation of the uterus 2 cm. (¾ inch) above the constrictor; (9) ligation of the uterine arteries in the stump or at the sides of it; (10) stitching the entire circumference of the stump in the lower angle of the abdominal incision with the free surfaces of peritoneum in contact; (11) suture of the abdominal wound; (12) mummification of stump with perchlorid of iron solution; abdominal dressings as in Cesarean section.

This operation is practically superseded by the usual modern method of supravaginal amputation. The technique, after the uterus is evacuated, does not differ from that of abdominal hysterectomy as done for fibroids. The after-treatment, too, is the same.

VAGINAL CESAREAN SECTION

Vaginal Cesarean section is delivery by sagittal section of the anterior and the posterior uterine wall per vaginam. It was first proposed by Dührssen in 1895. The operation demands considerable surgical skill and, in the opinion of the writer, should be limited to hospital practice.

Indications.—Conditions requiring prompt delivery, such as may be present in toxemia after the eighth week, eclampsia, accidental hemorrhage, placenta prævia, threatened uterine rupture; or conditions of the cervix causing obstruction, e. g., rigidity, stenosis, myoma, carcinoma or old cicatrices.

Technique.—An intramuscular injection of ergot may be given shortly before operation. In primiparæ room is obtained by a right lateral vagino-perineal incision. The field is exposed by retractors. The cervix is drawn well forward with two traction forceps, one caught in each lateral aspect of the anterior lip. The anterior vaginal wall is incised longitudinally from a little behind the urethra to the anterior lip of the cervix. The bladder is detached from the uterus as in vaginal hysterectomy. If required, the anterior vaginal wall may be separated from the bladder. The bladder is held up with a suitable retractor passed beneath the pubic arch.

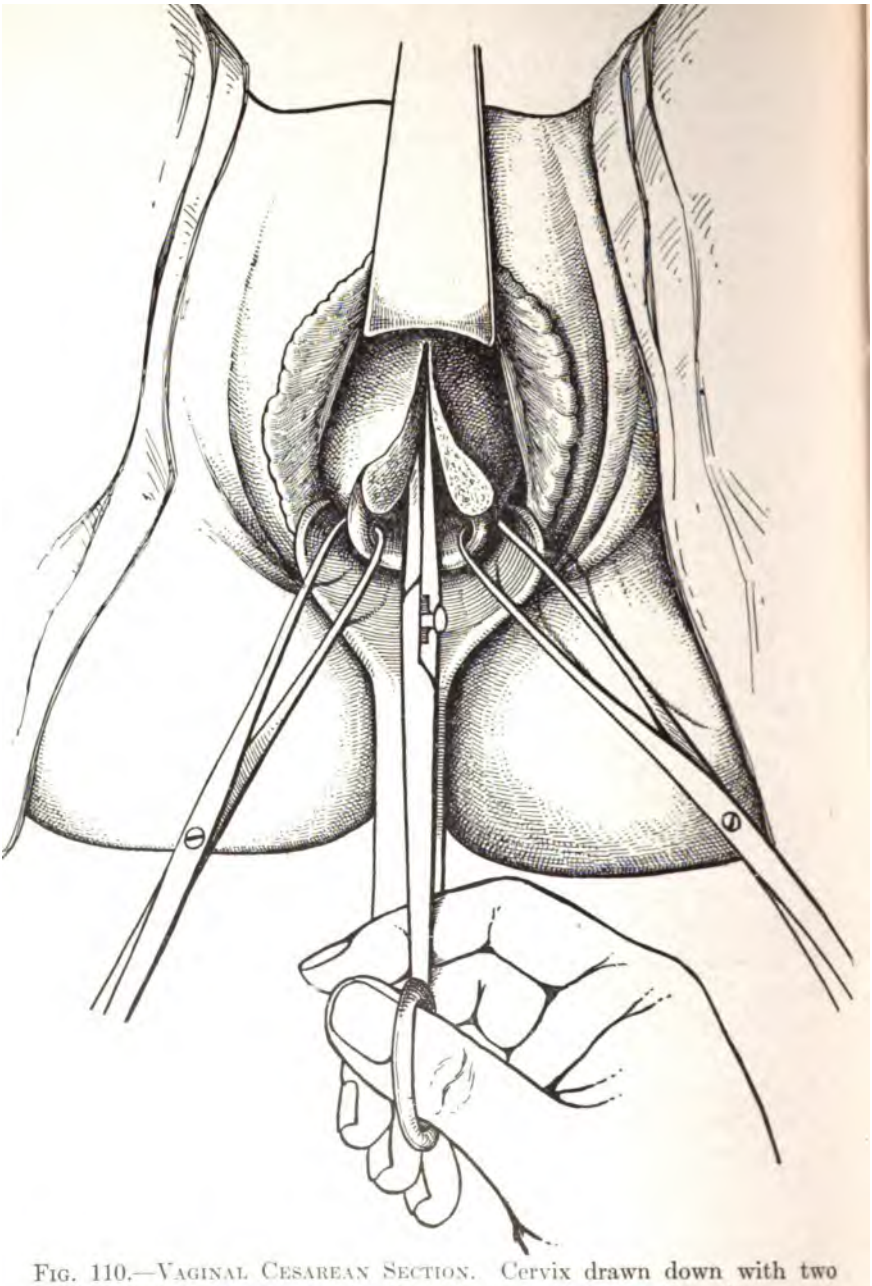


FIG. 110.—VAGINAL CESAREAN SECTION. Cervix drawn down with two traction forceps; anterior lip split to vesicouterine junction

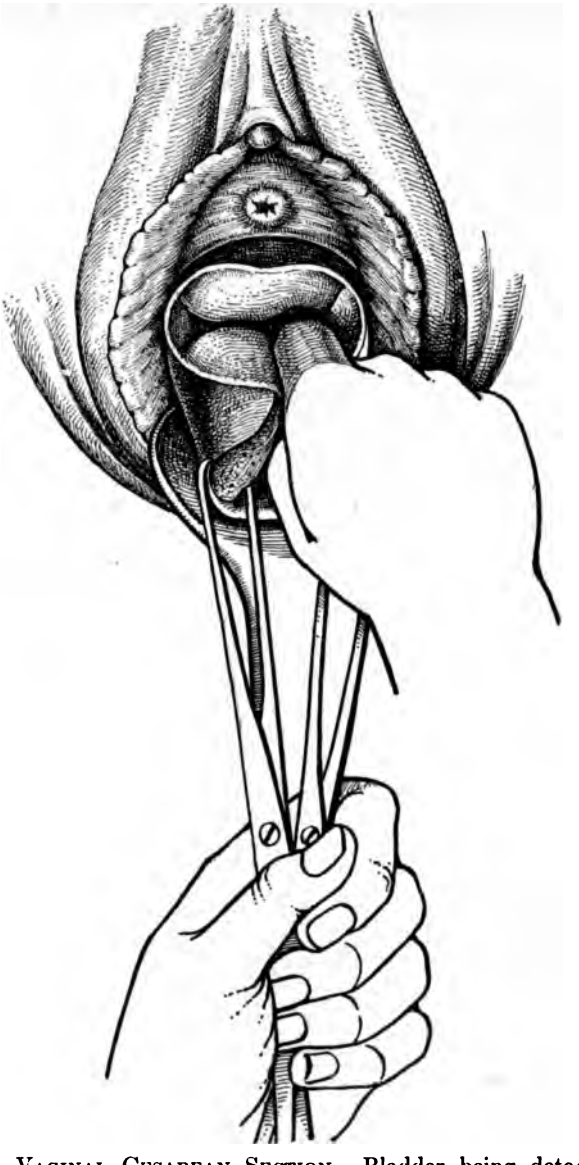


FIG. 111.—VAGINAL CESAREAN SECTION. Bladder being detached from its anterior uterine attachment by the finger

The anterior uterine wall is split in a sagittal direction from the lower border of the cervix to a point above the internal os, a distance of about 6 to 10 cm. The single anterior incision affords sufficient space for the extraction of the child up to the eighth month. A posterior uterine incision also is required in full term deliveries. The amniotic sac at once protrudes. Membranes are

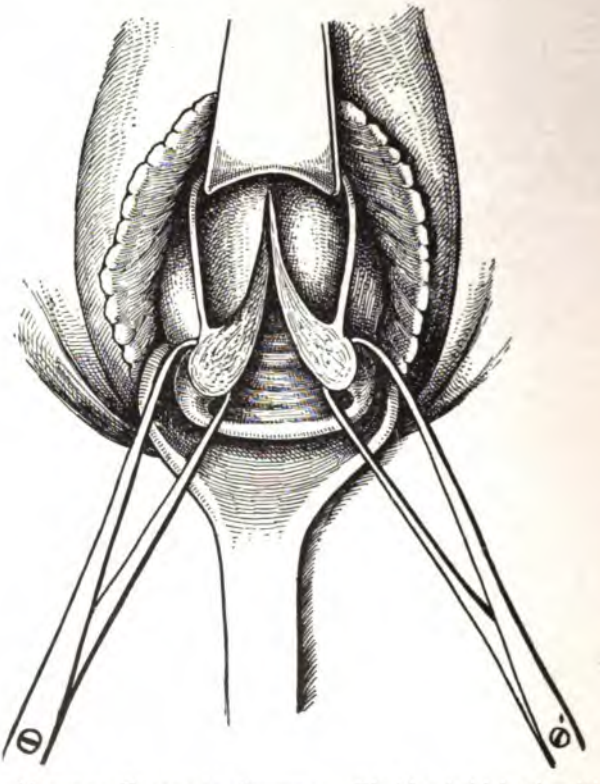


FIG. 112.—VAGINAL CESAREAN SECTION. Bladder held back with suitable retractors

ruptured and child extracted, generally by version, or, when the head is fixed, or can be engaged by forceps.

The placenta is removed and the uterus firmly packed with gauze until the sutures are placed.

The uterine incisions are closed with sutures. The vaginal and

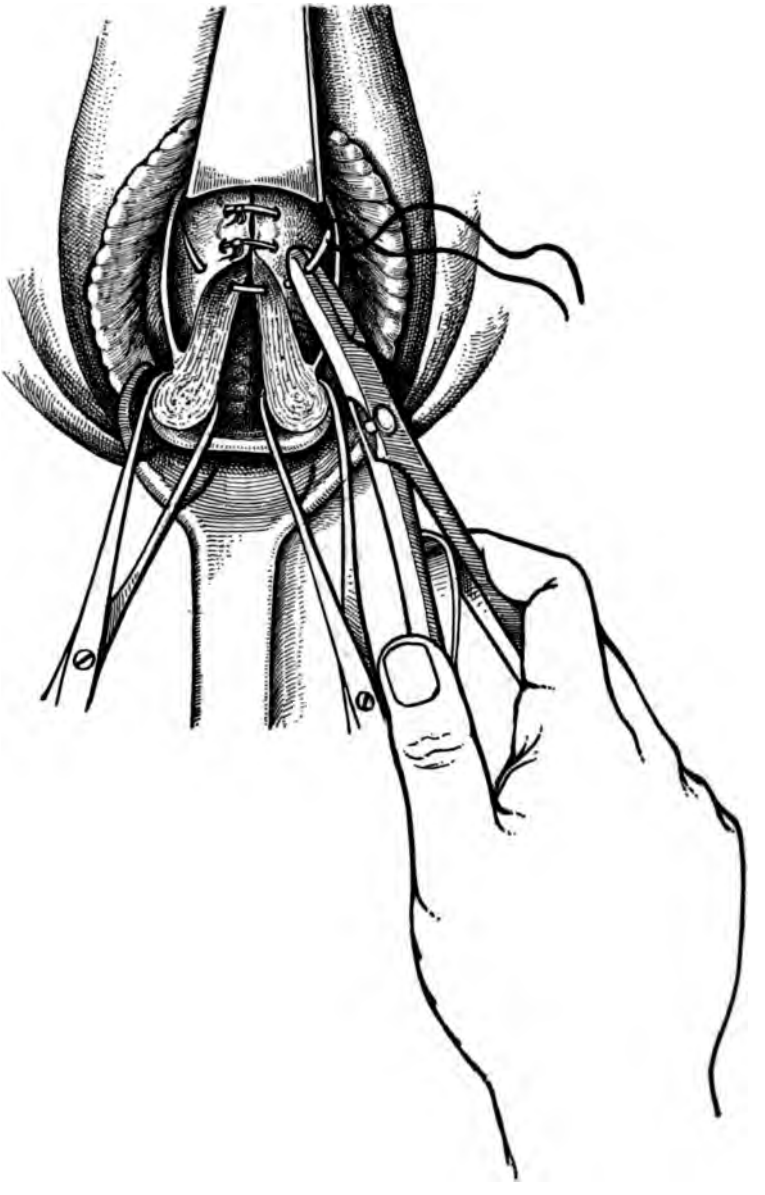


FIG. 113.—VAGINAL CESAREAN SECTION. Suture of the uterine incision by interrupted sutures

perineal incisions are sutured, a drain of gauze or rubber tissue being left between cervix and bladder. The drain is removed in 24 hours.

In myoma or carcinoma of the uterus the operation is followed by vaginal hysterectomy.

In moderate pelvic contraction, Dührssen has combined vaginal Cesarean section with hebotomy.

SYMPHYSIOTOMY

Historical Note.—Division of the pubic joint for the purpose of facilitating delivery in narrow pelves was first done on the living woman in France, by Jean René Sigault, in 1777. Meeting partial acceptance for a time, the operation, after half a century, had become practically obsolete. Revived by Morisani, of Naples, Italy, in 1866, it was taken up in the country of its birth by Pinard early in 1892. His success and advocacy led to its immediate adoption throughout the world.

Results.—The material mortality differs little from that of Cesarean section under equally favorable conditions. The fetal death-rate at the best is somewhat greater. The mortality for both patients, however, has been increased by operations performed on pelves too small. Restoration of the symphysis, as a rule, is complete. Possible complications of the operation are laceration of the anterior soft parts, including the urethra and bladder, and hemorrhage, more rarely suppuration of the symphysis and injury to the sacroiliac joints.

Space Gained.—The maximum pubic separation permissible is 7 cm. (2¾ inches); with an interpubic opening of that extent, the conjugata vera gains a little more than 1.3 cm. (½ inch). The transverse at the brim gains one and a half, the oblique about twice as much as the conjugate does. The parietal boss projects into the interpubic space, and this is equivalent to a slight additional increase in the conjugate.

Indications. Until within a few years, the indications were as follows: simple flattening of the pelvis not below 7 cm. (2¾ inches), or below 7.5 cm. (3 inches) in the conjugate, or equivalent disproportion from other causes; irreducible occipito-posterior

positions; firmly impacted mentoposterior face cases; irreducible brow presentation; and dystocia due to funnel pelvis.

At the present day, symphysiotomy is seldom chosen in preference to Cesarean section. Its chief disadvantages are the narrowness of its anatomic field and the consequent difficulty in selecting cases which fall strictly within its limits, the fact that it does not effect delivery but only prepares the way for it, and that the after-care is exacting and convalescence prolonged and tedious. The fetal mortality, too, is higher than in the Cesarean operation. Rarely division of the pubic joint may be better than Cesarean section, when the woman is too much exhausted for transperitoneal delivery, or the head is impacted deep in the pelvis.

The operation is contraindicated in ankylosis of one or both sacroiliac joints. The fetus must be living and viable. With a dead or nonviable child craniotomy should be substituted.

Method of Operating.—The patient lies in the dorsal position with the thighs strongly flexed and the knees held apart, under an anesthetic. The antiseptic preparation of the abdomen is the same as for celiotomy. The vulva is prepared with the same care as the abdomen.

The cervix must be fully dilated. A metallic catheter is passed into the bladder by an assistant and pressed backward and to one side. This helps to protect the urethra and vesical neck from injury, and, at the same time, keeps the bladder empty. Either the open or the subcutaneous operation may be chosen. The advantage of the former is that the steps are conducted under direct inspection; it is claimed for the latter that the wound is less exposed to infection by the lochia. The open method is recommended.

In *the open method* the division of the joint is conducted as follows: The incision exposes the entire length of the joint, extends an inch above it, and opens the space between the recti muscles. The clitoris is drawn down with a sharp hook caught just above it, its suspensory ligament cut, and the bony margin of the pubic arch laid bare by detaching from it the triangular ligament with a few strokes of the scalpel.

The retropubic structures are pushed back with the finger passed down behind the symphysis, a broad, strongly curved director (Farabeuf's) is passed immediately behind the joint from

below upward or from above downward. The clitoris and other vascular structures at the lower end of the symphysis are thus held back during the division of the joint. This prevents much hemorrhage, which is otherwise sometimes a troublesome complication.

The joint is located by finding the notch at the top between the pubic bones or by forcibly flexing and extending one lower extremity while the other is held stationary. With a strong, slightly curved, blunt-pointed bistoury, the symphysis is then divided from behind forward or from before backward.

The bones are cautiously separated and held apart to the extent of 7 cm. (2¾ inches), the lateral halves of the pelvis being firmly supported by the assistants to prevent further separation as the head comes down.

In *the subcutaneous method* the incision is from 2.5 to 7.5 cm. (1 to 3 inches) in length, according to the thickness of the abdominal wall, and it terminates below at the top of the symphysis. The rectus muscles are separated, the finger passed behind the symphysis, and the joint divided by the bistoury from behind forward and from above downward, the finger serving as a guard and a guide.

Venous hemorrhage, which is sometimes profuse, is controlled by pressure by packing the wound, and, if necessary, the vagina, with sterilized gauze or by hemostatic suture. The short incision may be extended, should it become necessary for the control of hemorrhage or by reason of other complications.

When, owing to bony ankylosis or to the sinuous course of the symphysis, division with the knife is impossible, the joint may be opened with a metacarpal or chain saw.

The child is extracted with the forceps if it is not promptly expelled by the natural forces. Bilateral episiotomy may be done, if necessary, to prevent laceration of the anterior soft parts at the vaginal outlet. Great care must be used during delivery lest the anterior vaginal wall be torn through.

After delivery of the child and placenta, the bones are brought together firmly, the urethra and the vesical neck being meantime held backward to avoid pinching between the bones.

The soft parts are closed with silkworm-gut sutures, which, in the open method of operating, should include the fibrous struc-

tures in front of the joint. Two or three strands of silkworm-gut may be carried down from behind the joint as a drain. This is removed in twenty-four hours. Zweifel sutures the fibrous structures with catgut and leaves the superficial wound open for 8 or 10 days, packing it with gauze.

The pelvis is immobilized by means of two or three strips of rubber adhesive plaster, reaching obliquely from one side of the pelvis to the other, above the wound, and over these a firm binder. Moreover, during convalescence, the patient lies on the back, in a hammock-bed (Ayers), or on two firm cushions (sand bags), extending from the axillæ below the great trochanters, which support the lateral halves of the body and the pelvis. A canvas binder provided with straps and buckles for fastening makes a firm and easily adjustable support.

An ounce or two of boric acid may be left in the vagina. *Pubiotomy has practically supplanted symphysiotomy in this country.*

After-treatment.—For three or four weeks the patient should lie on the back with the limbs outstretched. The urine may need to be drawn with a catheter for the first two or three days after operation. A trap door in the hammock-bed provides for bowel evacuations and for urination. Surfaces soiled by the dejections must be cleansed promptly.

The binder is changed as often as soiled. The sutures are removed by the eighth or tenth day. The patient is kept in bed for four weeks. The binder remains six weeks.

HEBOTOMY. PUBIOTOMY

This was first suggested by Gigli in 1893. The pubic bone is divided vertically just to one side of the symphysis. *The side chosen is that which the occiput confronts.* Pubiotomy actually comes in competition with Cesarean section in border line cases, when the test of labor has shown that the head cannot engage.

Indications are the same as for symphysiotomy.

Results.—The number of recorded operations to date is over 800, with a mortality of a little over 2 per cent. Williams reports 38 consecutive pubiotomies without a maternal death. The operation should be performed solely in the interests of the child.

Bladder injuries and vaginal laceration are possible complications. Final results generally have been satisfactory. The disadvantages

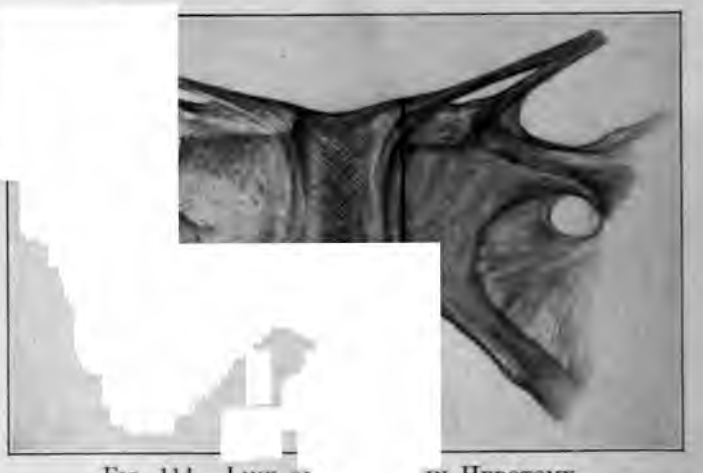


FIG. 114.—LINE OF [illegible] IN HEBOTOMY

of the operation are substantial[illegible] same as those of symphysiotomy.

Technique.—The patient is brought to the edge of the table

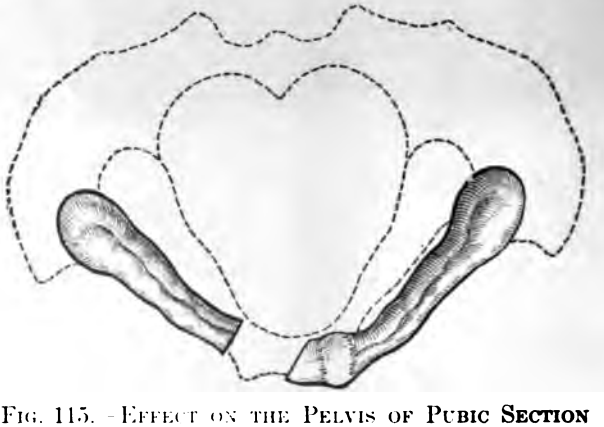


FIG. 115.—EFFECT ON THE PELVIS OF PUBIC SECTION

and the legs are held by assistants. The field of operation is prepared in the usual manner. The bone may be exposed by the open method by a vertical incision extending from just within the pubic

to a point immediately external to the labium majus, or the on may be made by *the subcutaneous operation of Döderlein, h is now generally adopted.* A horizontal incision is made the pubic spine inward, long enough to admit the finger. retropubic soft parts and those about the lower margin of the are then pushed back with the finger. With a large strong

FIG. 116.—PASSING THE DODERLEIN NEEDLE

d needle (Döderlein needle) or other suitable carrier, passed to the bone, a thread or narrow tape is carried behind the bis, emerging at a point just without the labium majus.

Gigli saw is drawn into place and the bone sawed through. great separation of the bones is prevented as in symphysi-. The child is delivered with forceps. Bilateral episiotomy onserve the integrity of the structure in the anterior or pubic nt. The bones are brought together, as after median sec-

tion, and the wound in the soft parts closed with one or two sutures.

After-treatment.—The wound is dressed with sterile gauze and a long strip of Zinc Oxid adhesive plaster 6-8 inches wide, is passed around the body to make firm and equal pressure on the sides of the pelvis and upper part of the thighs. The patient is

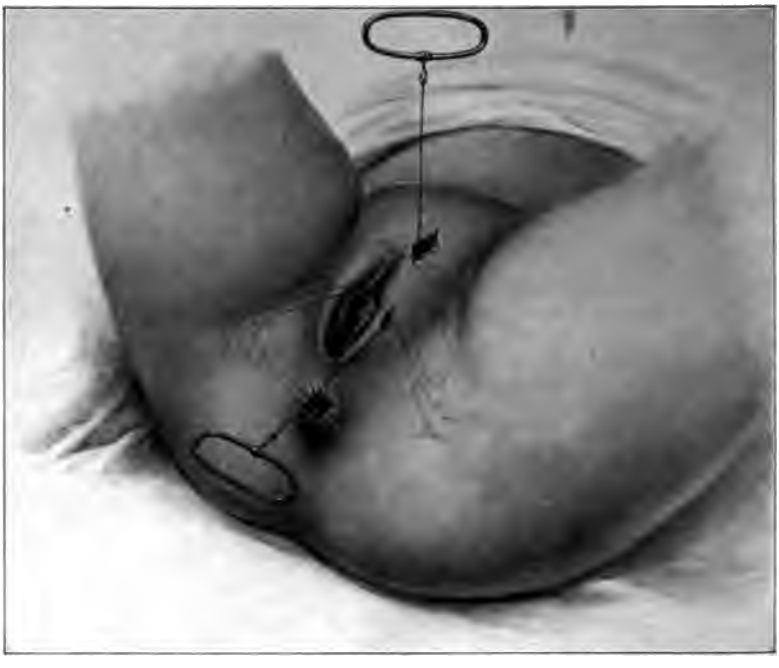


FIG. 117.—GIGLI SAW IN POSITION

allowed out of bed in two weeks. Union of the bone takes place by bony or fibrous union. Pubiotomy permanently enlarges the pelvis.

EMBRYOTOMY

Embryotomy is the general term for all obstetric operations employed to facilitate delivery through the natural passages by

Indications are hydrocephalus too large for safe extraction without perforating, and not manageable by aspiration of the cranial cavity; obstructed labor with a dead or nonviable fetus or a fetal monstrosity, conjugata vera exceeding 2¼ inches; impacted shoulder, face presentation, and other complications, ruptured uterus, ablatio placentæ, etc., if the child is dead.

It is very rarely that embryotomy will be justifiable on the living and viable child. The sacrificial operation must be considered as an alternative of Cesarean section or pubiotomy when the condition of the mother is unfavorable for the latter operations, and especially if she elects the former with a full knowledge of the facts.

CRANIOTOMY

Definition.—An operation for the comminution and removal of all, or a portion, of the cranial bones to facilitate delivery.

Steps.—1. *Perforation.*—The field of operation should be cleansed and disinfected and the woman placed on the table in the obstetric position and under an anesthetic. All but the operation field is covered with an aseptic sheet. The instrument may be a Smellie's scissors, Naegele's perforator, or, preferably, the trephine. In emergency, a long, sharp-pointed surgical scissors will serve the purpose. The bladder and rectum should be empty. An assistant steadies the head by grasping it and holding it firmly against the brim with the hands placed over the abdomen.

The point of the perforator is pressed against the head, perpendicularly to the surface of contact, just behind the pubic bones, the fingers of one hand serving as a guide. Except when the trephine is used, the puncture is best made through a suture or fontanelle.

The point is fixed in the tissues by a screwlike motion, and the perforation is then effected by a similar motion.

The blades are separated in different directions to enlarge the opening.

The most approved method of perforating is with the trephine. It removes a button of bone, leaving a permanent opening through which the cranial contents may readily be evacuated.

The after-coming head may be perforated through a skin

incision made at the base of the neck posteriorly; the perforator is passed subcutaneously.

The brain is broken up with the perforator and washed out with a stream of sterilized water forcibly injected with a Davidson syringe.

2. *Comminution.*—With the craniotomy forceps passed within the scalp, the cranial bones are seized, one by one, dislodged by rotating the forceps about its long axis and then removed. In moderate obstruction the head may be crushed and extracted with a cephalotribe.

Fig. 118.—Craniotomy. Basiotribe applied [illegible]

In the higher grades of pelvic contraction the cranial base, as well as the vault, may be broken up. Tarnier's basiotribe was devised for this purpose. Between its blades is a screw perforator, which is made to perforate the head, while the blades crush it. With the resources of modern obstetric surgery, basiotripsy is seldom justifiable.

3. *Extraction* is effected with the cranioclast, or, when space permits, with the cephalotribe, guarding carefully against laceration of the passages by projecting spicula of bone. If the cranioclast is used, one blade is passed within and one without the cranial cavity. In extreme narrowing the cranial base is best delivered edgewise by drawing down the chin.

CLEIDOTOMY

[illegible] division of both clavicles, which diminishes [illegible] when the shoulders obstruct [illegible] in the middle third with

CEPHALOTRIPSY

Cephalotripsy is an operation for reducing the size of the head by crushing the cranial vault. In moderate degrees of contraction a good cephalotribe is Tarnier's or Lusk's.

The method of application does not differ from that of the obstetric forceps. An assistant crowds the head firmly into the excavation if it is not already engaged. The head is perforated, and the cephalotribe is applied with care to secure a good grasp.

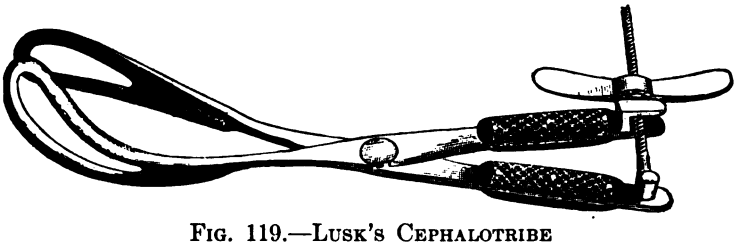


FIG. 119.—LUSK'S CEPHALOTRIBE

The skull is then slowly crushed by turning a powerful screw at the handles. The head is brought down with the cephalotribe, used as a tractor. Since the cranial vault is expanded in one direction as it is crushed in the opposite, care must be used to guard against laceration of the passages by projecting spicula of bone. The elongated diameter of the head must be kept in the long diameter of the pelvis.

Cephalotripsy is practicable only in moderate contraction.

EVISCERATION

This term applies to all operations for reducing the size of the trunk by removal of its viscera. The operation is limited almost wholly to cases of impacted shoulder in which decapitation would be difficult or impossible.

Perforation of the trunk may be done with a craniotomy perforator, or through the bony coverings of the chest with the trephine or heavy scissors. The viscera are then broken up with the perforator and removed with craniotomy forceps, with stout

dressing-forceps, or with the fingers. The bony walls, if necessary, may be cut away piecemeal with strong scissors.

Sometimes the trunk is divided into sections with a chain saw, or stout, blunt scissors, and delivered piecemeal. The head is then crushed and extracted with the cephalotribe.

DECAPITATION

Definition.—Separation within the uterus of the fetal head from its trunk.

Methods.—1. *Blunt Hook and Scissors.*—While an assistant draws the neck firmly down with a blunt hook or a strong tape passed around the neck, the neck is gradually severed with blunt pointed scissors, guarded by two fingers of the other hand.

2. *Braun's hook* is a convenient and safe instrument for decapitation. The hook is passed flatwise on the hand as a guide. It is carried up between the head and the pubic bones till it can be hooked over the neck. The neck is then firmly engaged in the hook by traction. By a to-and-fro movement of the handle the neck is readily severed.

3. *Écraseur.*—A tape is passed around the neck as follows: It is first well oiled and knotted at one end; the knot is pushed up over one side of the neck with the fingers of one hand, the fingers of the other hand catching it and pulling it down on the other side. Another method of carrying the tape into place is with an English bougie properly curved and armed with a stylet. The chain of the écraseur is attached to the tape and drawn into place. The neck is then cut through by tightening the chain.

A wire écraseur armed with piano-wire or common picture-wire may be used for the purpose, or a chain saw may be substituted for the écraseur.

Extraction.—After decapitation the head is pushed up and the trunk delivered by traction on the arm; then the head is extracted, chin first. Two fingers of one hand are hooked in the inferior maxilla and the head crowded through the pelvis by suprapubic pressure with the other hand or delivered with forceps or cephalotribe. In a narrow pelvis it may be necessary to crush the head before it can be delivered. Perforation may be done in the

grasp of the cephalotribe and the cranial contents then be broken up and removed in the usual manner. Care must be taken lest the uterus be ruptured in these manipulations or the vagina be lacerated by projecting bone fragments.

CHAPTER XVI

THE DUCTLESS GLANDS IN PREGNANCY

GENERAL CONSIDERATIONS

The importance of the endocrines and their bearing on pregnancy, labor and the puerperium, have had little or no consecutive study, yet, as the physical and mental development of each individual are dependent on the action and interaction of the ductless glands, it is apparent that these internal secretions must play an important part in the development and life of the child-bearing woman. Mendelism teaches us that the determiners of the traits of the father and the mother are brought together in the offspring; and as these are governed by the activity or inactivity of the several internal secretions, one can readily see that perfection or imperfection of development in the parents will have a large bearing on the mental and physical development of the offspring.

Before puberty the metabolism of girls is probably not very different from that of boys, the chemical processes of both are for the most part engaged in promoting the growth of the body, at puberty, however, a wide differentiation occurs and further development is due to the activity of the reproductive functions, for the ovary dominates a woman's life during her sexual activity, both in her physical development and mental processes. The difference in the skeleton as instanced in the shape and conformation of the pelvis in the female is an evidence of the modifying influence of the ovarian secretion on bony growth.

It is generally admitted that the hypophysis, adrenals, and thyroid apparatus, are the principal secretions which activate and control the calcium metabolism and bony development. The action of the hypophysis in inhibiting prolonged action of the thymus, inhibits the early development of the sex glands. When their activity is postponed the skeleton takes on more of the male attributes.

As a rule growth ceases at puberty, for with the advent of menstruation, there is a larger excretion of calcium and other substances which were previously required for the formation of the skeleton, which are now no longer wanted until pregnancy or lactation occurs.

Patients with a delayed ovarian secretion are tardy in their sexual development. They are usually the subjects of considerable obesity, of large bony frame, funnel or high assimilation pelvis with general hypoplasia of the uterus and adnexa. On the other hand, the early ripening of the ovary seems to have the opposite effect on the skeletal growth, with the result that these women have more perfect sexual organs and ample pelves.

If we can know what the ductless glands have done to an individual up to the time of puberty, we can prognosticate her development during adolescence; for the physical and mental development of a growing child is dependent on the activity of the hypophysis and the thyroid. Perfect balance between these secretions is imperative in order to produce the perfect organism.

In hypo-pituitarism, if there is a diminished function of the posterior lobe during infancy, and before puberty, there is a failure of stimulation of the uterus and ovaries, and sexual infantilism is the result; while if the hypo-pituitarism of the posterior lobe occurs after adolescence, general distrophy is the result. The action and interaction of these glands continue throughout life, as is shown in the pre-menstrual nervous symptoms so often seen in a poorly balanced endocrine system. In these same women clinical experience shows that this disarrangement of glandular interactivity produces a stormy menopause. A placid climacteric denotes a well balanced interglandular relation, for throughout the endocrine system, one gland at one time or another assumes the work of another, provided each functions properly, so that the transition from sexual activity to senility should be so gradual that no internal secretion becomes suddenly dominant.

The thymus also has a marked influence on ovarian development, for it is supposed this gland has an inhibiting effect on the gonads and determines the time at which sexual development is perfected; namely the time of puberty.

It is, however, the thyroid which has the widest influence on the female organs and their action in pregnancy, labor, and the puerperium. The thyroid governs the growth of all cells and sustains their functional activity. It is the thyroid and parathyroid which control calcium metabolism, and it is the thyroid which is a katabolic stimulant facilitating the breaking down of exhausted cells and governing the elimination of the waste products of their disintegration. This gland also exercises a protective antitoxic and immunizing action defending the body, not only against the toxic products of its own metabolism, but against disease producing micro-organisms and injury by their products. These metabolic antitoxic functions are attended by the discharge into the lymph and blood stream of a complex secretion which contains the active principles or hormones; its antitoxic function is but a part of the thyroid's major function of regulating metabolism, for by its action in maintaining the nutrition of all body cells and those of other hormone producing organs, the liver cells in particular, it regulates the production of protective substances and maintains at a high level the defensive mechanism of the body. This fact alone demonstrates the necessity of proper thyroid function during pregnancy, for in no other state is the organism so taxed, nor is it asked to adjust itself to so much increased waste or defend itself against the invasion of micro-organisms, as in the first and last trimester of gestation and during the puerperium.

The thyroid regulates the oxygen intake and the carbon-dioxid output of the body and maintains the constituents of the blood, the red cells, the white cells, the hemoglobin and salts, at a proper level. It also exerts its influence in regulating the body temperature and controls the metabolism of those metallic ions necessary for cellular activity. It influences arterial tone and is thus concerned in the regulation of blood pressure; it maintains the activity of the sympathetic and central nervous systems; it controls kidney excretion by its physiologic diuretic action on the renal epithelium, and by its action on the liver cells and other excretory organs of the body, and by stimulating certain other hormone producing organs, secures and controls their co-operation in regulating metabolic processes. *When properly functionating it keeps at a proper level every body function.*

The thyroid is specifically associated in the exercise of its function with the generative organs, the liver, the pancreas, the adrenals, the pituitary and the thymus gland; and besides maintaining the nutrition of the cells of these organs and their sympathetic nerves, through their agency controls body growth and metabolism. Interacting with the pituitary it is thought to influence skeletal growth. The thyroid stimulates and is stimulated by the adrenals thus indirectly controlling the blood-pressure and securing the supply to all parts of the body of perfectly oxygenated blood. The profound influence which it exercises over calcium metabolism is exerted through the medium of the gonads, thymus, pituitary, and other endocrine organs.

From the foregoing statements, it will be seen how dependent the process of gestation is upon proper thyroid function. For gestation increases the body waste and calls for more perfect metabolic action on the part of all of the glandular system, consequently defective thyroid function prevents the perfect correlation and interactivity of all of the ductless glands necessary to sustain the body mechanism in a perfect state.

Pregnancy is the result of the fecundation of a matured ovum which is the product of the healthy functionating ovary. In individuals growing normally and developing properly, the ovaries come to maturity and develop properly if they are sustained and nourished by a proper secretory relation on the part of the thyroid, the adrenals and the hypophysis. On the other hand a disturbance in the nutritional functions of the thyroid, the hypophysis and adrenals, interferes with the proper development of the female genitalia and the ovaries.

When the impregnated ovum comes into the uterus and imbeds itself in the overgrown decidua, by the enzyme action inherent in itself, menstruation ceases; for one function of the true corpus luteum cells is to retard ovulation by inhibiting the maturation and breaking through of follicles during the period of pregnancy. The cells given off from the outer layer of an impregnated ovum are thrown into the circulation as soon as the ovum is imbedded. Slight as this amount must be in the early days of pregnancy, it is sufficient through the medium of the circulation to reach the ovary, stimulate the action of the corpus luteum, and acting on the uterine lining to inhibit men-

struation. It is supposed that the trophoblast cells of the impregnated ovum are primarily responsible for this. These cells produce a reaction in the corpus luteum which does not regress after the premenstrual congestion *as it does when pregnancy does not take place;* but continues its growth for a period of many months, which in turn continues its nutritional effect on the uterus and decidua, inhibits menstruation, and aids continued attachment of the ovum.

The nutritional action of the true corpus luteum is of far greater importance in the first months of pregnancy than after the placenta has formed, for after placentation the placental secretion is added to the blood and plays an important part in stimulating the further growth of the uterus. The trophoblast secretion next affects the action of the hypophysis, and the anterior lobe begins to hyperfunction and actually increase in size. Like changes take place in the thyroid, adrenals, and other ductless glands which help to provide the patient with certain protective substances. The secretions of the trophoblast and placenta are entirely new elements thrown into the blood, and either activate the other glands to reaction or so over-stimulate them that this protective resistance is overpowered. *The irritating effects of the trophoblast and the placental secretion are evidenced by the nausea and vomiting of pregnancy.* The placental substance apparently irritates the central centres and the posterior lobe of the pituitary body, disturbing the functions of the gastric mucosa, the pylorus and the liver, and temporarily inhibits the production of the protective endocrine secretions which normally in the well balanced organism overcome the disturbances in metabolism consequent upon the appearance of these irritants in the blood. The secretion of the *corpus luteum of pregnancy* which continues in varying degree throughout gestation, is generally considered *as the chief reaction to the irritations produced in the blood, the ductless glands, and the uterus by this placental hormone.* It is on this theory that corpus luteum extract has been so extensively used for the control of the nausea and vomiting of pregnancy when this is employed; the preparation used should be made from the corpus luteum of pregnant animals and given for a relatively long period. Usually after the placenta is fully developed and has assumed the nourishment of the ovum, the so-called physio-

logical nausea ceases; this, however, is not the case if the protective substances produced by the ovary, the hypophysis, the liver and the thyroid are insufficient to maintain the proper body metabolism, for it is the thyroid which maintains the balance between the internal secretions during pregnancy and activates the other ductless glands to increased function. This explains the early toxemia of pregnancy with its epigastric pain, acid eructations, and the transient albuminuria in the presence of hypo-thyroidism; for in the absence of the inhibiting action of the thyroid, the placental secretion over-stimulates the posterior pituitary body which becomes the basic endocrine factor in the toxemia of the early months. All authorities admit the stimulation of the pituitary body during pregnancy, and in many cases an actual increase in growth takes place; this is specially evident where the thyroid hypo-functions or is diseased. This *stimulation is evidenced clinically by acromegalic hyperplasia which is shown in enlargement of the bones of the face and extremities of some pregnant women.* Transient hyperfunction of the posterior lobe of the hypophysis may also account for the intermittent glycosuria so often noted during the routine examination of the urine in pregnant women. Many times, however, lactose and not glucose is the substance which gives the sugar reaction; but this is usually a condition of the later months and may be due to the stimulation of the mammary gland. This gland is always stimulated by pregnancy. Experimentally the function of the mammary gland has been increased by the injections of corpus luteum, placental extract, and pituitary liquid; that is, a hyperemia has been produced, but not until after labor has occurred and the stimulating action of the ovary and hypophysis is no longer inhibited by the placenta and its secretion does the mammary gland secrete milk. This does not, however, explain the many reported cases of milk secretion in males and in non-pregnant women produced by prolonged suckling. There is no question in the writer's experience that the routine use of the endocrine glands materially aids in increasing the mammary secretion.

One fact must be constantly borne in mind, that the ovum and the placenta are parasites which depend for their nourishment on the resources of the mother, and in turn eliminate the waste fetal products through the emunctories of the mother; this

is an ever increasing load as the pregnancy advances. This tax on the basal metabolism is met by a compensatory hypertrophy of the thyroid, heart, kidneys, and if these organs are functioning properly by an increased liver combustion; it is apparent therefore, that dysfunction in any of these organs from disease, or over- or under- stimulation, will disturb the harmonious interaction of the others and result in a toxic state. This may be transient or permanent, when the latter there is a lasting pathology which is more or less dependent on the cause of the dysfunction.

The Parathyroids.—No general considerations of the ductless glands and their relation to the pregnant woman and fetal development is complete without reference to the parathyroids. These glands form an integral part of the thyroid apparatus, and although differentiated to some extent in their function from that of the thyroid, they contribute to the antitoxic function of the thyroid apparatus and there is reason to believe that they assist in protecting the central nervous system from the action of certain toxic products of bacterial growth in the alimentary canal. In pregnancy there is normally some hyperplasia in the parathyroids which is important because they are also concerned in the regulation of the calcium and uranidine metabolism; therefore just in so far as the mother's thyroid and parathyroid apparatus potentially possesses the inherent power of response to every demand of body metabolism, so far may we expect the child to be born normal.

CHAPTER XVII

THE THYROID IN PREGNANCY

The thyroid gland normally increases in size and in activity during pregnancy. This enlargement is due to the storage of colloid in the vesicles—from 65 to 90 per cent. of all pregnancies show a concomitant hypertrophy of the thyroid; this is probably due to a stimulation by the substances in the blood derived from the fetus and its envelope. The parathyroids also participate in this hypertrophy.

Richardson states that in Southern Italy, that it has been the custom for the parent to measure the daughter's neck before and after marriage, an increase in circumference being considered an evidence of conception.

The enlargement usually commences about the fourth month in primiparæ, and somewhat later in multiparous women. This hypertrophy continues until the termination of pregnancy; but after delivery in normal women, the gland commences to diminish and quickly recedes, but seldom returns to its normal size until late in the puerperium, and sometimes the hypertrophy continues throughout lactation.

Clinically there seems to be a definite relation between the thyroid function and kidney elimination; for *cases which show no hypertrophy of the thyroid are generally the subjects of some degree of hypertension with diminished urinary output and albuminuria.*

In a study of 133 cases Lang found 25 in which there was no thyroid hypertrophy. Of this number 20 had an albuminuria, therefore, it may be argued that relative insufficiency of the thyroid during pregnancy has an influence on kidney function. The thyroid also has some action on the mammary secretion and on the production of milk. The continued internal administration of the fresh gland may increase the secretion, but lactation seems to have no influence upon the size of the thyroid.

SIMPLE GOITRE COMPLICATING PREGNANCY

ITS EFFECT ON THE OFFSPRING

During pregnancy the thyroid gland nearly always increases in size and increases in activity. *This hyper-function is physiologic and activates the other ductless glands,* and so aids in protecting the individual from the toxic effects of the increased metabolic processes which are consequent upon pregnancy. This normal enlargement continues more or less marked throughout the puerperal period, and often ren[illegible]permanent. Increase in the volume of the gland occurs i[illegible] 65 per cent. to 90 per cent. of all cases of pregnancy. [illegible] study and observation of a long series of pregnant wome[illegible]per cent. showed a glandular enlargement. Should goitre [illegible]en already present prior to conception, there is commor[illegible]rease in the volume of the goitrous enlargement during[illegible]cy and particularly during delivery.

While some observers cla[illegible]t the glandular hyperplasia takes place sooner in multipara, than in primipara, in the experience of others, this observation has been reversed. The increase in volume is due to the hypertrophy and hyperplasia of the parenchymatous elements. Colloid and cystic nodules when present are only slightly involved. It is presumed that this hyperemia and hyperplasia increasing the volume of the gland is due to the action of the placental products on the thyroid. This glandular hyperplasia with its increased function is apparently intended for the destruction of the products of auto-intoxication, and the changes in the blood serum caused by pregnancy.

The clinical value of this observation seems to show that women who do not present any hyperplasia of the thyroid are very apt to become toxic during pregnancy; develop an albuminuria, and if the hypo-function of the gland persists, finally have eclampsia. That the latter part of this statement is not merely supposition, and is not based on simple coincidence was shown by Lang in a series of experiments in which partial thyroidectomy was done in cats. In those that were not pregnant, a fifth of the gland could be removed without any ill effects, but in the pregnant cat, the same operation, namely; the removal of one-

fifth of the gland at once induced an albuminuria and a nephritis, while the administration of the thyroid to these animals caused the symptoms to recede at once.

Similar observations have been made by Nicholson in the pregnant woman suffering from albuminuria and pre-eclamptic toxemia. The administration of thyroid extract in four of these patients, caused a prompt subsidence of the toxic symptoms and almost immediate relief from the albuminuria. On the other hand, no less authorities than Doederlein, Seitz and others, believe that eclampsia is not dependent upon thyroid function, but has its origin in the parathyroids; for the parathyroid exercises a special influence on uranidine and methyl uranidine metabolism. Tetany has been attributed to the accumulation of uranidine in the body, in the presence of certain gastro-intestinal poisons. It has been proven experimentally that after the partial removal of the parathyroids or the impairment of their function, when anaërobic cultures from the feces or fecal filtrates from goitrous subjects are injected, that the animal has tetany, but tetany is not similar clinically to the eclamptic picture; so we believe and admit that whatever the cause may be, thyroid hyperplasia in pregnancy is a physiological process which is probably intended to deliver the organism from waste products, products taking their origin in the mother and in the child. This hyperplasia is further intended to counterbalance the temporarily lost function of the ovarian secretion which is held in abeyance during the entire period of pregnancy.

In the majority of cases, during labor, and especially during the strain of delivery, the goitre increases in size. It may attain such dimensions that the neck would seem to burst; and dyspnea, and cyanosis enter the field of complications. In fact a goitre may take on such an exaggerated development during pregnancy, that asphyxia is threatened from tracheal pressure. It is seldom however, that the dyspneic symptoms become such as to necessitate surgical intervention.

The pressure effects produced by large goitres are evidenced during the expulsive pains of the second stage when severe straining efforts are being made. At this time the pressure may be so great as to cause the carotid pulse to disappear as is shown by taking the pulsation of the temporal artery. Guyon considers

that this phenomenon is a salutary attempt on the part of nature to regulate the cerebral circulation, and thus avoid cerebral hemorrhage by preventing an increase in the cerebral pressure during the acme of the pain.

In goitres of long standing, the goitre heart is always present and has a clinical significance in making the prognosis more grave in cases of pregnancy complicating such goitres, for the tachycardia may become a very troublesome and an alarming symptom.

Goitre has a definite influence on the cellular content of the blood, and the blood changes which occur in endemic goitre may be considered as fairly constant. It is usual for *the number of red cells as well as the hemoglobin index to be somewhat diminished, while the coagulability of the blood is increased. The total number of the leucocytes is reduced* and the polymorphonuclear leucocytes are constantly below the normal limit. *This reduction is absolute, not relative,* and it has been repeatedly noted that the polymorphonuclear leucocytes have been reduced to 50 per cent. of the normal, and they may form as small a part of the cellular elements of this tissue as 30 per cent. of the leucocytes in the peripheral blood. The average differential count in 73 cases was only 46.5 per cent. On the other hand, the *small mononuclear cells* are usually above the normal limit, the absolute increase in their number may be twice that of normal, and in the differential leucocyte count they may form as large a part as 45 per cent. of the total leucocyte count of the peripheral blood. The average count in 73 cases was 32.2 per cent. These eosinophile cells are usually increased in number and may form as high a proportion as 20 per cent. of the total leucocytes in the peripheral blood. The mononuclear cells are usually within the normal limit. These blood changes have a far reaching bearing on the resistance of the individual woman in her defense against toxemias and infections. It is during pregnancy that the organism has to meet and combat toxic and infective elements to a greater degree than in any other physiological process, hence impairment of the thyroid function and the loss of the activating hormones on cell activity means decreased resistance for the woman. This is notably true in puerperal infection; in this complication the woman with goitre or hypothyroid function

always has a more serious prognosis than her more normal sister. The influence of the child-bearing period of life is very great on the development of goitre. In illustration; in localities where goitre is not supposed to be endemic, the thyroid gland enlarges as a consequence of pregnancy in about 50 per cent. of all those conceptions which continue beyond the fourth month, but the added strain of goitrous influence greatly increases this proportion and converts these physiological swellings of pregnancy into pathological processes.

Congenital goitre is an entity which must be admitted. This is shown in the children born in certain Himalayan villages where every woman and almost every man is goitrous. In these localities congenital goitre has been found in over 60 per cent. of breast fed infants. In these villages the infant mortality as well as the percentage of abortions are also very high; hence the actual number of children born with goitre is probably considerably higher than the actual figures will show. On the other hand, in villages where the endemicity of the disease is lower, congenital goitre is not so frequent. The mothers of children born with congenital goitre are often myxedematous to some extent and they commonly suffer from tetany. Congenital goitre in the offspring is more commonly found among the poor and ill nourished classes than amongst the well-to-do. The pernicious influence of goitre in the parents on the development of the fetus is further shown in the study of cases of endemic cretinism, for in almost every case of endemic cretinism, goitre is present in one or both parents; the mother was the subject of thyroid disease in 96 per cent. and the father presented a definite goitre in over 40 per cent of the cases examined.

While it is admitted that cretinism can arise in the child of a woman free from goitre, it must be established as a rule that maternal goitre; that is to say, thyroid impairment, is in endemic localities one of the most essential conditions for the development of cretinism in the child.

The experiments of Halstead which were later confirmed by Edmund throw an interesting light on the influence of maternal thyroid impairment on the development of the fetal thyroid, and enable us to understand the train of events which gives rise to cretinism and congenital goitre.

Halstead found in the puppies of a bitch from which the goitre had been removed, and which was sired by a dog that had been in part deprived of its thyroid gland, that the thyroid lobe in the puppies was twenty times larger than those of normal puppies. This apparently shows that in the case of the partly thyroidectomized bitch there were more toxins circulating in the blood than her impaired thyroid apparatus could deal with. These toxins, therefore, called forth an abnormal development on the part of the puppies' glands with a resultant congenital goitre. Had the bitch been fed on fecal anaërobic cultures, we have no doubt that some of her puppies would have been cretins. Similarly in the goitrous pregnant woman, it is the failure to meet all of the demands of the increased body metabolism which constitutes a temporary inefficiency of the thyro-parathyroid apparatus, that places her in a position comparable with the partially thyroidectomized bitch of the experiment; but in her case, the added action of the goitrogenous influences is the final factor in determining the destruction of the fetal gland.

Goitrous women frequently exhibit some signs of thyro-parathyroid insufficiency during pregnancy. Of these the most common in goitrous localities is tetany. If they are sub-thyroidic before they become pregnant, the pregnancy may benefit them, the fetus taking in the excess of the thyroid secretion; consequently this benefit is dependent upon the extent of development that takes place in the child's thyroid, for just in so far as the mother's thyroid potentially possesses the inherent power of response to every metabolic demand, so far may we expect the child to be born normal.

In the presence of congenital thyroid instability or congenital goitre, or cretinism, all of which are to be regarded as but stages in the same process or as evidence of the minimal, mesial, or maximal action of the toxic stages in the unborn child's apparatus, we see what toxicity and dysfunction on the part of the mother can produce in the offspring.

Summary.—From this study of the influence of the thyroid and of goitre on pregnancy, and of pregnancy on goitre, certain clinical facts stand out: (1) That a normal functionating thyroid is essential for the perfect development of the ovum. (2) That in normal pregnancy in the normal woman, the thyroid

hypertrophies in order to compensate and activate the increased demand for cell activity. (3) That sometimes this normal hypertrophy is exaggerated by pregnancy into a pathologic process and goitre develops. (4) That pregnancy usually aggravates the goitrous condition and finally; that mothers with a sub-thyroidic function are frequently subjects of toxemia and a direct influence on the thyroid development of the child.

Treatment.—In all pregnant women the condition of the thyroid and its functional activity should receive careful attention. This entails a study of the basal metabolism especially during the first and last trimesters of pregnancy. If this gland is found to be manifestly enlarged or altered, or if there is clinical evidence of thyroid insufficiency, the active principle of the gland should be administered in one of the available forms. On this point all authorities agree; furthermore, that in administering thyroid to these women, the dosage should be small, and should be continued for several weeks or months. Thyroid-organotherapy is especially valuable in patients with hypertension and diminished urinary output.

It has been found that where thyroid-organotherapy has been started in the early period of pregnancy, that undue thyroid hyperplasia has been prevented. It has also been shown experimentally in thyroidectomized cats, that the administration of thyroid extract or its active principles, prevent albuminuria and nephritis in pregnancy. These experiments have been so conclusive that coupled with the clinical work of Nicholson, it would seem to be advisable to feed the woman on some form of thyroid extract in order to prevent those serious complications of pregnancy; such as the toxemias that so frequently result in renal disease and eclampsia.

In every case of pregnancy complicated with goitre, be it simple or thyrotoxic or both, the wishes of the parents regarding the life of the child, and the importance of that child should be carefully ascertained, and the influence which the pregnancy may have on the goitre, and the effect of thyrotoxicosis of the mother on the unborn child should be fully explained to them; *for we have seen that goitre has an influence on the unborn child, and that pregnancy does subject the mother, who is the subject of subthyroidic function to greater toxic risks.*

Recently we have subjected several women with marked thyrotoxicosis, to thyroidectomy, and the patients have continued their pregnancy and been delivered without complication at term.

When pregnancy complicated by simple goitre has reached an advanced stage without marked toxicosis, as may be shown by basal metabolism studies, there is no cause for undue alarm, and *there is no occasion for interruption of the pregnancy;* as in the greater majority of such cases everything will terminate to the satisfaction of both patient and physician. Great benefit may be attained by the relatively free use of morphine and scopolamine during the dilatation stage, this controls the tachycardia and mental apprehension; conditions which frequently obtain in deficient thyroid function. In the presence of pressure symptoms, cyanosis and dyspnea, which seem to threaten the life of the patient during the straining efforts, the labor would better be terminated by Cesarean section.

In those women in whom before labor the dyspneic symptoms are marked or where tachycardia has been a prominent symptom, we may feel sure that both of these symptoms will be increased in severity during labor; such a patient should be delivered by section before the actual labor pains start in. Of course if the dilatation has progressed and the cervix is already obliterated, and the presentation is normal, and the presenting part has descended well into the pelvis, the labor may be terminated under morphine-scopolamine with the forceps. The woman is thus saved the strain of the second stage. The administration of a general anesthetic is always dangerous in goitrous women, hence, it has been our custom to rely chiefly upon morphine and scopolamine analgesia and the local novocain injections into the perineum. These may be supplemented with light gas-oxygen anesthesia. Wherever possible, local anesthesia should be the method of choice. We feel that thyroidectomy during pregnancy should only be elected when the growth is of such dimensions as to cause pressure symptoms and produce congestion of the entire cervical region, or where the patient is suffering from such severe thyro-toxicosis that the usual palliative measures are of no avail. *It must always be kept in mind that the thyroid during pregnancy is in a state of compensatory hypertrophy,* and that before operation is elected, a careful study of the basal metabolism should be

made. The early termination of pregnancy by therapeutic abortion has but a limited field, and should be decided upon only when repeated studies of the basal metabolism show that the pregnancy is increasing the toxic load.

EXOPHTHALMIC GOITRE

That a woman afflicted with Graves' disease may become pregnant, or that thyro-toxicosis may develop either during or at least in connection with pregnancy, is a well-known fact. The point of interest does not lie therein, but how do these two conditions influence each other, and what shall be our attitude in the given case? Fortunately, *the occurrence of pregnancy* in the course of an active exophthalmic goitre is very uncommon. Goetsch states that even when the patient suffering from this disease does not practice contraconception, the coincidence of pregnancy with exophthalmic goitre is not frequent. In further support of this statement we find in the service of Sir Haliday Croom, in the Maternity at Edinborough, but one case is noted in a series of 15,000 pregnant women. However, he reports 12 other cases which he has taken from his private case records, and concludes that pregnancy in Graves' disease is found more frequently in the rich, than in the poor. Bonnaire agrees with this conclusion, as he observed only two cases of exophthalmic goitre in 30,000 cases of pregnancy. These observations, however, are in direct variance with the fact that goitre occurs more generally among the poor and illnourished than among the rich.

Seitz collected 112 cases of exophthalmic goitre with pregnancy from his own material, and from the literature and circular letters. In this study he has carefully tabulated the menstrual history, the appearance of the first symptoms, the history of previous pregnancies, the therapy employed, and the results as far as the mother and child were concerned. In this study he found that hyperthyroidism was not affected one way or another in 40 per cent. of the cases. A very small number were improved by pregnancy; while 67 out of 112 or approximately 60 per cent. of the total were made distinctly worse as a result of the gestation. In one-fourth of the pregnancies in consequence of the thyrotoxicosis produced became a serious menace to the

health and life of the woman. Seven patients died, 5 needed a therapeutic abortion, and in all, 11 premature labors occurred—3 miscarriages and 3 macerated fetuses were observed, and in 7 thyroidectomy was performed during the pregnancy. On the other hand, VonBeck in reporting 260 cases of Graves' disease complicating pregnancy, says that he felt compelled to perform thyroidectomy in 5 cases; but in no case did he find it necessary to interrupt the pregnancy. This is indeed a remarkable record, and must be explained by the fact that these thyro-toxic conditions were secondary to previously existing goitre, and that the goitre was endemic and that these cases were not truly exophthalmic goitre.

It is generally conceded that pregnancy makes Graves' disease worse, and only a very small minority are unaffected by the occurrence of pregnancy. Therefore, we must come to the conclusion that Graves' disease is generally unfavorably influenced by pregnancy and often has its origin in gestation. It predisposes the woman to uterine hemorrhage, and may result in death of the fetus. These cases are often complicated with albuminuria and other evidences of toxemia, the tachycardia is always greatly increased during gestation; the heart action becomes slower soon after labor, consequently we can conclude that the great majority of all patients suffering from Graves' disease are made worse by pregnancy, and that pregnancy must be regarded as a serious complication in all thyro-toxic patients, and in patients suffering from this condition we may lay down the dictum: Girls no marriage, Women no pregnancy, Mothers no nursing.

ECLAMPSIA

Recent investigations seem to point to a placental origin in many cases of eclampsia. Obata following the investigations of Dold found that when an extract of fresh human placenta is injected into mice, symptoms resembling those of eclampsia are produced and that there is no difference between the effect of placenta from a normal case, and the extract of placenta from a case of eclampsia. He further observed that fresh serum from the blood, either of a normal person, or of an eclamptic patient produced similar symptoms in mice; but no increase in the toxicity was noted in regard to the serum of eclamptic patients.

When, however, the extract of a *placenta was mixed with the blood serum from a normal person*, and it was found that sex or pregnancy did not affect the issue, *the toxic effects of the placental extract and also of the serum were neutralized;* but on the other hand, the serum from the blood of an eclamptic patient failed to neutralize the toxin of the placenta. At first it seems curious that this substance is present in the blood of males as well as in the blood of females, until we remember that the fetus is the product of the male no less than the female. The clinical application of this observation is supported by Blair Bell in the report of a case of eclampsia delivered at full term of still-born twins; the convulsions continued after delivery and only two ounces of albumin laden urine were obtained by catheter. During eighteen hours subsequent to her admission, she was semicomatose, jaundiced, and had a pulse that was hardly perceptible at the wrist. This patient was transfused with 500 c.c. of her husband's blood; the response was almost immediate. Within the next sixteen hours the woman passed fifty ounces of urine; the convulsions ceased, the coma cleared up and her recovery was uneventful.

In this case whole blood was used and thrown into the woman's circulation in order that an antitoxin might be introduced into the blood-stream of the patient to neutralize the toxins from the placenta. Certainly the happy result can hardly be attributed to any other theory than that resulting from Obata's investigations. Notwithstanding the striking evidence supplied by this case, the consensus of opinion at the present time is that eclamptic convulsions are the result of an auto-intoxication, and that the conditions existing are an increased blood-pressure, a perverted metabolism, a decreased elimination by the kidneys with, in the majority of cases, an albuminuria, with or without casts. The pathologic findings being fatty degeneration of the liver and kidneys.

The placenta may be looked upon as a digestive organ preparing the nutrition for the fetus; it may possibly also have a hepatic function and destroy the toxic products of fetal metabolism before the fetal blood enters the vena cava, consequently, it is argued that pathologic conditions of the placenta may impair this function and toxic fetal products entering the mother's blood cause toxemia in the mother. In contradiction of this last

statement Obata's experiments showed that it was the introduction of placental extract that produced the convulsion, and that it made no difference whether it was the extract of a normal placenta, or the extract from the placenta of an eclamptic; hence it would seem that we must look to some of the glands of internal secretion to furnish the blood with the necessary antitoxic substance to combat the toxicity of this placental toxin.

From both experimental and clinical evidence it is in all probability the thyroid-parathyroid apparatus which supplies this antitoxin. We know that the thyroid normally increases in size and hyperfunctions during pregnancy, in response to the excessive demand made upon it by the increased metabolism, it is therefore, reasonable to assume that it is the normally active thyroid that activates the blood cells to combat the effects of the placental toxins. In support of this, it has been shown by Garnier and Roger, that it is by no means uncommon for the thyroid to be affected by the acute diseases of childhood, and consequently in the first pregnancy, especially in young women, there may be a deficiency of thyroid secretion, which may be a factor in producing eclamptic convulsions in these young primiparæ, but the excitation of the gland during this pregnancy will have a tendency to increase its function and thus prevent a recurrence of the symptoms at the next pregnancy. In other cases the gland never acquires a sufficient secreting power and eclamptic convulsions occur at every successive labor. In those who have no eclamptic symptoms at the first pregnancy, but in whom they appear in later pregnancies, it may be assumed that the strain upon the gland during the first pregnancy or some intercurrent disease has affected the proper functioning of the gland.

From the foregoing statements it is fair to draw the following conclusions:

(1) That eclampsia in all probability has a placental origin and that the placental toxin is the irritant in the blood which produces the convulsion.

(2) That this toxin is neutralized by normal blood which contains some unknown antitoxic substance.

(3) That the thyroid-parathyroid apparatus by its increased

function activates the cell activity of all of the ductless glands and helps to supply this antitoxic substance in the blood.

Therefore in the administration of thyroid extract during pregnancy, and the employment of transfusion in eclampsia, we have two exceedingly valuable agents added to our armamentarium.

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W. Okker	MAR 20 1934
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M. at	
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