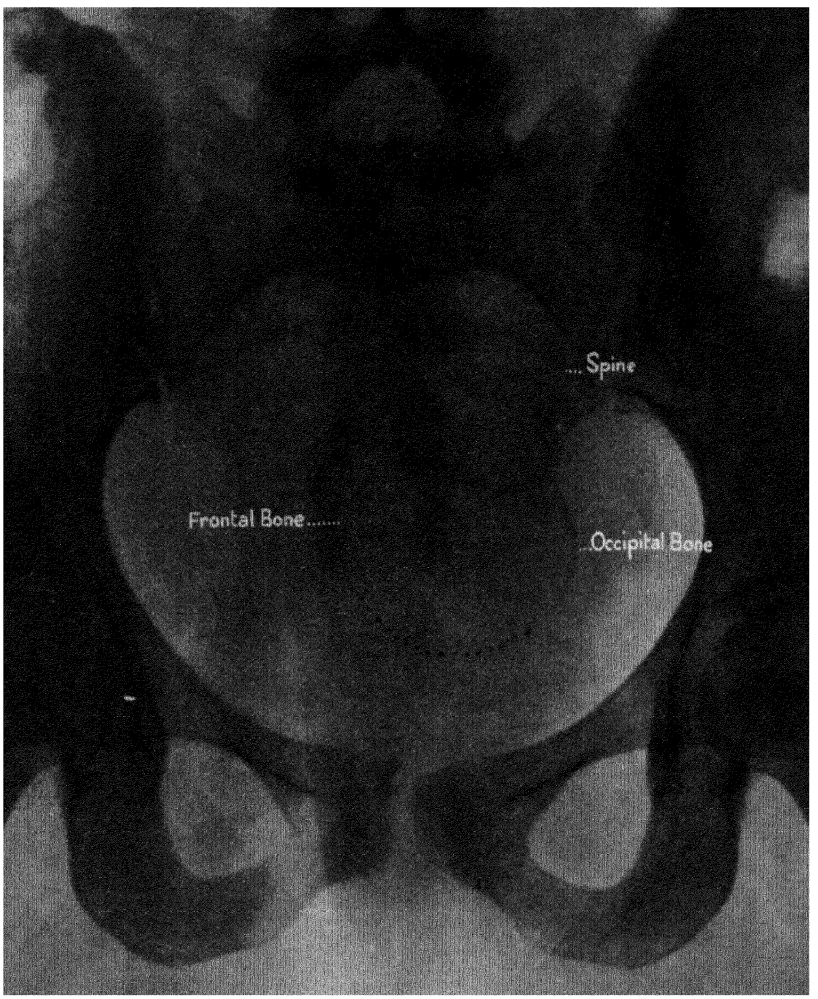
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SKIAGRAM OF A SIXTEEN WEEKS' OLD FOETUS IN UTERO.

[*From the Department of Radiology, Royal Infirmary, Liverpool, by kind permission of Professor W. Blair Bell and Dr. R. E. Roberts.*]

MIDWIFERY

BY

TEN TEACHERS

UNDER THE DIRECTION OF

COMYNS BERKELEY

M.A., M.D., M.C.(Cantab.), F.R.C.P.(Lond.)

OBSTETRIC AND GYNÆCOLOGICAL SURGEON TO THE MIDDLESEX HOSPITAL, ETC., ETC.

EDITED BY

H. RUSSELL ANDREWS

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PREFACE

THIS book is frankly written for students preparing for their final examination, and in the hope that it will prove useful to them afterwards, and to others who have passed beyond the stage of examinations.

An effort has been made to overcome to some degree the disadvantages of collective authorship. Though the subjects dealt with have been in the first instance portioned out among the ten writers whose names appear on the previous page, each manuscript has been typed, manifolded and distributed among the whole body. Numerous meetings have been held, and the whole of the matter has been criticized, amended and partly re-written, so as to include, as far as can be, the views of all. In other words, the whole corps has acted in an editorial and revisional capacity on every chapter and section of the book, both text and illustrations. Thus the responsibility is general, and perhaps the book will be found to have acquired more uniform characteristics than is generally possible with collective authorship.

The writers have certain qualifications for producing a text-book of midwifery for students. They are all teachers in London medical schools, and most of them have had experience as examiners. Among them are represented eight general hospitals with medical schools and the three large lying-in hospitals. If the volume contains the collective wisdom and experience of all the schools it represents, it will surely prove that there is a place for this new movement in the production of students' text-books.

LONDON,
April, 1917.

PREFACE TO THE THIRD EDITION

IN preparing a new edition the Editors and Contributors have endeavoured to keep this book in line with recent advances in obstetrics by a thorough revision of the text. The sections dealing with the

toxæmia of pregnancy and the disturbances of metabolism and with infant feeding have been largely rewritten and brought into accord with the latest views. The valuable statistics of the collective investigation on the treatment of Eclampsia and on Cæsarean section, carried out by the Section of Obstetrics and Gynæcology of the Royal Society of Medicine, have been made full use of. Several new Skiagrams have been reproduced in this edition in order to emphasize the advances made in the application of X-ray photography to obstetric diagnosis.

It is the sincere desire of the Editors and Contributors to maintain this book in the position it has attained among students of midwifery, and they trust that this edition will be as highly appreciated as its predecessors.

May, 1925.

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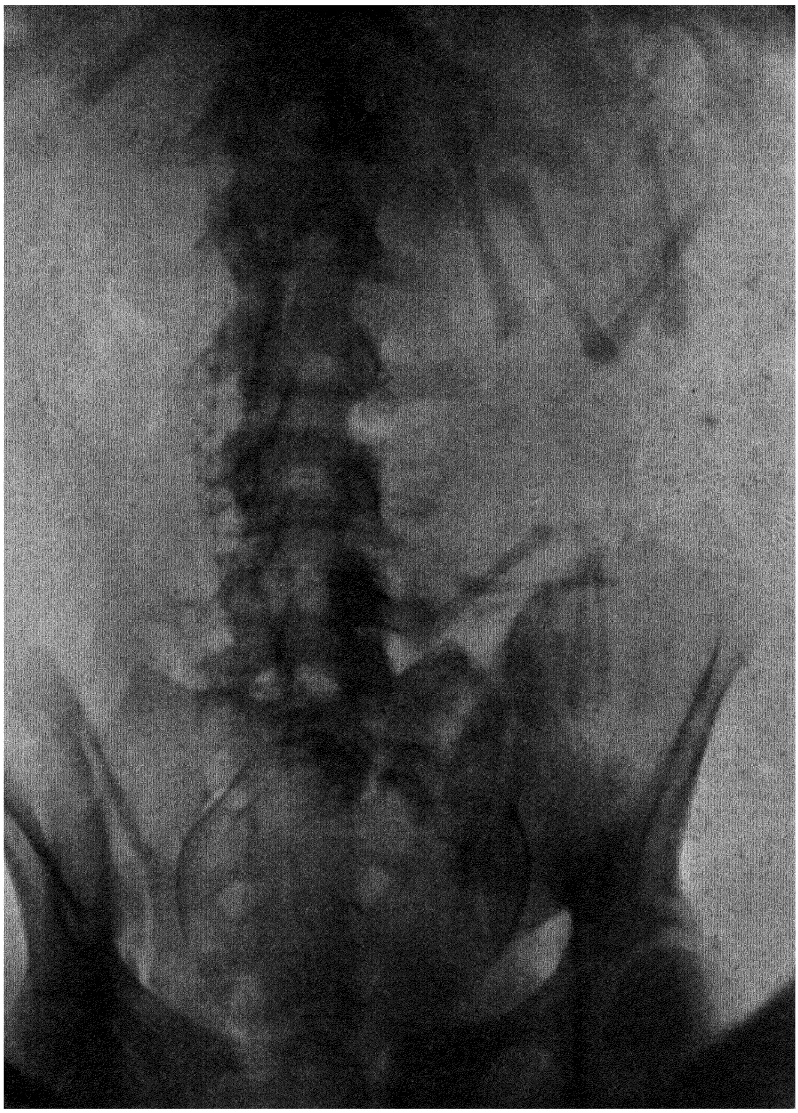
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SKIAGRAM OF A THIRD VERTEX PRESENTATION,
THIRTY-FIFTH WEEK OF PREGNANCY.

[*From the Radiological Department of St. Thomas's Hospital.*]

[*See page* 306.

Section I—PREGNANCY

CHAPTER I

OVULATION, MENSTRUATION AND FERTILIZATION

The process by which the Graafian follicles in the ovary become ripened and rupture, setting free the ova into the peritoneal cavity, is known as ovulation.

Menstruation may be defined as the periodical discharge of blood and mucus from the uterus, which occurs during the years between the onset of puberty and the menopause.

The relation between ovulation and menstruation is not fully defined in the human female, but certain facts would make it appear that these processes are not necessarily simultaneous. For instance, fertilization of the ovum may occur before menstruation has started, during a period of amenorrhœa and even after the menopause, so that it is clear that ovulation can occur in the absence of menstruation. On the other hand, it is quite certain that the most common time for conception to occur, *i.e.* for the fertilization of an ovum, is just after a menstrual period, and consequently it follows that ovulation is most likely to occur during the menstrual flow.

We have no knowledge of the duration of life of a shed ovum in the human female from the time it leaves the Graafian follicle until it is fertilized or becomes disintegrated, but it is quite possible that an ovum may be able to live for several days in the Fallopian tube, perhaps obtaining nourishment in the meantime from cells of the membrana granulosa of the ovary which adhere to it, or from the secretion of the Fallopian tube. Graafian follicles, apparently ripe and ready to rupture, have been seen during abdominal operations, at all times during the intermenstrual periods.

The analogy of the lower mammals, in whom ovulation only occurs at the periods of œstrus or rut, at which times only will the female receive the male, affords no clue to the elucidation of the time of occurrence of the process in the human female. All that can be

said at present is that as a rule ovulation probably occurs coincidently with menstruation, and that when it occurs at other times it must be regarded as abnormal.

The theory is now well established that the corpus luteum in some way presides over and influences the embedding of the fertilized ovum in the uterus, and it is reasonable to suppose that the greatest activity of this structure would occur soon after its formation. The greatest period of fertility is just after a menstrual period, and perhaps the coincidence of the two may be taken as an additional proof that ovulation and menstruation must occur at about the same time.

OVULATION

The changes which bring about the ripening and rupture of a Graafian follicle can be followed out in a series of microscopical

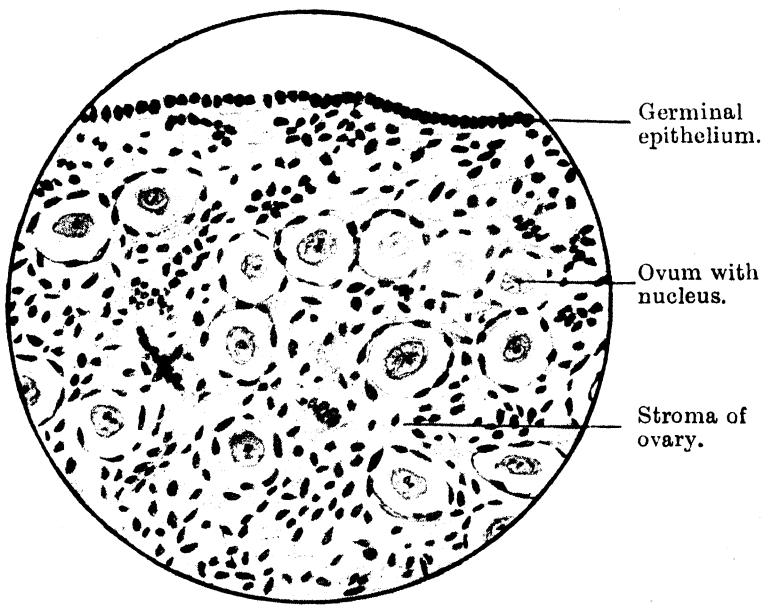


FIG. 1.—SECTION OF THE CORTEX OF AN INFANTILE OVARY, SHOWING THE PRIMORDIAL OVA.

sections of the human ovary. They are best seen in the ovaries of infants, since the process of ripening occurs at all ages, although with very few exceptions rupture takes place only after puberty. The Graafian follicles are much more crowded together in the small ovary of the infant, and consequently more of them will be found in the different stages of maturation or ripening in a comparatively few sections than in an adult ovary. Nevertheless the essential changes

are just the same. The youngest Graafian follicles occur near the surface of the ovary, and consist of a large spherical cell with nucleus and nucleolus, surrounded by a single layer of flattened cells which form a capsule. The large cell is the primordial ovum, and the flattened cells are the precursors of the membrana granulosa of the mature follicle. The ovum is found at the very earliest stage of the germinal ridge of the young embryo, and is a specialized cell of the so-called germinal epithelium.

The flattened cells forming the capsule are now believed to be derived from the stroma cells of the ovary, and not from the germinal

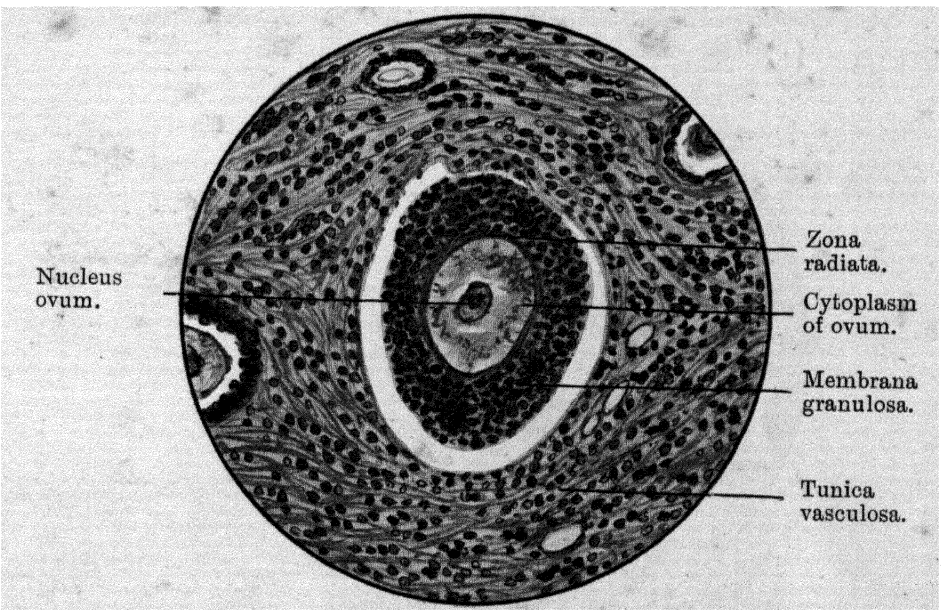


FIG. 2.—SECTION OF AN INFANTILE OVARY, SHOWING A RIPENING GRAAFIAN FOLLICLE.

epithelium, which was Waldeyer's original view. Outside the capsule cells the ovarian stroma is undifferentiated and shows no special connective tissue changes such as appear later.

The process of maturation consists of—

1. The enlargement of the ovum.
2. The proliferation of the capsule cells to form the membrana granulosa.
3. The differentiation of the surrounding stroma to form connective tissue sheaths.

The first change which occurs is an increase in the number of capsule cells, which elongate radially and form a lining to the Graafian follicle very much like a cubical epithelium. This layer, single at first, continues to proliferate and soon forms two

layers, then many layers around the ovum, and constitutes the *membrana granulosa*. At the same time the enlarging ovum acquires a thick outer coat, known as the *zona radiata*, possibly a secretion from the granulosa cells. The name is derived from the fine radiating lines which are easily seen in this layer.

Fluid now begins to accumulate among the cells of the membrana granulosa, first in droplets, which gradually coalesce and produce a large cavity containing the liquor folliculi. This cavity forms eccentrically, and the amount of fluid in it rapidly increases and accounts for the full size of the ripe Graafian follicle. Whereas the primordial ovum and its capsule are not as large as the fully

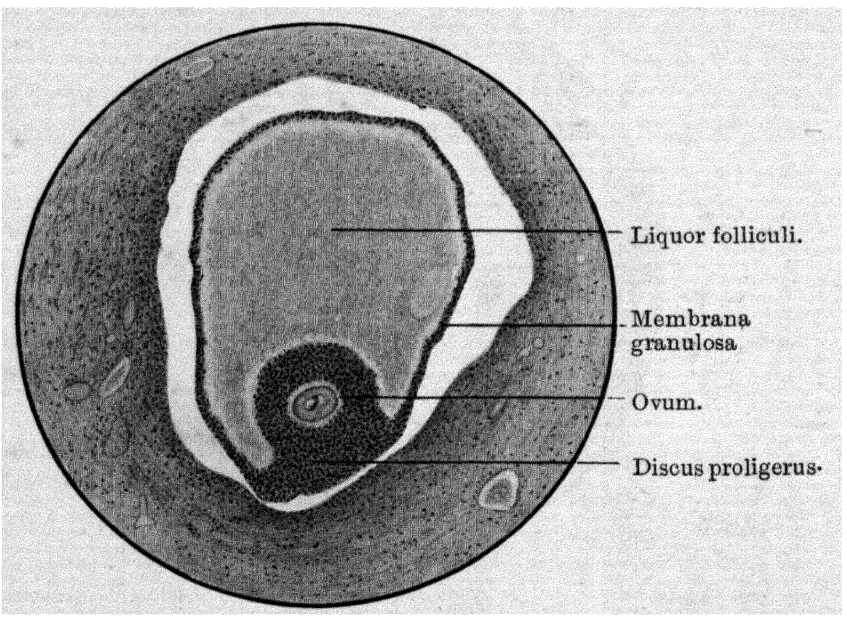


FIG. 3.—SECTION OF AN INFANTILE OVARY, SHOWING A NEARLY RIPE GRAAFIAN FOLLICLE.

developed ovum (200μ), the ripe Graafian follicle may measure as much as 3 cms. in diameter. The formation of the liquor folliculi leaves the ovum attached to one side of the Graafian follicle surrounded by a mass of granulosa cells called the *discus proligerus*, while the rest of the follicle is lined by two or three layers of rather flattened granulosa cells.

While these changes are taking place, the ovarian stroma around the follicle becomes very vascular and concentrically arranged, and eventually is differentiated into two layers, the *tunica vasculosa* nearest the follicle, and the *tunica fibrosa* outside. The former contains large numbers of blood-vessels, as its name implies.

While these changes are in progress the Graafian follicle at

first appears to sink more deeply into the ovarian stroma, but as ripening approaches completion the follicle reaches the surface and forms a considerable swelling, almost doubling the apparent size of the ovary.

The ripe ovum consists of a mass of cytoplasm containing a few droplets of food-yolk, a large nucleus (germinal vesicle), and a small nucleolus (germinal spot) with the thick outer covering, the zona radiata. The follicle is now ready to rupture and set free the ovum. During the enlargement of the follicle, the ovarian stroma covering it becomes more and more thinned as the follicle bulges on the surface. The tension in the follicle increases as the liquor folliculi collects, and as a result the most prominent portion is rendered non-vascular and undergoes pressure necrosis. Probably also the menstrual congestion, which is shared by the ovary, produces a somewhat sudden rise of pressure in the follicle, and as a result its wall gives way at the weakest spot. At the same time the granulosa cells become degenerate, and consequently when the follicle ruptures, the sudden release of tension sets the ovum free, and it escapes with the liquor folliculi, surrounded by some adhering granulosa cells.

The ovum is now in the peritoneal cavity, and meeting with currents in the peritoneal fluid set up by the cilia of the fimbriated extremity of the Fallopian tubes, is swept into one or other tube and gradually passed along towards the uterus.

Corpus Luteum.—After the rupture of the Graafian follicle a series of changes occurs in it which constitute the corpus luteum. First the relief of tension causes blood-vessels in the tunica vasculosa to give way, and hæmorrhage into the follicle occurs, some of which may escape into the peritoneal cavity. Under pathological conditions the amount of free bleeding may be considerable and produce symptoms, of which pain is a prominent one. The blood in the follicle coagulates and the opening closes, at first being plugged with clot, which later organizes. A remarkable change then occurs, which results in the formation of a thick layer of lutein tissue outside the blood clot. This is formed from the connective tissue cells of the tunica vasculosa. These cells enlarge and elongate radially, dovetailing one into the other by their somewhat pointed ends. They have granular protoplasm containing yellow droplets of lutein substance and large vesicular nuclei. Capillary vessels spread in amongst them from the remains of the vascular layer. This lutein cell layer is always thrown into folds, because the blood clot never completely distends the follicle, which consequently is collapsed and has folded walls.

The follicle now to the naked eye has a red centre and an outer folded yellow capsule of lutein tissue, with the fibrous sheath still visible outside. The blood clot is gradually absorbed by the lutein tissue, which in its turn becomes degenerate, and gradual shrinking takes place. The lutein tissue loses its nuclei, the cell outlines become indistinct, and eventually a somewhat crumpled mass results. This is gradually organized into fibrous tissue, and becoming less and less vascular, eventually forms what is known as a *corpus fibrosum* or *corpus albicans*. With the shrinkage of the corpus luteum the surface of the ovary is drawn in and a small

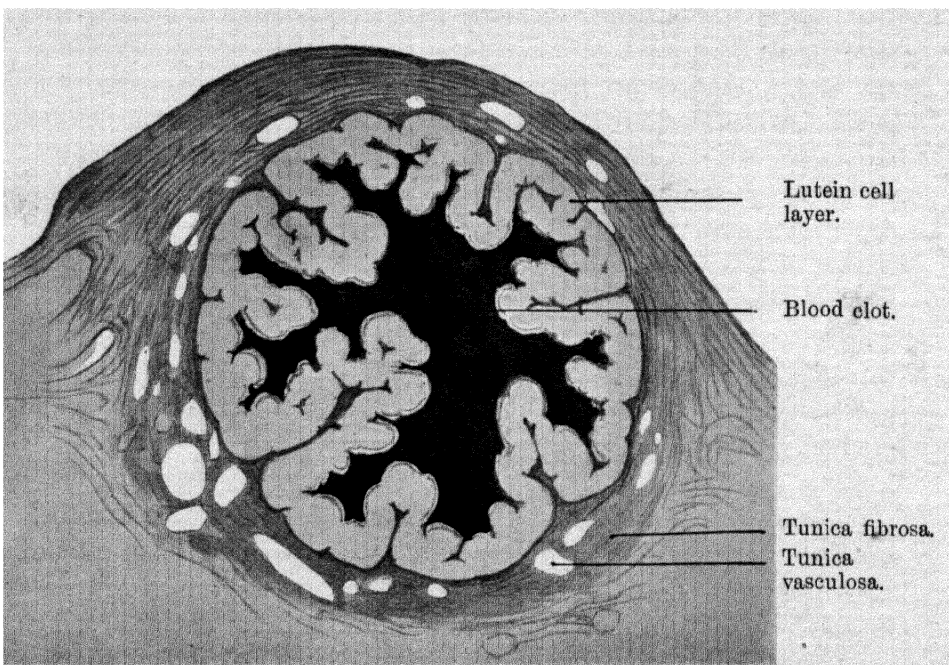


FIG. 4.—SECTION OF A CORPUS LUTEUM FROM AN ADULT OVARY. × 3.

wrinkle appears. Hence the senile ovary has a much wrinkled surface, and becomes hard from the accumulation of these fibrous bodies.

This series of changes is seen in the Graafian follicle whether pregnancy occurs or not. There is a difference, however, in the time occupied by the various processes; during pregnancy the corpus luteum remains large a much longer time, and at full time is still a large, conspicuous object; when pregnancy does not occur the corpus luteum goes through its series of changes much more quickly, and shrinks to a comparatively small size by the time the next monthly flow begins. Thus the old names corpus luteum of pregnancy and of menstruation must now be abandoned as meaning

anything peculiar as to structure. They are identical structures, differing only in their duration. In infant's ovaries maturation of the Graafian follicles and ova occurs just as in adults, but no rupture follows. Instead the ovum is removed by a process of phagocytosis, cells derived from the membrana granulosa acting as phagocytes and gradually absorbing the egg. During the process a species of granulation tissue is formed from the tunica vasculosa, this gradually absorbs the contents of the follicle and forms a mass

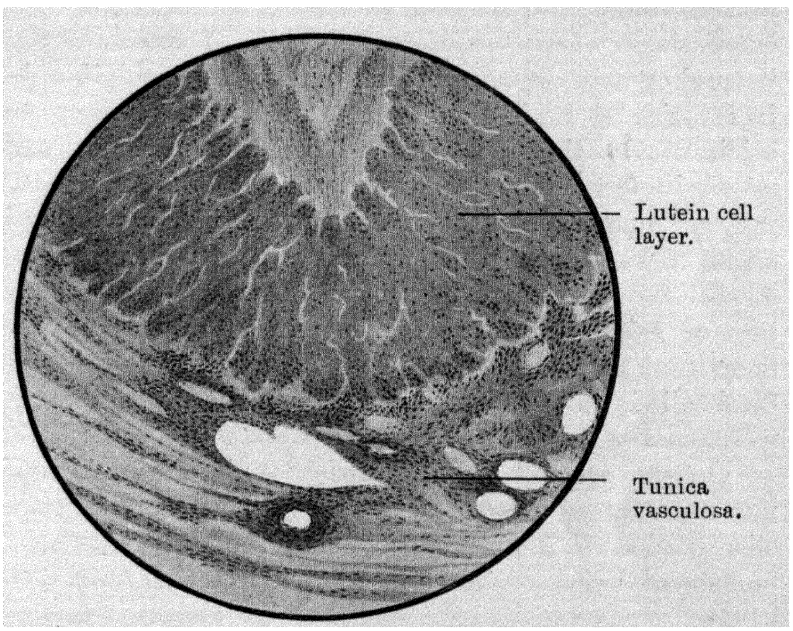


FIG. 5.—SECTION OF A CORPUS LUTEUM FROM AN ADULT OVARY. × 15.

of fibrous tissue, which is eventually like a corpus fibrosum, but much smaller, and forms a microscopic mass of scar tissue.

MENSTRUATION

The periodic flow of blood and mucus from the uterus commences at puberty, usually in this country at about the age of fourteen, and persists for over thirty years. The usual age at which cessation of menstruation occurs, known as the menopause, is about 48 on an average, varying between 45 and 51 under normal conditions. The age at which menstruation begins depends rather upon racial characteristics than upon climate, but in general is earlier in warm than in cold climates, although this dependence upon climatic conditions does not always follow.

The onset of menstruation is accompanied by changes which

characterize the transition from childhood to puberty and budding womanhood, and must be regarded as a time of considerable stress. Normal menstruation follows a regular rhythm, varying somewhat in different individuals, but most usually four-weekly. The number of days during which the flow persists also varies in different women within normal limits, four to five days being the commonest length of time.

The amount of blood lost naturally varies very much within normal limits, but has been estimated at from 2 to 8 ounces. The composition of the menstrual fluid is of some interest, as it has been shown to differ from that of normal circulating blood. Thus it is said by Blair Bell to contain a much larger proportion of calcium salts than circulating blood, and under normal conditions no fibrin ferment. This would seem to indicate that the uterine mucous membrane exerts some sort of selective action in the character of the blood which it allows to pass during menstruation. With these characters it is clear that there must be a considerable loss of calcium salts during menstruation, and also that normal menstrual blood does not clot. The latter certainly is true, and further it is only under abnormal conditions that clots form during menstruation.

On the other hand, Beckwith Whitehouse contends that the menstruating uterus normally always contains a clot, and that this clot gradually dissolves producing the fluid which is known as menstrual blood. Whitehouse attributes the clotting to thrombokinase derived from the endometrial tissues thrown off during menstruation, while the solution of the clot, he believes, is brought about by a fibrinolysin contained in the secretion of the uterine glands. If these hypotheses prove to be true they will have an important bearing on the pathology of uterine hæmorrhage.

In addition to blood and calcium salts, menstrual fluid contains mucus and cell débris derived from the endometrium and vagina.

The histology of menstruation has been studied by many observers, but cannot yet be said to be absolutely settled. The essential changes in the endometrium depend upon a premenstrual congestion, a period of active blood-loss, a period of repair, and a short quiescent interval.

The *premenstrual congestion* affects chiefly the superficial capillary vessels around the opening of the glands, but also to some extent the deeper portions. As a result of this congestion, or at least accompanying it, the glands become enlarged, with swollen epithelium and some increase in their tortuous outlines. The stroma becomes œdematous and the cells swell up and approach

more closely to one another, but there is no enlargement of the cells which can be said to be at all comparable with that which occurs in the decidua of pregnancy. There is never any difficulty in recognizing a menstrual cast of the endometrium as compared with a pregnancy decidua.

During the active blood-loss, blood escapes between the epithelial cells on the surface, through the glands and also through small breaches in the surface from which a few epithelial cells have broken away. Under normal conditions there is never any shedding of an appreciable part of the endometrium.

The *period of repair* comprises reconstruction of any breaches in the surface, shrinkage of the glands and stroma cells, and return of the blood capillaries to the quiescent stage.

The meaning of menstruation and the part played by it in the physiology of the female is the most difficult and least understood part of the subject. The analogy of the period of œstrus in animals does not hold quite true for the human subject, for it appears that the blood-flow in animals prepares the endometrium for the reception of a fertilized ovum. This is not so in the human female, because the appearance of the flow marks the failure of the uterus to receive a fertilized ovum; the flow does not appear when fertilization and embedding of the ovum have occurred. Thus it would be correct to say that the premenstrual congestion and swelling represent the preparation of the endometrium to receive a fertilized ovum, while the flow marks its failure to do so. This is, as it were, a purely local explanation of the function of menstruation.

FERTILIZATION

It is now commonly believed that the union of the spermatozoon with the ovum takes place in the Fallopian tube, and further that the early stages of development occur in this tube, while the young embryo is on its way to the uterus. This view is upheld by the analogy of the lower mammals, in which embryos in the early stages can be found in the Fallopian tubes, and also by the frequent occurrence of tubal gestation and its accidents in the human female.

It seems probable, on common-sense grounds, that the human fertilized ovum attains some degree of development before it enters the uterus, as it is able to begin to embed itself at once. If the ovum was not fertilized until it reached the uterine cavity it might perish or fall out of the uterus before it had attained sufficient development to embed itself. It is well known that spermatozoa

are capable of remaining alive in the Fallopian tube for many days after they have found their way into it, but nothing is known of the life of the ovum before fertilization. Further, spermatozoa are able to remain alive long enough to reach the peritoneum and to penetrate a ruptured Graafian follicle in the ovary from which the ovum has not escaped, a phenomenon which is proved by the undoubted occurrence of ovarian gestation.

As the ciliary current in the Fallopian tube and uterus is towards the external os, it follows that spermatozoa must make their way against the current. Why they should do this instead of swarming aimlessly in the vagina is not explained, but it may be that the Fallopian tube secretion exerts a positive chemiotaxis upon the spermatozoa, slight at first when diluted with uterine secretion,

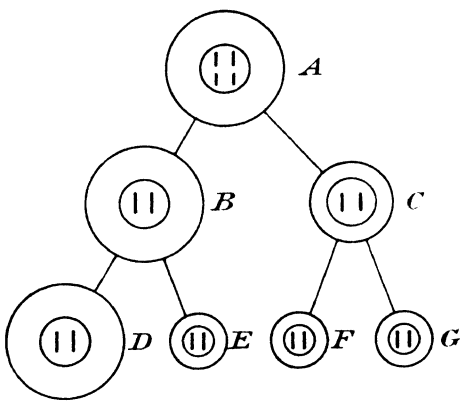


FIG. 6.—DIAGRAM OF A HYPOTHETICAL OÖCYTE CONTAINING FOUR CHROMOSOMES.

A, Oöcyte; *B*, Oöcyte; *C*, 1st Polar Body; *D*, Mature Ovum; *E*, 2nd Polar Body; *F*, *G*, Polar Bodies.

but much stronger as the spermatozoa reach the Fallopian tube orifice.

The process of fertilization has not been seen in the human being, but there is no reason to suppose that it is different from that in the lower animals. By the maturation of the ovum, that is, by the extrusion of the polar bodies, the chromosomes in its nucleus are reduced to one-half the original number. Maturation of the ovum is brought about in the following manner: the nucleus of the oöcyte divides and one of the resulting nuclei is the first polar body, the other remains as the nucleus of the oöcyte. This division is heterotypical, *i.e.* a reducing division, the nucleus of the oöcyte only containing half the number of chromosomes. The nucleus of the oöcyte again divides, producing the second polar body, and the oöcyte itself

now becomes the mature ovum. This division is homotypical. The first polar body in the meantime divides homotypically into two, so that there are now three polar bodies as well as the mature ovum, all containing half the original number of chromosomes. The number of chromosomes in the spermatozoon has already been reduced by one-half during the stages of spermatogenesis. Fertilization is essentially a union of the pronucleus (head of the spermatozoon) with the female pronucleus (the nucleus of the ovum after extrusion of the polar bodies) resulting in a nucleus (segmentation nucleus) in which the number of chromosomes is once more brought up to the original number existing in the ovum, or any other cell of the human species. The new cell, however, will now consist of elements and characteristics derived both from the male and from the female.

The early stages of development of the human ovum have not yet been observed, and consequently all suggestions concerning

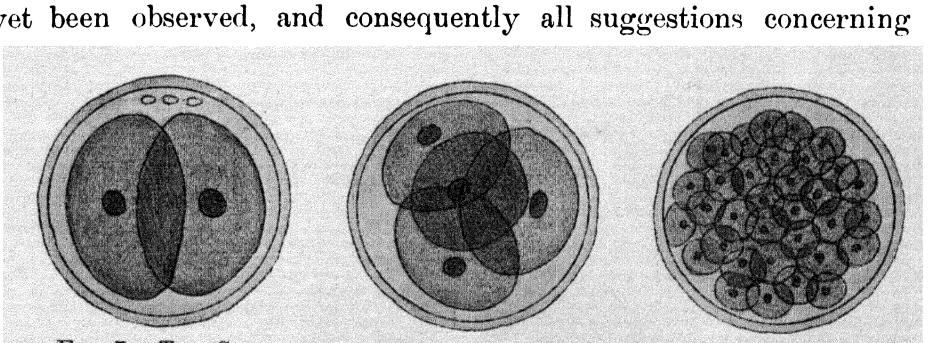


FIG. 7.—THE SEGMENTATION OF THE FERTILIZED OVUM. (Diagrammatic.)

Showing the first division into two, then into four, and then into many cells. The polar bodies are still seen at the two-cell stage.

them must be a matter of hypothesis. There is, however, now such a mass of evidence concerning the early stage of development of mammalian embryos in general, that it seems quite reasonable to theorize concerning that of the human species. This is especially the case since the discovery of the Bryce-Teacher ovum, Peters' ovum, and Graf v. Spee's ovum, which are of a sufficiently early stage of development to warrant certain assumptions as to their antecedent stages.

After fertilization has occurred, segmentation begins probably at once, while the ovum is still in the Fallopian tube. The first segmentation naturally divides the egg-cell into two, then into four, eight, sixteen, thirty-two, and so on, until a solid mass of cells is produced which may be termed the *morula stage.*

Although segmentation is complete and holoblastic, the resulting cells are not all alike. Some are smaller, divide more rapidly,

and occupy the surface of the morula; others are larger and more centrally placed, so that even at this early stage, cells of two categories are produced. While this is going on, fluid begins to collect in the morula, and gradually separates the outer cells from the inner, and converts the solid morula into a hollow *blastocyst*.

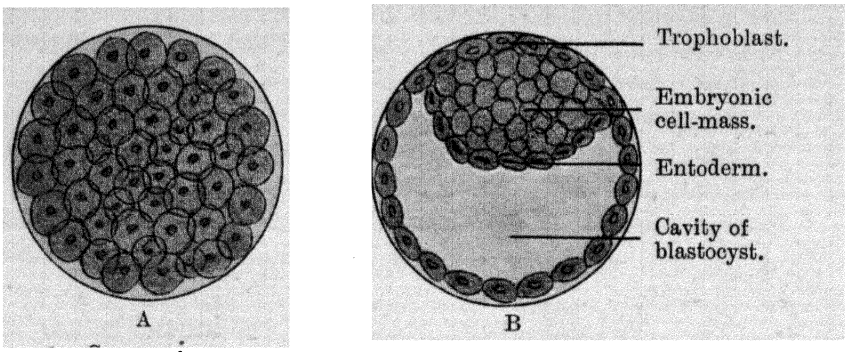


FIG. 8.—SEGMENTATION OF THE FERTILIZED OVUM. (Diagrammatic.)
A, Morula. B, Blastocyst.

At this stage the outer layer of small cells is known as the *trophoblast*, the inner cell-mass is known as the *embryonic cell-mass*, or *enclosed ectoderm*. The next stage is the first appearance of the

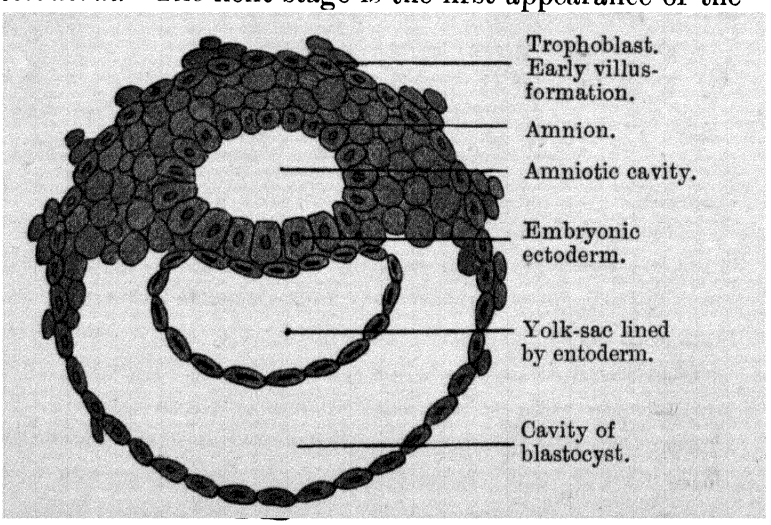


FIG. 9.—HYPOTHETICAL STAGE IN THE DEVELOPMENT OF THE HUMAN EMBRYO. (Diagrammatic Section.)

entoderm, which is differentiated as a layer of somewhat flattened cells from the innermost part of the enclosed ectoderm.

This layer forms a closed sac, separated by a considerable interval from the trophoblast, which is growing very rapidly, and enlarging the hollow blastocyst out of all proportion to this sac and to the size of the enclosed ectoderm.

While the yolk-sac is forming, a split or cavity appears in the enclosed ectoderm which represents the future *amniotic cavity*, and in the floor of which the actual embryo is formed. The cells in the floor of the amniotic cavity (nearest the entoderm) become more columnar in character, and are termed the *embryonic ectoderm*. All this time the trophoblast has been enlarging and the blastocyst has increased out of all proportion to the enclosed ectoderm, and thus the yolk-sac and amniotic sac form a small projection at one pole into the blastocyst, attached only by a thick stalk of enclosed ectoderm. This may be termed the ventral stalk, and is the precursor of the umbilical cord.

It must be clearly recognized that these stages in human development are purely hypothetical, and are suggested by the embryology of the rabbit, monkey, and a lemur (*Tarsius spectrum*).

The formation of the third germinal layer, the *mesoderm*, may be described as the growing out of a sheet of cells from that place at which the embryonic ectoderm is in contact with the yolk-sac entoderm, a primitive streak and its knob-like thickening, "Hensen's knot," first appearing. These mesodermic cells grow all round in contact with the inner side of the trophoblast and cover the outer side of the yolk-sac entoderm, the cavity between these layers now becoming the primitive *cœlome*.

With the formation of the three germinal layers, ectoderm, entoderm, and mesoderm, together with the amniotic cavity and yolk-sac, the known and described stages of the human embryo are reached.

At these stages the trophoblast (extra-embryonic ectoderm) is beginning to form *villi*, to attach the embryo to the maternal decidua and to obtain its nourishment. The amniotic cavity has become much flattened instead of having a more spherical form, as shown in the hypothetical ovum of Fig. 9, the embryonic ectoderm is flattened instead of concave, and the ventral stalk has shifted round so as to project from that end of the embryonic ectoderm which will eventually become the tail end of the embryo.

The details of the development of the actual embryo are outside the scope of this work, but it may be noted that in Graf v. Spee's embryo of 2 mm., the embryonic ectoderm is folding round to form the head in front, the primitive streak has perforated posteriorly, forming the *neurenteric canal*, and a primitive *allantois* has grown out as a diverticulum a little way into the solid ventral stalk. At the same time the entoderm is becoming pinched in, as it were, from the yolk-sac, to form the primitive gut (archenteron). The discovery of the earliest yet known embryo has brought

out some points of interest: for instance, that the amnion is a closed sac from the first, not formed by up-growing ectodermal folds as in the chick; that the allantois is a small protrusion from the hinder end of the primitive archenteron, and never protrudes beyond the actual boundaries of the embryo; and that the forerunner of the umbilical cord is a solid mass of enclosed ectoderm now known as the *ventral stalk.*

Embedding of the Fertilized Ovum in the Uterine Mucous Membrane.—It is probable that the embryo begins to embed itself in the uterine mucous membrane when it has reached the hypothetical stage shown in Fig. 9. It is covered by a layer of tropho-

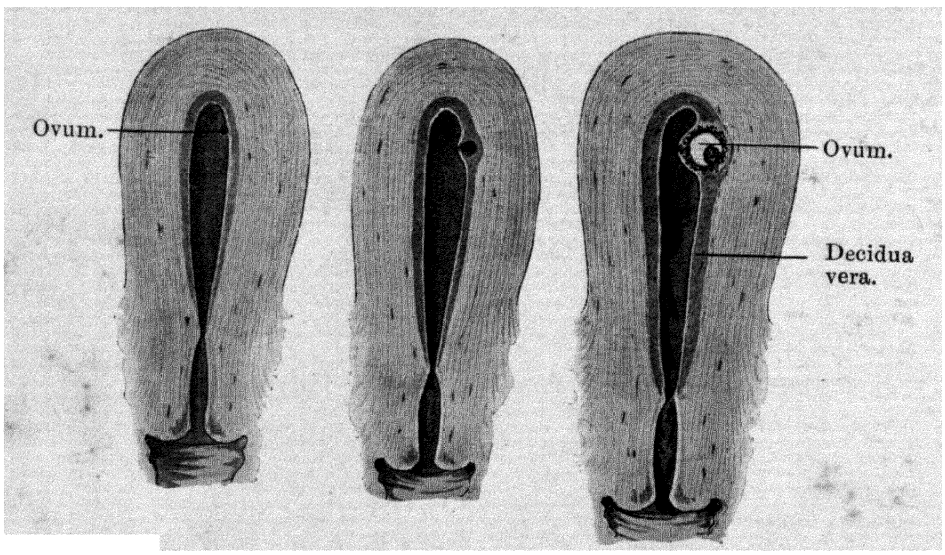


FIG. 10.—DIAGRAMS TO SHOW THE METHOD OF EMBEDDING OF THE OVUM IN THE UTERINE MUCOUS MEMBRANE.

blast, already showing rudiments of chorionic villi, but as yet containing no mesoderm and consequently no blood-vessels.

This trophoblast layer, at first composed of single ectoderm cells, very soon, however, differentiates into two layers, an outer composed of undifferentiated masses of protoplasm with many nuclei, the *syncytium*, and an inner composed of discrete cells with well-marked outlines, the *Langhans' cells.* This double-layered trophoblast has the power of eating away the uterine mucosa, probably by secreting a digestive ferment, and thus permitting the ovum to bore its way through the endometrium. As the ovum enlarges while it is boring into the endometrium, the hole through which it entered appears smaller than the actual ovum, and is filled in by a small mass of fibrin, called Reichert's cicatrix. The appearance of the ovum at this stage is shown in Fig. 10.

While this is happening changes occur in the endometrium surrounding the ovum, and the first appearance of a decidual formation begins. The formation of the decidua thus starts first around the ovum and gradually spreads to the rest of the endometrium. The cause of the decidual formation is unknown, but it must in some way be associated with the growth of the ovum, because the decidua keeps pace with its growth, and thus there is always a layer of

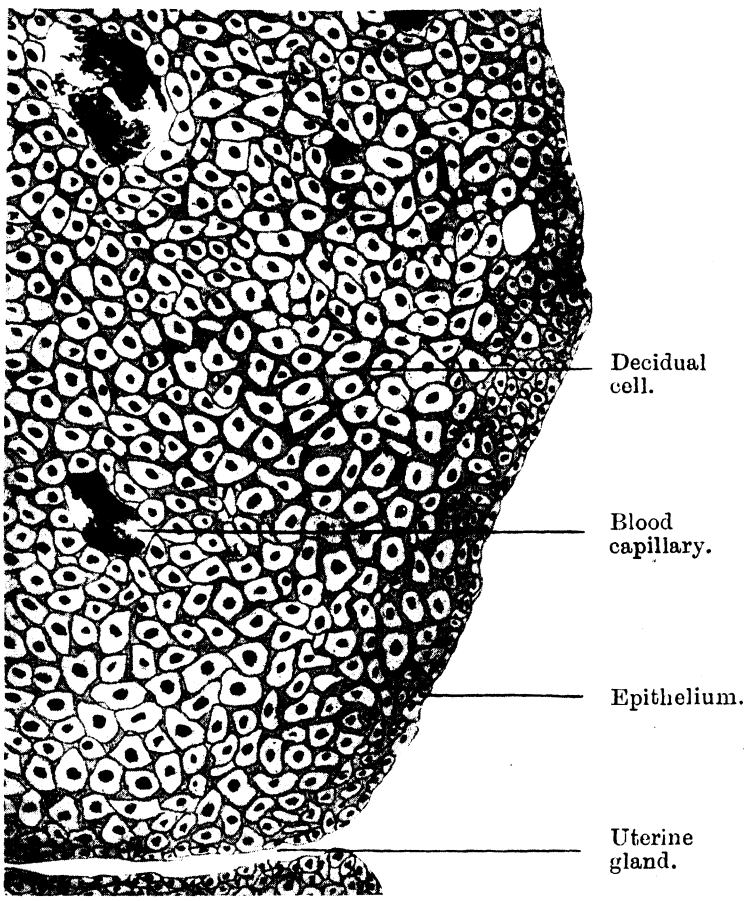


FIG. 11.—SECTION OF DECIDUA VERA FROM AN EARLY ABORTION.

decidua between the ovum and the uterine muscle. In a sense the decidua is protective, because if it were not present the ovum would bore its way into the uterine muscle, and would eventually perforate the whole thickness of the uterine wall, just as it perforates the Fallopian tube in ectopic gestation. The decidual change consists essentially in an enlargement of the stroma cells of the endometrium, along with a disappearance of any fibrillated connective tissue. Thus the fully formed decidua is composed of large polygonal

cells with spherical nuclei, which touch one another on all sides without any connective tissue stroma, apart from the very small amount which remains around the blood-vessels. This arrangement of the decidual cells is well shown in Fig. 11, which is drawn from a section of decidua derived from an early abortion. The uterine glands persist in the decidua, their epithelial lining becoming swollen and enlarged, their deeper portions being dilated, while their mouths are comparatively narrow and far apart. Thus the super-

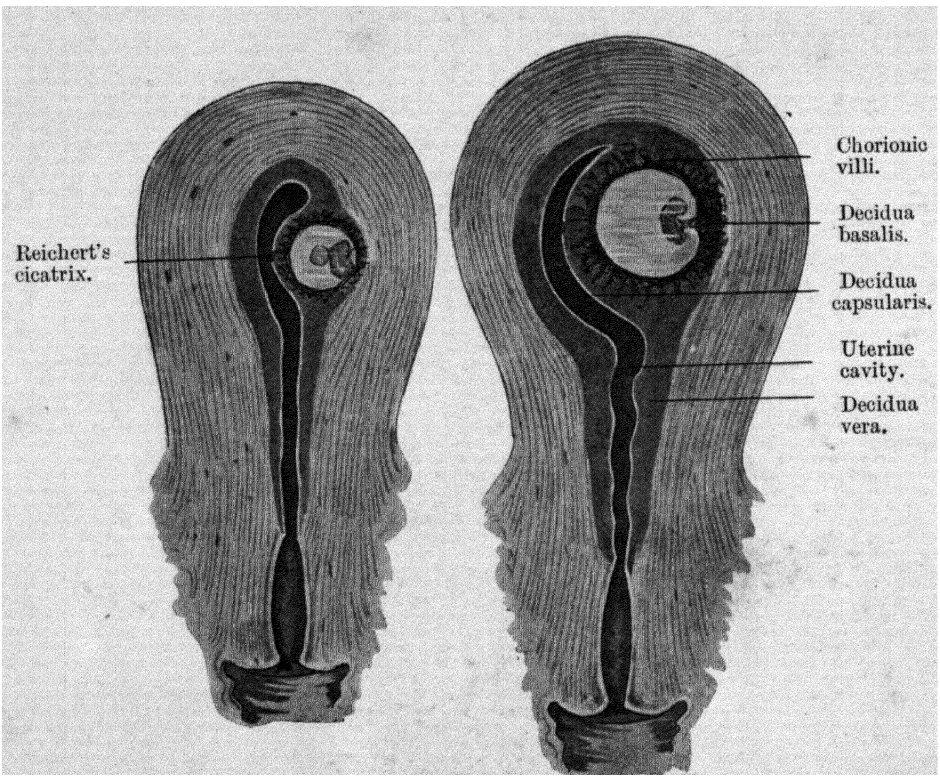


FIG. 12.—DIAGRAMS TO SHOW THE EMBEDDING OF THE OVUM, AND THE FORMATION OF THE DECIDUA, AND THE DIFFERENTIATION OF THE DECIDUA BASALIS AND THE DECIDUA CAPSULARIS FROM THE DECIDUA VERA.

ficial part of the decidua is called "compact," while the deeper part is called "spongy," from the wide glandular spaces in it. The actual thickness of the decidua is very variable, but it often measures a quarter of an inch. When the whole endometrium is transformed into decidua, names are given to it according to its relation to the growing ovum. Thus that part which lies between the ovum and the uterine muscle, in which the placenta is afterwards formed, is called the *decidua basalis;* that which covers the ovum and bounds the small opening through which it entered

is known as the *decidua capsularis;* while the rest of the decidua lining the uterine cavity away from the ovum is called the *decidua vera.*

The method of formation of the decidua capsularis is interesting and simple. As the ovum enlarges the decidual layer which bounds

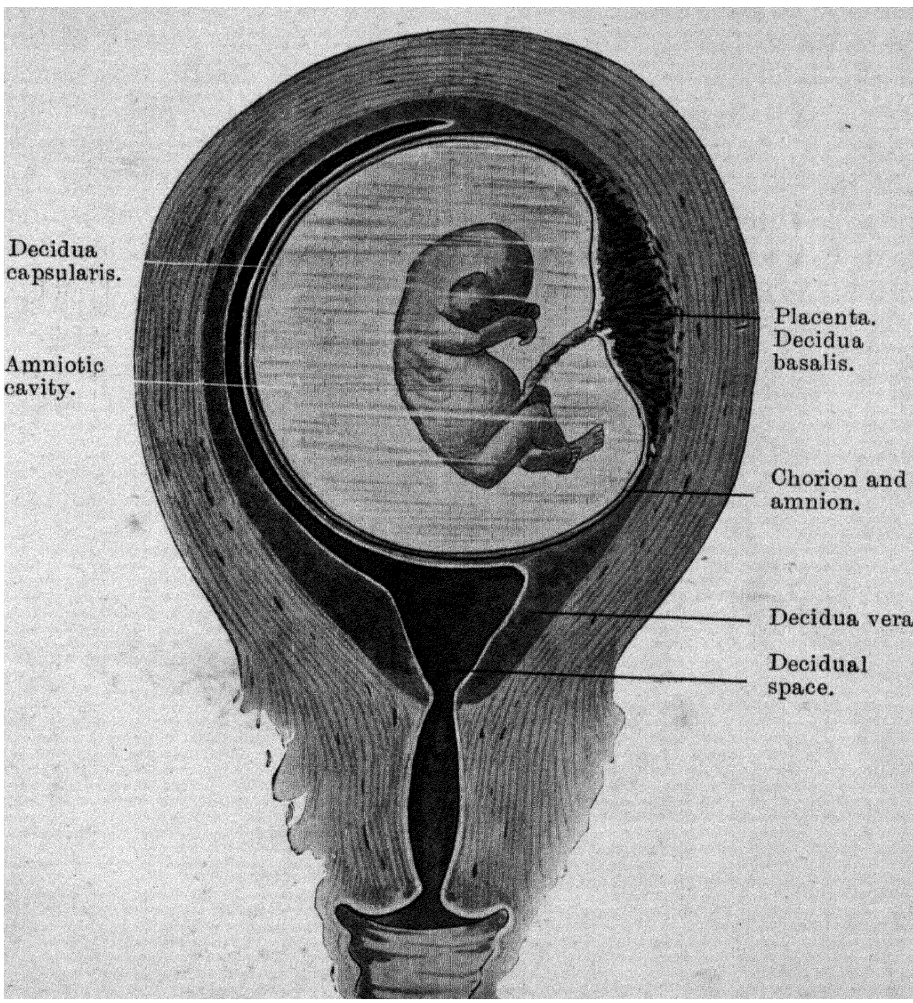


FIG. 13.—TO SHOW THE CONTENTS OF THE UTERUS AT THE END OF TWELVE WEEKS' GESTATION.

Hegar's sign (see Fig. 23) depends on the presence of the decidual space as depicted above.

Reichert's cicatrix becomes raised and thinned out as shown in Figs. 12 and 13. Thus there is always from the first a layer of decidua separating the ovum from the uterine cavity. It was formerly believed, before the method of embedding was thoroughly understood, that the decidua grew up all round the ovum, and gradually

covered it in. Now this hypothesis is known to be erroneous. As the ovum becomes still larger it follows that the uterine cavity must be gradually obliterated, the decidua capsularis coming into contact with the decidua vera and adhering to it. This takes place at about the end of twelve weeks' development, at a time when the placenta is also fully developed. At the full time of pregnancy, remnants of decidua can still be recognized on the surface of the chorion which is towards the uterine wall. The decidua only keeps pace with the growing ovum at that part where the placenta will eventually be formed, the basalis; everywhere else in the capsularis and the vera gradual thinning of the decidua takes place as the ovum and uterus enlarge. At full time the actual amount of decidua vera and capsularis is very small and thinned out. The mucous membrane of the cervical canal is not transformed into decidua.

CHAPTER II

DEVELOPMENT OF AMNION, CHORION AND PLACENTA

THE first indication of the formation of *chorionic villi*, as small solid projections of trophoblast, occurs at the hypothetical stage of the human ovum shown in Fig. 9. At this time the blastocyst is enlarging rapidly by the accumulation of fluid in it, and the embryo projects at one point as a small mass with two cavities and a thick stalk. Later the villi begin to branch as shown in Graf v. Spee's 2 mm. ovum. At this stage they consist entirely of solid branching buds of trophoblast, showing, however, the beginnings of the two layers into which the trophoblast divides. Even at this early stage the chorionic villi act as nutritive organs absorbing whatever is required for the growing embryo from the maternal tissue fluids with which they are in contact. In addition they have a respiratory function by facilitating an interchange of gases, oxygen and carbon dioxide, between mother and embryo. The trophoblast sends out a solid bud of protoplasm with numbers of nuclei, and as this enlarges, the cells of Langhans' layer proliferate actively into it. The trophoblast at first consists only of discrete cells with defined outlines, but later the syncytium is formed by numbers of the cells in the superficial layers fusing together to form solid multinucleate plasmodial masses.

At quite an early stage of development mesoderm begins to grow into the chorionic villi through the ventral stalk, and spreads all round the blastocyst as a definite layer inside the trophoblast. This mesoderm, at first only cellular, quickly becomes fibrillated, and gives rise to the connective tissue core of the villi. At first it does not contain any blood-vessels, but eventually these push their way into, or form in, the ventral stalk. Thus the fully formed villus consists of—

1. The double-layered trophoblast (ectoderm),
2. The connective tissue core (mesoderm), and
3. The blood-vessels which are derived from those of the embryo.

The first appearance of blood-vessels is on the yolk-sac, by a process of canalization of connective tissue cells, which become quickly connected with the two primitive aortæ of the embryo, with the two marginal sinuses (umbilical veins), and with the vessels of the chorion through the ventral stalk. It is not known for certain, but it is believed that the vessels of the chorion and of the yolk-sac communicate with one another before there are any main blood-vessels in the human embryo. The yolk-sac circulation ceases very early to be of importance, while that of the chorion becomes all important in the human embryo. When once blood-vessels have formed in the connective tissue of the villi, vascularization

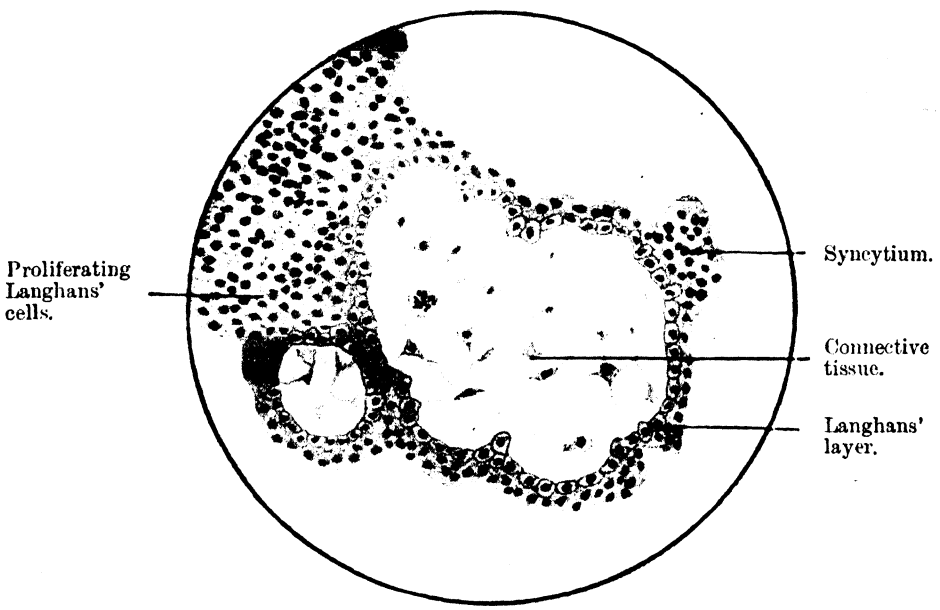


FIG. 14.—SECTION OF A CHORIONIC VILLUS AT ABOUT THE FOURTH WEEK.

keeps pace with their growth. Small capillaries can be seen developing in the trophoblast buds soon after they have formed.

By the end of about four weeks the whole blastocyst is covered by a chorion completely invested with branching villi, about half an inch long and producing a hirsute appearance when floated in water. Later on those villi which are opposite the decidua basalis enlarge and branch repeatedly and become attached to the decidua, while those all over the rest of the chorion gradually atrophy. Thus the chorion is artificially divided into a *chorion frondosum* (attached to the basalis), which forms the fœtal portion of the placenta, and a *chorion læve* (attached to the capsularis), which atrophies and takes no part in the formation of the placenta.

The development of the placenta consists essentially of three parts—

1. The growth of the villi of the chorion frondosum.
2. Their attachment to the decidua basalis.
3. The formation of the maternal blood-sinus or space around the villi.

The growth of the chorion frondosum is brought about simply by the budding of the trophoblast, the growth of the mesoderm into the buds, and the prolongation of blood-vessels into them.

The attachment of the villi to the decidua basalis is brought about in this way:—When the syncytial covering of the villus

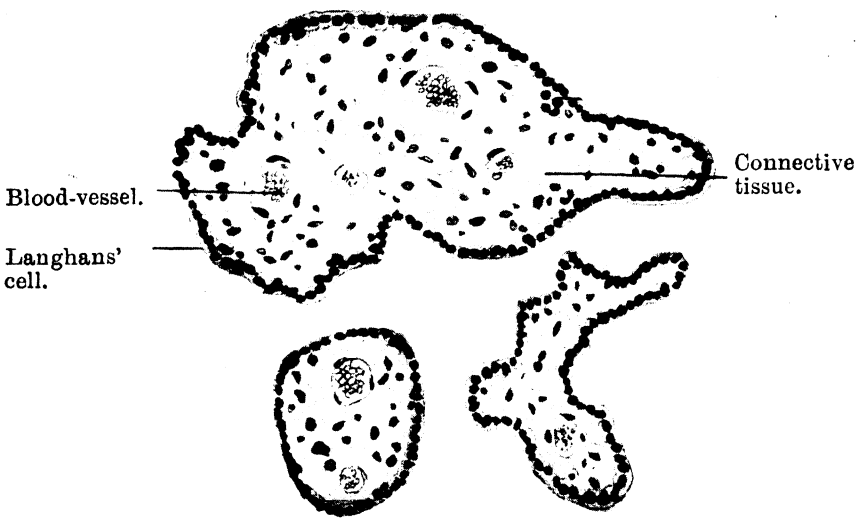


FIG. 15.—SECTION OF A CHORIONIC VILLUS FROM A PLACENTA AT FULL TIME.

Compared with the early villus shown in the previous figure the villus of the ripe placenta is seen to possess a denser connective-tissue core containing blood-vessels and a thinner cellular covering chiefly composed of Langhans' cells, the syncytium having almost disappeared.

comes into contact with the decidua, a luxuriant proliferation of the Langhans' cells takes place in the centre. The Langhans' cells penetrate the decidua and thus weld the villus to the decidua; the syncytium in the meantime passes off from the surface of the villus on to the decidua and is continuous with the syncytium of the villi next to the one in question. Thus there is a space between the villi filled with maternal blood and lined by syncytium.

This intervillous blood-space is the most difficult part of the placenta to understand. Our knowledge of it is derived from the appearances seen in the Bryce-Teacher ovum and from Peter's ovum. When the ovum bores its way into the endometrium, the

trophoblast comes into contact with capillary blood-vessels which are merely channels in the decidua lined by endothelium, so that they are easily attacked and eaten into by the trophoblast. Thus a capillary vessel is opened by the trophoblast, and a blood-space is formed whose wall is at first partly trophoblast and partly endothelium and decidua. As the trophoblast continues to grow, the channel of the vessel practically becomes surrounded by trophoblast, but always retains two openings by which the blood flows in and out. Thus a minute blood-island appears in the trophoblast, fed and emptied by a maternal capillary vessel.

This is the beginning of the intervillous blood-space. As this process is going on all over the area of the decidua basalis, large numbers of blood islands appear in the trophoblast communicating with one another between the villi. Naturally as the villi enlarge and become vascularized these blood islands also increase *pari passu* as more and more maternal blood-vessels are opened up. Further, as the maternal capillaries are absorbed into the trophoblast, it must happen that eventually a small artery or vein is reached, and thus in the end the blood-sinus becomes a big structure, fed by maternal arteries, emptied by maternal veins, and everywhere lined by syncytium.

The placenta is completely formed at the end of twelve weeks, and its structure is essentially the same then as at full time, with only minor differences, due to growth in size and degenerative changes. The placenta grows in size by the constant budding and branching of the chorionic trunks, which also increase in thickness by the formation of more fibrous tissue in them, at the part nearest the umbilical cord (ventral stalk). As there is always a layer of decidua between the placenta and the uterine muscle, it follows that the placenta grows in thickness by its trophoblast constantly attacking this decidua as it keeps pace with the placental growth. The same applies to the growth in area of the placenta. Some of the main chorionic trunks extend through the whole thickness of the placenta and are attached to the decidua; others, lateral branches, may never reach the decidua, and so are not attached. The enormous number and complexity of the branches of the chorionic trunks, with their syncytial covering, produces a vast area of fœtal tissues exposed to the maternal blood in the blood-sinus. This is necessary in order that there may be a ready interchange of food-stuffs, waste products and gases between the fœtus and the mother. The blood in the chorionic vessels (fœtal) is separated from the maternal blood only by the trophoblast, a thin layer of loose connective tissue, and the endothelial lining of the fœtal capillaries. As long as the syncytium

is intact and the villi are well supplied by fœtal blood, the maternal blood in contact with the villi remains fluid. If, however, a villus for some reason is deprived of its blood supply, degeneration begins to take place, and the maternal blood in contact with that villus will no longer remain fluid. Fibrin is then deposited from the maternal blood upon the damaged villus and a solid placental infarct is formed.

THE FULL-TIME PLACENTA

The placenta at full time is circular in shape, forming a spongy disc 7 to 8 inches in diameter and about an inch thick near the insertion of the umbilical cord when this is centrally placed. The margin of the placenta is abrupt and much thinner than the central portion, the thickness gradually diminishing from the centre to the periphery. The weight of the full-time placenta is about a pound.

Naturally the placenta varies in size and weight with the child which it supplies, but in some conditions of disease it may be much larger than it would be expected to be according to the weight of the infant.

The placenta has a fœtal surface and a maternal surface.

The *fœtal surface* is covered by the amnion and is smooth to the touch, the blood-vessels being visible beneath it as they radiate from the insertion of the umbilical cord. The amnion passes smoothly off the placental edge on to the uterine wall, to which it is adherent through the medium of the chorion and degenerate decidua.

The *maternal surface* is rough and spongy to the touch, presenting a number of rounded or polygonal areas known as cotyledons, each being somewhat convex in the centre, and having a shallow groove around the margin, which separates the cotyledons from one another. The colour of the maternal surface is a dull red, with a thin greyish somewhat shaggy layer on the surface. This is the remnant of the decidua basalis which has undergone degenerative changes, and through which the line of separation from the uterine wall has occurred. In an uninjured specimen the decidua basalis is continuous over the cotyledons and the grooves between them. The decidua basalis is perforated by the arteries and veins which supply and drain the maternal blood-sinus. The maternal surface often has a gritty feel, the result of calcification of small degenerate areas

If a section is made across the thickness of the placenta from the amniotic surface, the following structures will be cut through: amnion, chorion, main trunks of the chorionic villi, lateral branches

of the villi, the intervillous blood-space, the attachments of the main chorionic trunks to the decidua, the lining of the maternal blood-space and finally the decidua basalis. The chorion can be seen to form a thin connective-tissue layer, loosely united with the amnion and in it the main vessels pass to and from the umbilical cord. The main chorionic trunks branch out from the chorion, and many of them pass straight through the placenta to be attached to the decidua,

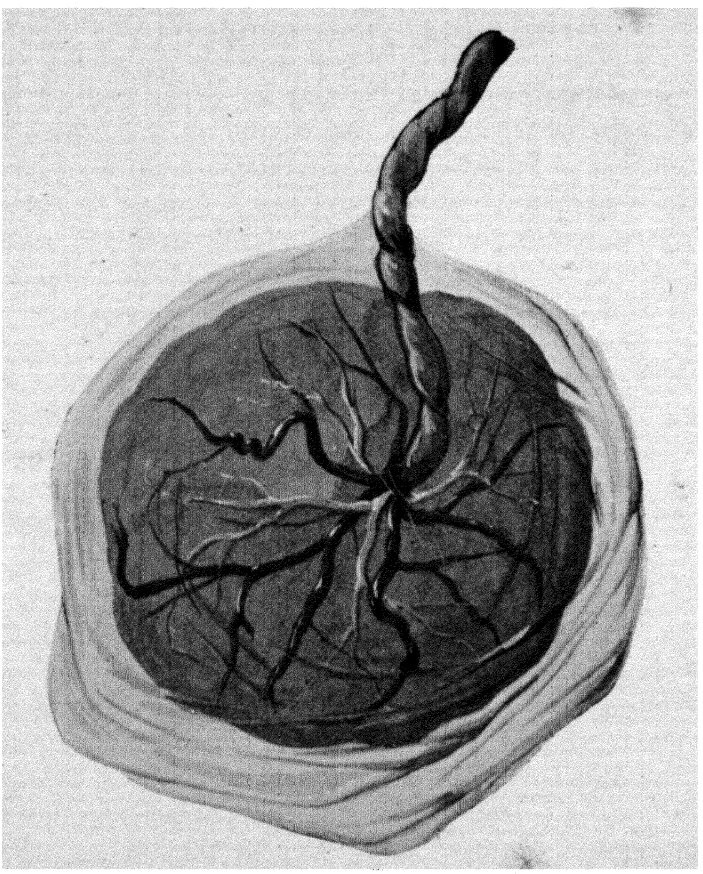


FIG. 16.—NORMAL PLACENTA, SHOWING THE FŒTAL SURFACE.

thus uniting the two surfaces. Others are not attached to the decidua but branch repeatedly and form an arborescent tuft which practically fills the intervillous blood-space. A cut made through either surface of the placenta naturally opens the maternal blood-space and injures the villi inside. If the blood is washed out of the maternal blood-space, the arborescent tufts of villi can be seen greyish in colour and hanging free. The blood naturally drains out of the maternal space after normal separation, but no fœtal blood is lost because no villi are torn or injured during a normal separation.

Thus it happens that the child and placenta can be expelled together and left, the cord not being tied, without any fœtal blood being lost or the child suffering in any way.

It will thus be seen that the great bulk of the placenta is of fœtal origin, the only maternal tissue entering into its formation being the decidua basalis and the mother's blood. The lining of the

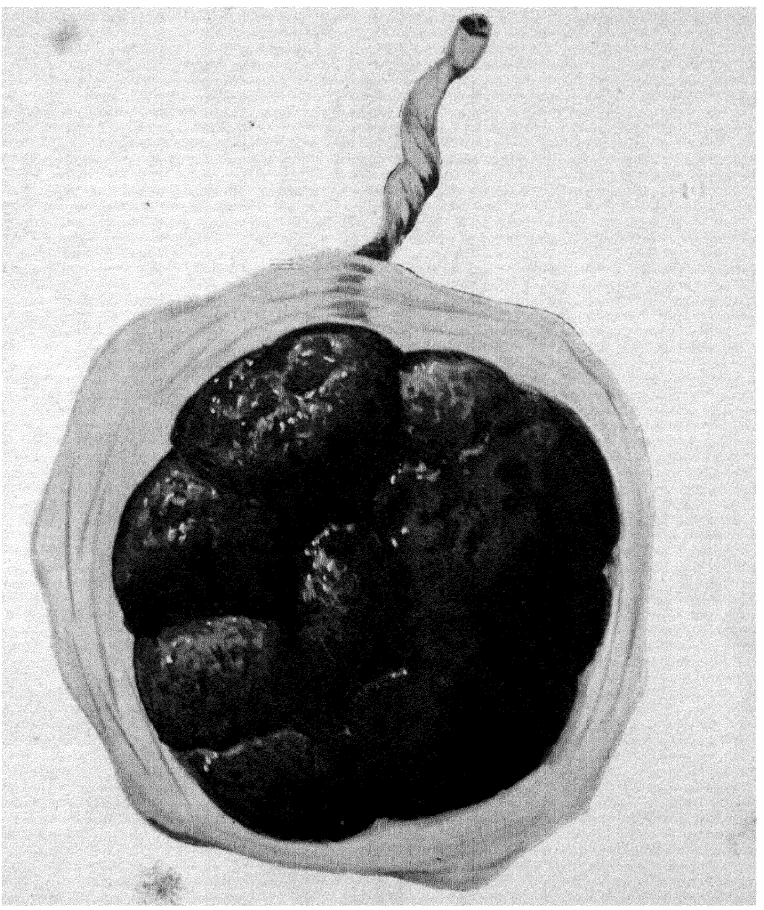


FIG. 17.—NORMAL PLACENTA, SHOWING THE MATERNAL SURFACE, DIVIDED INTO COTYLEDONS.

intervillous blood-space has already been shown to be the syncytial layer of the trophoblast, continuous over all the villous trunks and lining that portion of the decidua basalis between the attachments of the villi.

The blood-channels in the deepest layers of the decidua supplying and draining the intervillous blood-space, although continuous with maternal arteries and veins, are merely thin-walled sinuses, devoid of any muscular coat. The fœtal vessels, two umbilical

arteries and one vein, can be seen spreading out from the umbilical cord under the amnion, branching separately and being lost in the chorionic trunks before they reach the margin of the placenta.

Passing more or less completely round the circumference of the placenta is a thin-walled venous channel, which is known as

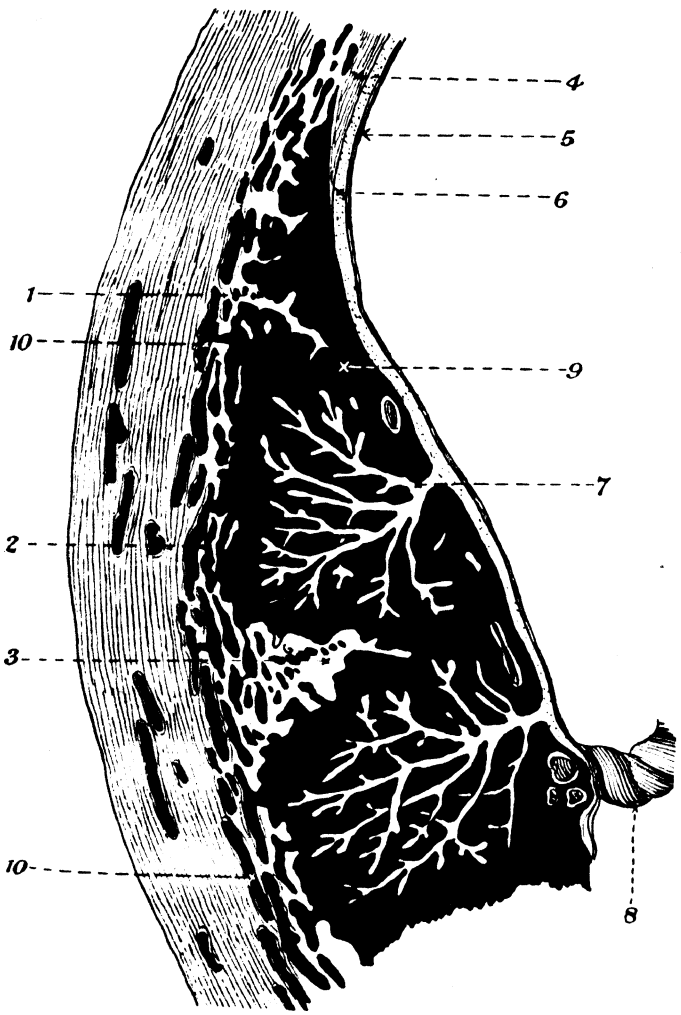


FIG. 18.—DIAGRAMMATIC SECTION OF PLACENTA AND UTERINE WALL.

1. Chorionic villus attached to uterus. 2. Free branch of a villus. 3. Blood-vessel (fœtal) in a villus. 4. Decidua. 5. Amnion. 6. Chorion. 7. Main trunk of a villus. 8. Umbilical cord. 9. Intervillous blood-space. 10. Uterine sinus supplying or draining intervillous blood-space.

the *circular sinus* of the placenta. This assists in draining the venous blood from the intervillous blood-space. Rupture of this circular sinus has been known to occur before delivery, with serious or even fatal maternal hæmorrhage.

Degenerative Changes in the Placenta.—Degenerative changes occur normally in the placenta from about the 28th week onwards, taking the form of "white infarcts" and fibrinous transformation of the cells of the decidua basalis.

White infarcts are seen commonly around the margin of the placenta and on the surface of the cotyledons. It is only in conditions of disease that they occur as large yellowish cheesy masses in the substance of the placenta. They are essentially the result

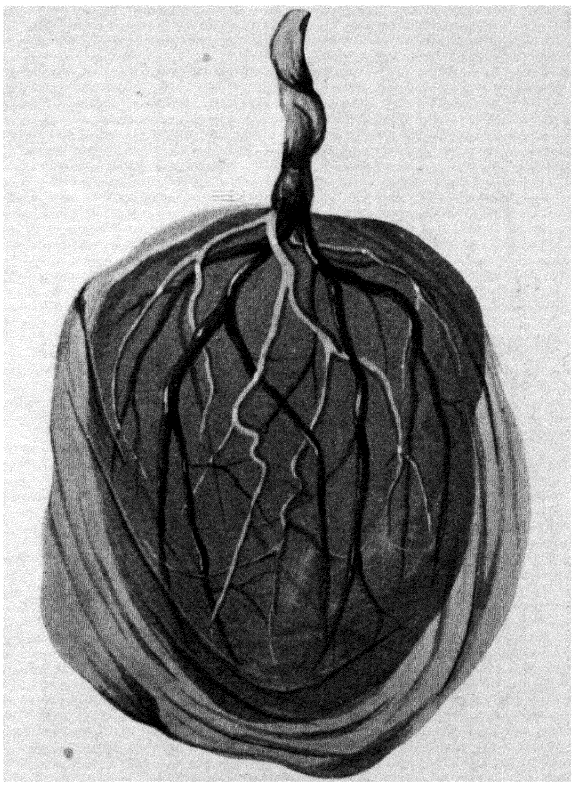


FIG. 19.—BATTLEDORE PLACENTA.

of the deposition of fibrin in layers from the maternal blood upon villi which have been deprived of their blood supply from the fœtus. This deprivation is the result of gradual closure of fœtal vessels in the villi, by a process of obliterative endarteritis.

This process has the result of destroying the nutrition of the ends of the villi and so damaging their syncytial covering. Maternal blood will only keep fluid in contact with undamaged villi, and consequently, when these are practically dead tissues, fibrin is deposited upon them, layer upon layer, gradually increasing and forming solid masses, welding the villi together and forming the

infarct. The decidua basalis in contact with the villi gradually loses its cellular structure, the cell-outlines being lost and their

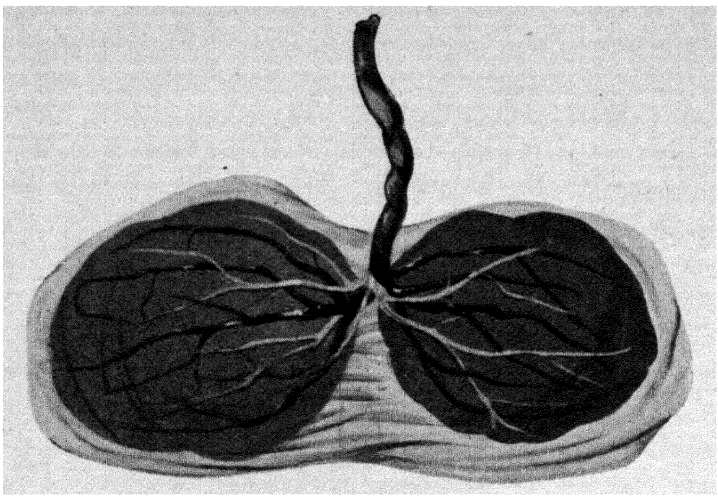


FIG. 20.—BIPARTITE PLACENTA.

protoplasm running together to form a hyaline or fibrinous layer devoid of structure. It is along this softened degenerate layer that separation takes place normally.

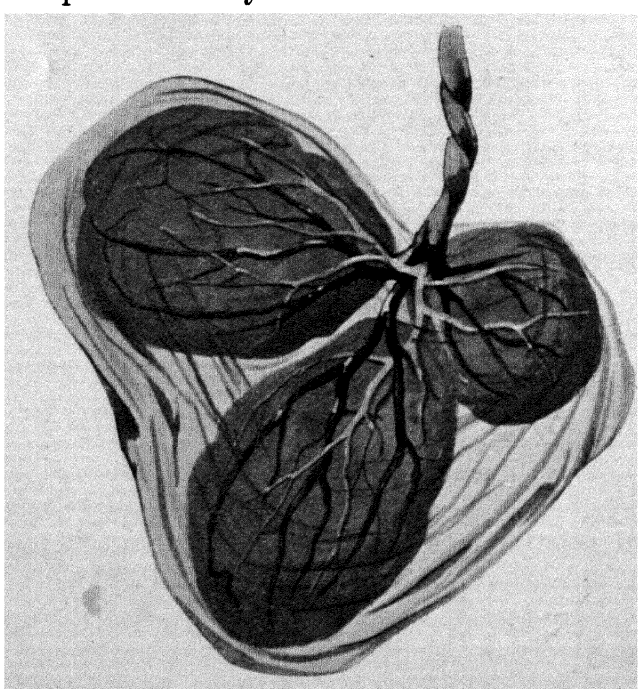


FIG. 21.—TRIPARTITE PLACENTA.

Together with this change a certain amount of thrombosis is said to occur in the blood-channels which supply the maternal

blood-space, thus restricting to some extent the circulation of maternal blood around the villi.

Varieties of the Placenta.—Instead of the usual circular discoidal form of the placenta with a central insertion of the umbilical cord, variations may occur both in the shape of the placenta and in the insertion of the cord.

The cord may be eccentrically placed, or may be attached to the margin of the placenta. In the latter case the term *battledore placenta* is used (Fig. 19).

In another variety the cord is attached to the membranes at some distance from the placenta, the vessels radiating from this attachment to enter the placenta at its margin; this is called *placenta velamentosa.* This form may be a source of danger to the infant, as the vessels may pass across that part of the chorion which presents at the os uteri, and may be torn when the membranes rupture. In such a case the infant would probably bleed to death unless very quickly delivered.

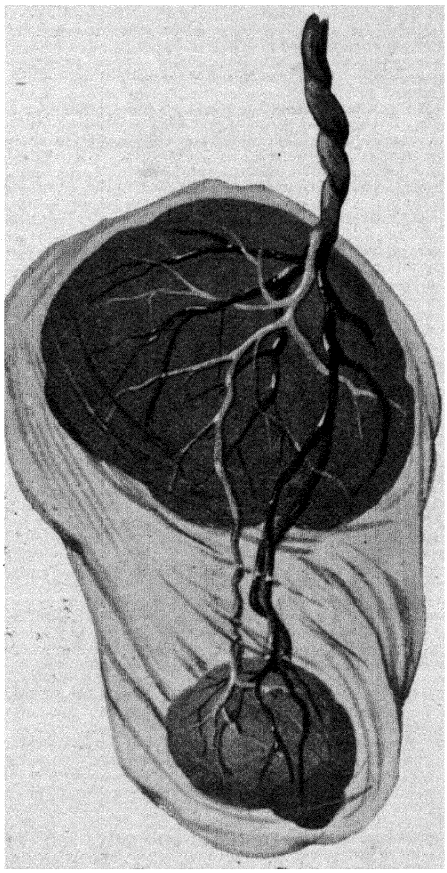


FIG. 22. — PLACENTA SUCCENTURIATA, SHOWING VESSELS RUNNING IN THE CHORION FROM THE MARGIN OF THE MAIN PLACENTA TO THE ACCESSORY PORTION.

The placenta may be lobed instead of a single disc; thus it may be bipartite (Fig. 20) or tripartite (Fig. 21). Sometimes there is a small supplementary lobe developed at some distance from the main placenta, or more than one of these supplementary lobes may be found. This is known as a *placenta succenturiata* (Fig. 22), and in such cases the blood-vessels of the supplementary lobe run in the chorion from the margin of the main placenta. These succenturiate placentæ are of clinical importance, because they may be torn away from the membranes during expulsion and thus be left behind either attached or loose in the uterus. Such an occurrence may be

recognized by noting a gap in the chorion covered by intact amnion, with the vessels running in the chorion from the placenta towards the gap. The amnion remains intact because being tough it separates from the surface of the supplementary placenta.

THE AMNION

The first appearance of the amnion is a hollow space in the enclosed ectoderm and ventral stalk. It is lined by, more or less, cubical cells, which, however, quickly become more columnar at the part away from the ventral stalk which eventually forms the embryonic plate and the embryo. At first more or less spherical, the amniotic cavity soon becomes flattened down upon the embryo and closely applied to it. As the head and tail appear and the body

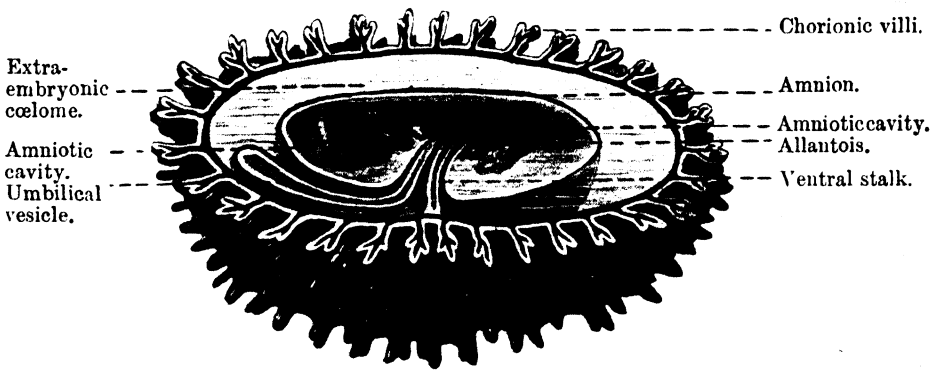


FIG. 23.—DIAGRAMMATIC SECTION THROUGH AN EARLY EMBRYO AND ITS COVERINGS.

walls fold round to enclose the embryonic cœlome, the amnion attached at their margins is carried round also, so that the embryo is, as it were, pushed up and projects into the amniotic cavity. When the body cavity of the embryo is quite closed up, the amnion is attached all round the place at which the ventral stalk emerges, as shown in Fig. 23.

At this period the embryo is relatively very small, and has the amnion closely applied to it, while the cavity of the blastocyst is relatively very large. Now a great change begins to occur. The amniotic cavity enlarges out of proportion to the embryo, and becomes distended with fluid. This enlargement gradually encroaches on and obliterates the cavity of the blastocyst (extra-embryonic cœlome), and the embryo is gradually carried more and more into the amniotic cavity by elongation of the ventral stalk. The enlargement of the amniotic cavity, as it were, rolls the amnion

outwards along the elongating ventral stalk, and forms a close investment to it, and the ventral stalk becomes the *umbilical cord.*

The remnant of the yolk-sac, which has in the meantime gradually shrunk from absorption of its always scanty contents, lies between the amniotic balloon and the umbilical cord. With the gradual and complete obliteration of the cavity of the blastocyst, the amnion comes into contact and joins loosely with the chorion, mesoderm to mesoderm.

The enlargement of the amniotic cavity is due to a secretion of fluid from its ectodermal lining, at first a specific secretion, but later, as the fœtal kidneys begin to function, it is added to by them. The enlargement of the amniotic cavity which brings about the complete investment of the umbilical cord, likewise brings the amnion into close contact with the fœtal surface of the placenta. This surface is therefore completely covered by the amnion. The amnion and placenta unite in a loose manner, and can be separated up to the insertion of the cord in a full-time placenta.

The amnion is lined by a single layer of rather short, thick epithelial cells of the low columnar type. They do not form a very regular row of cells, but here and there one will project a little beyond its fellows. The nuclei of these cells are situated nearer the outer than the inner, attached border. The epithelium is attached to a layer of loose connective tissue which is the descendant of the original mesoderm. This connective tissue being upon the outer side of the amniotic membrane is closely applied to the similar connective tissue upon the inner side of the chorion læve. The two just stick together, but are not organically united. They can easily be separated from one another at all periods of pregnancy.

That portion of the amnion which covers the umbilical cord is very closely incorporated with the connective tissue of the cord and cannot be stripped off.

The Amniotic Fluid.—The amniotic fluid is usually slightly turbid from the admixture of solid particles derived from the fœtal skin and the amniotic epithelium. It may also be stained a greenish colour if any meconium has been passed into it (which does not necessarily imply that the fœtus is dead).

The composition of the fluid at full time is fairly constant. It has a specific gravity of about 1010, sometimes sinking as low as 1004, while in the earlier months it may rise as high as 1025. It contains inorganic salts, chiefly alkaline chlorides, phosphates, sulphates, and albumin.

Urea is present from the 5th week onwards in increasing amounts up to full time. The solid matter present in the fluid is composed of lanugo (hair from the skin of the fœtus), epidermal cells, cast-off amniotic epithelium and vernix caseosa.

The amount of amniotic fluid at full time is variable, anything between ten and forty ounces being considered normal. The relative amount of the fluid to the size of the fœtus is much greater in the early months of pregnancy, when the fœtus floats freely in it. The maximum amount of fluid is reached about the 28th to the 32nd week, after which time some of the fluid is said to be absorbed. This, of course, is practically incapable of proof, and may be a fallacy, because as the fœtus grows in size, the liquor amnii may remain stationary in amount, and become less obtrusive since it is more spread out between the fœtus and the amnion.

The source of the liquor amnii is still open to debate, but certain facts are known about it, which point to the maternal as well as the fœtal blood contributing to it. There are no blood-vessels in the amnion itself, apart from those which directly underlie it where it covers the placenta. Nevertheless it seems certain that the connective tissue of the amnion is bathed in fluids, and it seems probable that the amniotic epithelium will act as a secreting surface. It is also equally certain that substances from the maternal blood can find their way into the amniotic cavity, because soluble colouring matter (sodium sulphindigotate) injected into the maternal circulation passes into the liquor amnii without appearing at all in the urine of the fœtus.

Also it is well known that disease of the maternal kidneys accompanied by dropsy may produce hydramnios (excessive amount of liquor amnii), and further that dropsy of the fœtus may also result. This is not necessarily a mechanical condition due to blood-stasis or venous congestion, but is much more likely to be the result of damage to the vessel walls (maternal and fœtal) owing to the circulation of some toxic substance. In some cases of early death of the fœtus, the amniotic sac may contain an amount of liquor amnii out of all proportion to the normal quantity, the fœtus having disappeared by maceration and disintegration. In such a case the fluid could only be a transudation from the maternal vessels.

The gradual increase in the amount of urea present up to its maximum at full time has been taken as an indication that the fœtus urinates *in utero*. The almost complete absence of colouring matter derived from the fœtal urine in the liquor amnii is not surprising if the paleness of the urine passed by the infant shortly

after birth is noted. Further, the salts found in the amniotic fluid are very similar to those commonly present in fœtal urine.

The Uses of the Liquor Amnii.—In the first place the liquor amnii provides a protective medium for the fœtus, guarding it against shocks and jars, preserving it from the pressure exerted by uterine contractions, and allowing it, at least in the early months, plenty of room for free movement. It is also a source of fluid for the fœtal tissues, because there can be no doubt that some of it is swallowed. This is proved by the presence of lanugo and epidermal scales in the meconium of the fœtus. It can hardly be regarded as a store of nutriment for the fœtus in any other sense than that of water, as the amount of albumin and salts in it is so small. During labour the liquor amnii helps to form a fluid wedge which, under the influence of the uterine contractions gradually forces open the internal os uteri and canal of the cervix. When the membranes rupture at the end of the first stage of labour it flushes the birth canal from above downwards with a fluid which is at least aseptic.

THE UMBILICAL CORD

The umbilical cord or funis forms the connection between the fœtus and the placenta. As has been shown, it is derived from the ventral stalk and receives a close covering of epidermis. The cord is commonly about 20 inches in length, but it varies greatly, and may be as long as 5 or 6 feet, or as short as 3 inches. It is usually as thick as the little finger, but is not uniform; as a rule it presents nodes and swellings which sometimes are caused by dilatation of the umbilical vein, but more often by simple local increase in Wharton's jelly. At the earliest stage the cord is straight and somewhat flattened, but later (as early as the third month) it shows a spiral twist. This is not always real, but may be an optical illusion produced by the twisting of the contained blood-vessels. The causation of this twisting is unexplained. In addition to the nodes above mentioned, sometimes called false "knots," the cord not uncommonly contains one or more true knots, due to the fœtus passing through a loop in the cord. When a true knot has existed a long time, Wharton's jelly becomes atrophied from pressure at the knot. If such a true knot becomes drawn very tight the child may perish from obstruction to its circulation. The cord is often coiled round the child's body or neck, but seldom gives rise to any serious trouble thereby.

The constituents of the umbilical cord are as follows:—

1. The covering epithelium, which is now believed to be derived from the fœtal epidermis and not from the amnion. It consists of stratified epithelium instead of a single layer as in the amnion.

2. Wharton's jelly, which is a myxomatous connective tissue, composed of cells with elongated anastomosing processes in a gelatinous fluid. It is a special form of embryonic connective tissue.

3. Blood-vessels. These are at first four in number, two arteries and two veins. The two umbilical veins fuse after the third month to form a single vessel. The two umbilical (hypogastric) arteries are derived from the iliac arteries of the fœtus, and carry the blood from the fœtus to the placenta. The umbilical vein carries the blood from the placenta to the fœtus.

4. The umbilical vesicle and its vitelline duct, the shrivelled remnant of the yolk-sac, may be found as a very small yellow body near the attachment of the cord to the placenta.

5. The allantois, which sometimes occurs as a blind-ending tube just reaching into the cord. It does not, however, always reach the cord. It is continuous inside the fœtus with the urachus and bladder.

The Attachment of the Cord.—The attachment to the placenta is generally central or nearly so, the main blood-vessels spreading out from the cord under the amnion to enter the chorionic villi. The cord is, however, sometimes inserted at the edge of the placenta, in which case a "battledore" placenta is spoken of (see Fig. 19). In rare cases the cord is attached to the amnion at some distance from the placenta, the blood-vessels spreading out from this insertion in the membranes to reach the placenta. This is known as a "velamentous" insertion, or placenta velamentosa.

CHAPTER III

GROWTH AND GENERAL DEVELOPMENT OF THE FŒTUS

It is important to remember, in describing the length of a fœtus that the measurements in the earlier weeks are commonly taken from the vertex to the coccyx, while from the end of the fifth month onwards the length of the legs is taken into account. At this period the measurement is taken from the vertex to the heels. A further difficulty arises in connection with very early embryos up to about the 6th week, because of the forward bending of the head. The

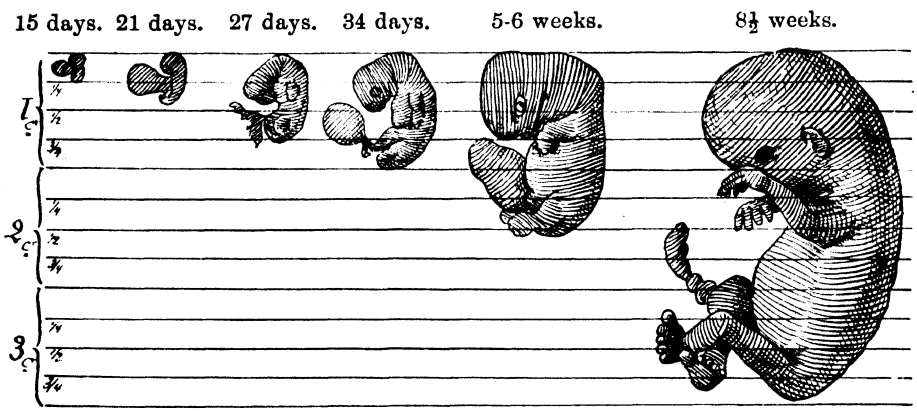


Fig. 24.—To show the Relative Sizes of Early Embryos.

Each is drawn 1½ times its natural size. The largest embryo actually measures 30 mm., the others are drawn in their proper proportions.

greatest length of the embryo at this stage is taken from the back of the neck to the breech. Measured by these methods the length of the embryo at the end of 4 weeks is less than a centimetre, 7·5 mm. according to His' embryo of 27 to 30 days. At the end of 8 weeks the vertex to breech measurement is 4 centimetres or $1\frac{3}{5}$ inches (Fig. 24).

At 12 weeks this measurement is 7 centimetres or $2\frac{4}{5}$ inches.

At 16 weeks the length is 12·5 centimetres or 5 inches.

At 20 weeks the total length from vertex to heel is 25 centimetres or 10 inches.

At 24 weeks it is 30 centimetres or 12 inches.

At 28 weeks it is 35 centimetres or 14 inches.

At 32 weeks it is 40 centimetres or 16 inches.

At 36 weeks it is 45 centimetres or 18 inches.

At 40 weeks it is 50 centimetres or 20 inches.

Thus it will be seen that the greatest period of relative increase of growth is from the 8th to the 20th week, allowing for the discrepancy created by measuring the vertex to heels length at the 20th week instead of the vertex to breech length. After the 20th week the fœtus increases roughly 5 centimetres or 2 inches per four weeks. A ready method of reckoning the length of the fœtus at the various periods of four weeks is that of Haase, and is thus carried out: Up to the end of the 5th lunar month square the number of the month, thus at 16 weeks, *i.e.* the 4th lunar month, the length should be 4 × 4 centimetres = 16. This is rather too great for the vertex-breech length, but is about right for the vertex-heels measurement. After the 5th lunar month the number of the month is to be multiplied by 5. Thus at the 7th lunar month or 28 weeks the fœtus should measure 35 centimetres, vertex to heels.

It is important to note other characters of the fertilized ovum from month to month, as they are of value in determining the stage of development. At 4 *weeks* the chorionic sac is very large, the amnion closely invests the embryo, and there is a large cavity between the amnion and chorion, the extra-embryonic cœlome. The 7·5 mm. embryo is markedly bent on itself, the head and well-marked tail almost touching one another. The yolk-sac is still present very close to the ventral stalk. The olfactory pits, the optic vesicles, and the auditory vesicles are all formed, and four branchial clefts can be seen with the mandibular, hyoid, and three branchial bars bounding them. The full number, 35, of mesodermic somites show very clearly as oblong or square masses from the back of the neck to the tail on either side. The heart and liver next to the head form the greatest bulk of the embryo, the Woolffian ridges are developing, and the limbs are only present as small projecting buds.

At 8 *weeks* the embryo has taken on distinctly human characteristics, the embryo up to 4 weeks having the same characters as any other mammalian embryo at the same stage. The 4-centimetre embryo now lies in a much-enlarged amniotic cavity, the amnion being in contact with the chorion, and the extra-embryonic cœlome is obliterated. The ventral stalk and yolk-sac stalk have united

to form the umbilical cord invested by the amnion, and the primitive small intestine is contained in the dilated proximal extremity of the cord. The chief human characteristics lie in the completion of the facial form, by the union of the parts around the olfactory pits to form the nose and separate it from the mouth. These are complete by the end of the 8th week. At this time also the ear is completely formed externally, and the eyelids have appeared around the eyeball. The visceral clefts are now closed. The limbs are enlarging, and show their jointed appearance, and the fingers and toes are formed. The fore limb always precedes the hind limb in the extent of its development. The tail has practically disappeared. The flexion of the trunk is considerably diminished and the head is lifted up, so that the vertex now forms the upper end of the embryo rather than the back of the neck.

At 12 *weeks* the decidua capsularis has fused with the decidua vera and the placenta has taken on its complete discoid form. The amnion entirely fills the chorionic sac; the umbilical cord, still short and thick, shows a spiral twist. The proximal portion of the umbilical cord has contracted, and the primitive small intestine is completely withdrawn into the body cavity. Nails have appeared on the fingers and toes, and the two sexes are differentiated as far as the external organs are concerned. The length of the embryo is 7 centimetres, and its weight is about 4 ounces.

At the 16*th week* the 12·5-centimetre embryo weighs about 7 to 8 ounces. Short hairs, known as lanugo, are beginning to appear on the body and head. They are devoid of colour. The skin is of a reddish-pink colour, and the development of the muscle gives a plumper appearance to the fœtus. The anal canal is pervious.

At the 20*th week* the 25-centimetre fœtus weighs about a pound. The hair becomes longer; the intestine contains slightly bile-stained fluid, the commencement of the meconium. The vernix caseosa begins to form. This is a greasy substance composed of the secretion of sebaceous glands, mixed with dead epidermal cells. Its function is to prevent the skin of the fœtus macerating in the liquor amnii. The legs are now growing longer than the arms. The attachment of the umbilical cord is moving farther away from the pubes and is attached nearer the centre of the abdomen.

At the 24*th week* the 30-centimetre fœtus weighs nearly 2 pounds. The vernix caseosa is definitely established and is beginning to form a coating in certain parts. The skin is wrinkled, eyebrows and eyelashes appear, and the hair on the scalp begins to form pigment and darken in colour.

At the 28*th week* the 35-centimetre fœtus weighs about 3 pounds. The subcutaneous fat is becoming more developed, so that the skin wrinkles begin to disappear. The testicles appear in the inguinal canals. The eyelids open. At this period the fœtus is said to be viable, but the number of infants which survive such premature birth is small.

At the 32*nd week* the 40-centimetre fœtus weighs over 4 pounds. It is completely covered with vernix caseosa, particularly thick on the scalp, in the axillæ and groins. The nails almost reach the finger-tips. The scalp hair increases in length and the lanugo begins to disappear. The red colour of the skin changes to that of flesh colour. The chances of survival of an infant born at this period are fair only if ideal conditions are present.

At the 36*th week* the 45-centimetre fœtus weighs over 5 pounds. The skin and hair changes are proceeding as at the 32nd week. Just before the 36th week one testicle has usually descended into the scrotum. The nails reach the ends of the fingers but not of the toes. Most infants born at this period survive.

At the 40*th week* the fœtus measures on an average 50 centimetres, (20 inches), and weighs from 6 to 8 pounds. The signs that the fœtus has reached full time are not always clear, but the measurement and weight must be regarded as very important. In addition the nails usually project beyond the finger-ends, and have reached the ends of the toes. The skin is not so red as in a premature infant. The lanugo has almost disappeared except over the shoulders. The whole of the intestine contains meconium. The umbilicus is practically at the centre of the body. Both testicles have descended into the scrotum. As a rule only one epiphysis has commenced to ossify, that in the lower end of the femur. This, however, appears just before full time, and at term the centre of ossification of the upper epiphysis of the tibia and humerus may have appeared.

The weight of the full-time child, usually from 6 to 8 pounds, not infrequently exceeds or does not reach this amount. Children weighing 10 pounds are not uncommon, but heavier children than this are decidedly rare. If a really full-time child weighs under 5 pounds it is probably very badly nourished and feeble, and on this account has a poor chance of survival. It is, of course, different with twins, when both may weigh under 5 pounds and yet, being full-time and well nourished, are likely to survive. The heaviest children are born when the mother's age is between 25 and 35 years. The weight of the child increases in successive pregnancies, provided the mother's age is below 35. Very young mothers

commonly have small babies. Males are heavier than females on an average.

The Fœtal Circulation.—The umbilical vein carries pure blood from the placenta to the fœtus. It enters the body at the umbilicus and divides into two branches, one of which joins with the portal vein to supply the liver; the other, which is named the *ductus venosus*, passes straight into the inferior vena cava. The inferior vena cava receives as well the blood from the liver, and also that from the lower limbs and body-wall below the diaphragm. As the limbs and body-wall require but little blood, the amount from them, although venous, is not large enough to vitiate the pure blood in the ductus venosus to any great extent.

Thus the purest blood, *i.e.* most highly oxygenated, enters the right auricle by the inferior vena cava. This blood-stream is directed by the Eustachian valve through the foramen ovale into the left auricle.

From the left auricle the blood passes by the mitral valve into the left ventricle, and then passes up the aorta to be distributed chiefly to the head, neck, and spinal cord, which require the largest amount of pure blood, owing to the early and great development of the brain and spinal cord.

From these situations the venous blood is returned by means of the superior vena cava to the right auricle. Here it might be expected that this stream would mix with the pure blood entering by the inferior cava. This does not happen, however, for once more the Eustachian valve comes into play, and directs the venous stream through the tricuspid valve into the right ventricle, from which it passes into the pulmonary artery, and by a wide channel, the ductus arteriosus, direct from the pulmonary artery into the arch of the aorta beyond the point at which the vessels to the head, neck, and upper extremities are given off. Passing down the thoracic and abdominal aorta vessels are supplied to the body-wall, intestines, stomach, liver, and also to the lower limbs, but the bulk of the venous blood is returned by the umbilical (hypogastric) arteries, branches of the iliac arteries, along the umbilical cord direct to the placenta, and the round is completed (Fig. 25).

Thus it appears that although oxygenated blood is delivered to the fœtus by the umbilical vein, it always gets mixed with small quantities of venous blood before being distributed to the head. The admixture, however, is not sufficient to make the blood essentially venous; it remains sufficiently oxygenated for purposes of nutrition. In the same way the blood supplied to the lower

extremities is in reality venous, but it serves for purposes of nutrition and growth.

Changes in the Fœtal Circulation at Birth.—The first important change is brought about by the respiratory efforts of the child

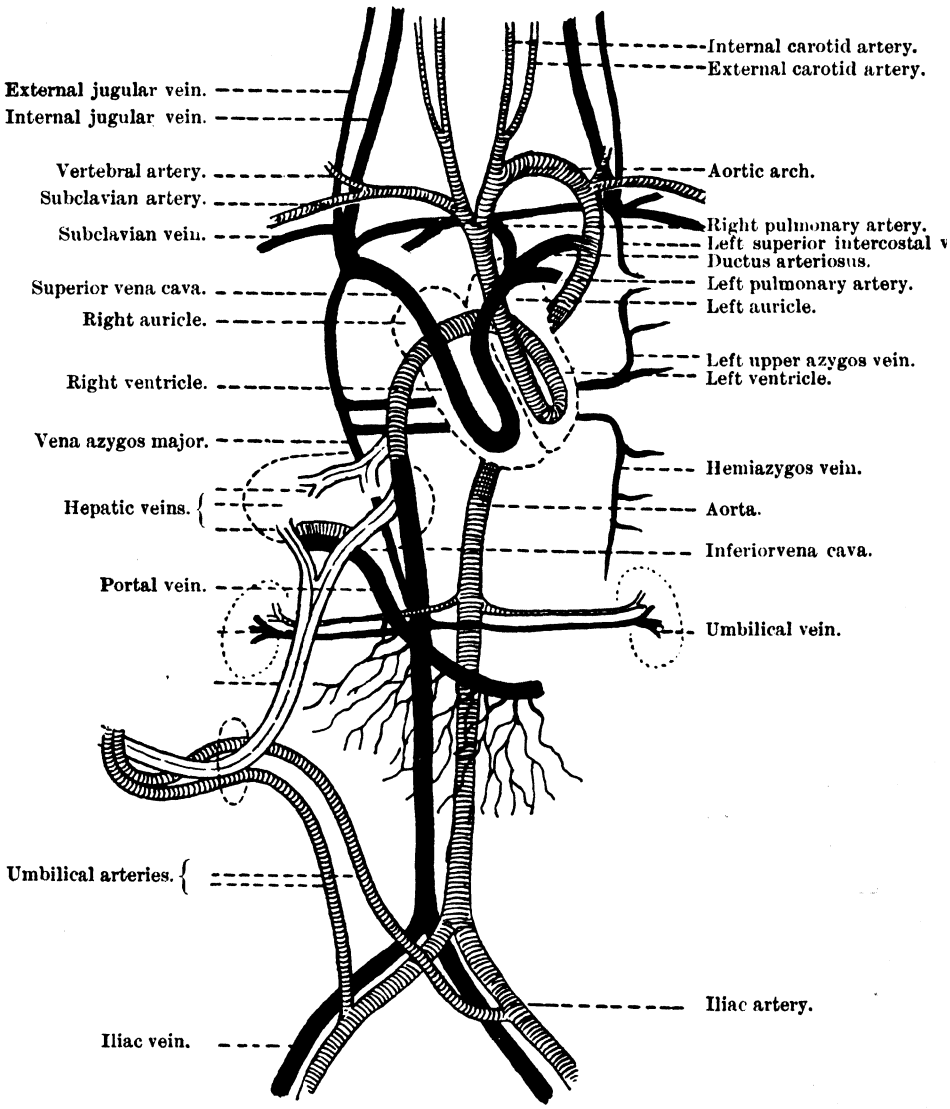


FIG. 25.—THE FŒTAL CIRCULATION.

directly after birth. The inflation of the lungs immediately determines the necessity for a large supply of blood to them through the pulmonary arteries. This diverts the blood current from the ductus arteriosus, which rapidly thickens, loses its lumen and becomes a fibrous cord.

The blood returning from the lungs is now oxygenated instead of venous, and entering the left auricle passes into the left ventricle, and is then distributed all over the body by the aorta and its branches. The sudden cessation of the placental circulation deprives the umbilical vein and ductus venosus of their blood current, and consequently they collapse, empty, and gradually atrophy, becoming converted into fibrous cords. The umbilical (hypogastric) arteries rapidly cease to carry any blood, being cut off from the placenta at the umbilicus; they also close, becoming fibrous cords which can be still recognized in the adult as the obliterated hypogastric arteries.

The alteration in the course of the blood stream through the heart, from auricle to ventricle on each side, instead of from the right auricle to the left auricle *viâ* the foramen ovale, throws the latter aperture out of function as no blood passes through it. It therefore gradually closes, the crescentic margin of the valve of the fossa ovalis joining up with the margin of the Limbus of Vieussens. This closure is not effected at once; several months may elapse before it is complete. Sometimes it never completely closes, in which case a form of congenital heart disease arises which is known as *morbus cœruleus*, because the patient has a blue or cyanosed appearance. The hypogastric arteries usually completely close by the fourth day, and the ductus arteriosus by the seventh or eighth.

Diagnosis of the Death of the Fœtus.—Death of the fœtus *in utero* is not a very common occurrence, apart from death during labour, but when it occurs it gives rise to difficulties in diagnosis.

The patient, as a rule is the first to call attention to its possibility, either because no fœtal movements have been felt, or because they have ceased after having been felt. It does not follow because no fœtal movements have been felt that the infant is dead, but failure to feel them after they have been definitely perceived is strong presumptive evidence.

A fœtus which has died is often retained for a considerable time *in utero*, but it is commonly believed that the next monthly cycle (when a menstrual period would have occurred) usually determines the onset of uterine contractions, and the expulsion of the fœtus in a more or less macerated condition.

In exceptional cases the fœtal heart may have been heard, and then when the mother fails to perceive fœtal movements, the fœtal heart may be no longer discoverable. This is very strong presumptive evidence of fœtal death. As a rule auscultation is employed

for the first time when the fœtus is supposed to be dead. Failure to hear the fœtal heart or to feel fœtal movements on repeated examinations, is strong presumptive evidence of fœtal death.

The breasts usually show retrogressive changes when the fœtus is dead, becoming soft and flabby and ceasing to enlarge. Sometimes the mother will notice tumultuous movements of the fœtus, amounting almost to pain on her part, after which she says all movements have ceased. Too much reliance cannot be placed upon the mother's statements, but taken in conjunction with the absence of fœtal movements and heart sounds and retrogressive breast changes, the death of the fœtus becomes almost a certainty.

It is much more difficult to be sure of the death of the embryo before the 16th week when no movements have been felt. The question usually arises in connection with threatened abortion when uterine hæmorrhage and pain have occurred. The embryo is not necessarily dead because hæmorrhage has occurred, even if continued for long periods. If the vaginal discharge is brown and offensive the embryo is more likely to be dead than when the discharge is bright red and sweet.

Unless abortion is deemed to be inevitable on other grounds, and as long as the hæmorrhage is not so severe as to make interference imperative, the uterus may be left alone. Time will then show whether there is continued enlargement of the uterus (a sure sign that the embryo is living, except in the case of a hydatidiform mole) and continued development of the breasts.

If, however, the uterus ceases to enlarge and alters in consistence, often becoming much harder (as when it contains a carneous mole), and also when the breasts cease to enlarge and perhaps morning sickness ceases, it is quite safe to judge that the embryo is dead and that interference is justifiable.

In any doubtful case, as long as the mother's life is not in any danger, as from hæmorrhage, the safest course is to wait and note whether the progressive signs of pregnancy are present.

CHAPTER IV

THE PHYSIOLOGICAL CHANGES INDUCED BY PREGNANCY

Uterus.—The increasing size of the embryo and its placenta induces changes in the uterus, to adapt it as a containing organ and to enable it to expel the fœtus when labour begins. These changes include increase in size, development of the decidua, hypertrophy of the muscle coats, softening and coloration of the cervix, and physiological relaxation of the lower uterine segment.

Increase in Size of the Uterus.—The increase in size of the uterus is brought about chiefly by the hypertrophy of its muscle coats and increased vascular turgescence. At first the increase in size is largely limited to the fundus and upper part of the body, and consequently the body has a shape much more globular than the pyriform which it assumes later. At the end of the third month, the body of the uterus is roughly spherical, with the lower segment and cervix forming a continuous canal containing no part of the embryo. Later the lower segment also becomes dilated and the ovum descends into it, so that the uterus gradually acquires a shape more and more pyriform with its broad end upwards.

The height of the uterus at different periods of pregnancy is roughly shown in Fig. 26, which can, however, only be accepted as illustrating a uterus and enclosed fœtus of average development.

In the last three weeks the fundus sinks somewhat when the patient is in the erect position, so that it is at about the same level at 40 weeks as it was at 36 weeks.

Naturally these landmarks are rather arbitrary and are often difficult to estimate with certainty. The amount of fat in the abdominal wall makes them somewhat variable. It is found in practice to be better to speak of the number of *weeks'* development rather than the number of *months,* thus avoiding the confusion which is likely to occur when it is not known whether calendar or lunar months are spoken of. It has been shown recently by Ellice Macdonald that the average upward growth of the uterus

after the 5th month is at the rate of 3·5 centimetres every four weeks, and from this a method of estimating the duration of pregnancy has been deduced. If the height of the fundus uteri is measured (with callipers) in centimetres from the top of the symphysis pubis, the figure obtained divided by 3·5 will give the number of lunar months during which pregnancy has progressed. The figures so obtained have not proved to be universally satisfactory, probably owing to the varying size of the fœtus, the amount

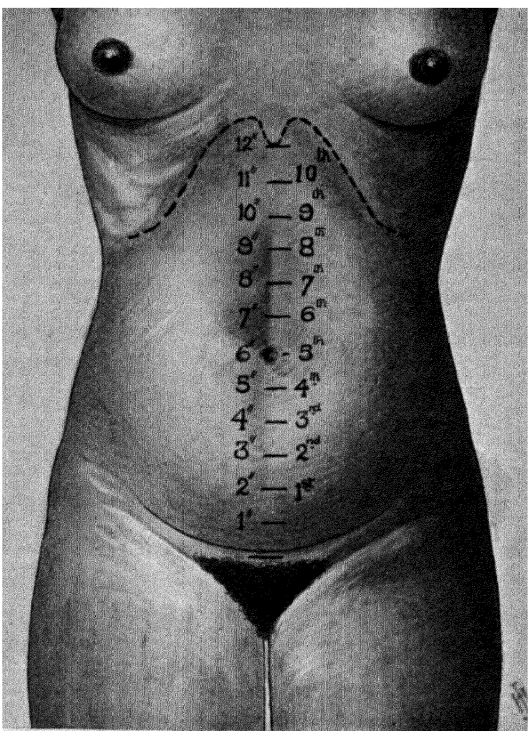


FIG. 26.—DIAGRAM SHOWING THE HEIGHT OF THE UTERUS AT THE VARIOUS PERIODS OF PREGNANCY, THE PATIENT LYING ON HER BACK.

of the liquor amnii, and the condition of the abdominal muscles. It is, however, a useful guide when there are no data to go upon, such as the exact date of the last menstrual period.

The height of the fundus uteri is more definite and regular in a primigravida, in whom the abdominal muscles are unaltered by previous abdominal distension. In a parous woman there may be a marked pendulous condition of the abdomen from relaxed abdominal muscles, and consequently the fœtal head and lower uterine segment will not sink so low into the pelvis as in a primigravida.

At full time the pregnant uterus measures 12 to 14 inches in *length* and about 9 inches in *diameter.*

Its *weight* is variable, but from twenty-three to twenty-eight ounces are within normal limits. The non-pregnant uterus weighs about an ounce.

The position of the pregnant uterus is rarely quite central. It usually presents some degree of lateral obliquity, so that the fundus inclines towards one side, usually to the right. At the same time there is some rotation on its long axis, the anterior wall facing a little to the right, while the left cornu approaches nearer the abdominal wall than the right cornu. It is said that this position of the uterus is due to the presence of the pelvic colon to the left and behind.

Development of the Decidua.—All the coats of the uterus become altered during pregnancy, beginning first with the decidual transformation of the endometrium and ending with the peritoneum. It has already been shown that the endometrium in the immediate neighbourhood of the ovum first shows the decidual change, later the whole lining becomes transformed. The decidua shows compact and spongy layers, the latter being due to the dilated deeper parts of the uterine glands. The decidual cells are most perfectly formed in the compact layer, but show quite well in the deepest portion around the dilated glands. At about 12 weeks the decidua vera is at its thickest, and may be one-third of an inch in thickness. After this the decidua is gradually thinned as the fœtus enlarges the vera and capsularis stick together, and at full time the whole decidua forms a very thin layer which adheres to the chorion. The decidua separates from the uterine wall through the spongy portion. Regeneration of the endometrium takes place from the latter.

Hypertrophy of the Uterine Muscle.—The muscle coats increase in thickness to keep pace with the growth of the fœtus, but at the same time the total thickness of the uterine wall at term is not as great as in the non-pregnant organ. As a rule, the average thickness of the uterine wall at term is under half an inch, but it may be considerably less than this in the lower uterine segment. There must therefore be a small degree of stretching of the uterine wall as well as increased growth.

The growth of the uterine wall is almost entirely confined to the muscle cells. These cells increase in size to a very marked degree, but authorities differ as to the exact amount. In general the muscle cells increase about ten times in length and three to five

times in breadth. It is said also that new muscle cells are developed, and that the intermuscular connective tissue increases.

The muscle coats can be artificially divided into three layers, an outer which is chiefly longitudinal in direction, a middle coat which consists of interlacing bundles encircling the blood-vessels, and an internal coat which is arranged in a circular manner especially around the tubal orifices and the internal os.

Morphologically, according to Blair Bell, there are only two layers, an outer longitudinal, derived from the peritoneal muscles, and an inner circular. The interlacing bundles in this description would belong to the outer coat.

The *peritoneal coat* is stretched and may show scars like the striæ gravidarum of the skin. It also grows to some extent to keep pace with the enlargement of the uterus. It preserves its usual relations to the body of the uterus antero-posteriorly, the portion below the level of the internal os being loosely attached and easily separated. At the sides, however, the gradual distension of the lower uterine segment separates the layers of the lowest part of the broad ligaments, the mesometrium, so that its level is raised and a larger area of the uterus is uncovered by peritoneum than in the unimpregnated condition.

Blood-vessels.—The uterine arteries are enlarged as pregnancy advances, and become straightened in their course up the side of the uterus. They still, however, preserve their corkscrew-like character in their passage through the uterine wall. Their walls become thickened and rather nodular, a condition which persists to some extent after delivery.

The veins become enlarged, especially in the region of the placental site, and are closely attached to the muscle and connective tissue of the uterine wall. The veins are described as running a course parallel to the peritoneal surface and then dipping at abrupt angles through the muscle; they have no valves, and this acute bending assists the contractions of the uterine muscle to close the veins after delivery, and so prevent hæmorrhage from them.

Lymphatics.—The part played by the lymph channels in promoting involution of the uterus after delivery is considerable, and they may have increased work to do during pregnancy. They are known to enlarge and increase in complexity.

Nerves.—The nerves also grow in size and keep pace with the increase of muscle tissue. The cervical ganglion, which plays an

important part in labour, is said to increase to twice its normal size. There appears to be increased excitability of the nervous tissue in the uterus, which allows of muscular contractions being easily provoked.

Softening and Coloration of the Cervix.—Although the cervix uteri hypertrophies to some extent during pregnancy, it does not do so to anything like the same extent as the body of the uterus. This would naturally be the case because the cervix plays a passive *rôle* in the progress of labour, and its normal musculature is amply sufficient as a rule to prevent premature dilatation. Two changes, however, stand out as very important features of the pregnant uterus, namely, physiological softening of the cervix and the violet colour which the cervix assumes very early.

Softening of the cervix begins in the early weeks and varies considerably as to the time at which it can be definitely recognized. As a rule, at the end of twelve weeks it is quite well marked. The cause of this softening is not quite clear, but there can be no doubt that increased vascularity plays a considerable part, and possibly lymphatic dilatation plays another, by making the general structure more loose and spongy.

The softening begins in the lower uterine segment above the os internum, and gradually spreads down to the vaginal portion. The very marked softening of the lower uterine segment felt between the 6th and 8th week constitutes an important part of Hegar's sign of pregnancy (*q.v.*). The actual degree of softness of the vaginal portion of the cervix in the later weeks of pregnancy, as compared with the cervix of the non-pregnant uterus, is illustrated by the difference in consistence between the lip and the nose in most instances, though sometimes the cervix feels even softer than the average lip.

The violet coloration of the cervix is produced as a result of venous congestion, and precedes in point of time the coloration of the vagina to be noted later.

The natural effect of this increased vascularity is to produce more secretion from the cervical glands, so that there is always a plug of mucus in the cervical canal, and in addition an increase of the normal vaginal discharge, whereby the vulva is practically always moist in the pregnant condition.

Physiological Relaxation of the Lower Uterine Segment.—Considerable controversy has taken place concerning that part of the uterine body, known as the lower uterine segment, which has to be stretched and dilated to allow of the passage of the child.

If the lower part of the cavity of the uterus at the end of pregnancy is examined in a normal case with a vertex presentation, it will be seen to have roughly the shape of a half-sphere with the internal os at the lower pole. This part of the uterus has to be converted from a half-sphere into a cylinder during labour to allow the fœtus to pass. Thus it is clear that the greater part of the lower segment must of necessity play a passive *rôle* during labour, opposing as little resistance to dilatation as possible. It is found that the lower segment does not hypertrophy to any great extent, and its muscle coats remain thinner than the rest of the body of the uterus.

The actual amount of uterine wall which is dilated in the above-mentioned manner must vary in almost every case, according to the size of the child's head, so that the extent of the lower uterine segment as a passive part of the uterus cannot be a fixed quantity.

It is commonly agreed that the lower segment is represented by that part of the full-time pregnant uterus within a radius of three inches from the internal os; it roughly corresponds with that part of the uterus which lies below the level of firm attachment of the peritoneum in front.

The lower uterine segment is of clinical importance in connection with placenta prævia, rupture of the uterus, and the formation of a contraction ring in cases in which there is no obstruction, or of a retraction ring in obstructed labour. The actual site of the ring in either case has caused much discussion, but in the case of the "retraction ring" it has commonly been stated to occur at the junction of the upper and lower uterine segments.

There is no doubt that rupture of the uterus commonly takes place through the thinned-out lower uterine segment, and that the implantation of the placenta upon it is fraught with the certainty of antepartum hæmorrhage.

The cervix and its canal still exist at the end of pregnancy before labour begins. That, however, there is some opening up of the internal os before labour begins is abundantly clear, both from its appearance in frozen sections of women dying before labour, and from the clinical evidence in cases of placenta prævia.

In some frozen sections the upper part of the cervical canal is rather funnel-shaped, the uppermost part of the canal being just opened up. In placenta prævia bleeding sometimes occurs as early as the 26th week. This can only result from the separation of the placenta around the internal os, and is commonly explained by the opening up of the internal os, due to the painless contractions of pregnancy. Clinically the supravaginal cervix often is

wider to the touch at the end of pregnancy, and this is taken to represent some opening up of the internal os.

Apart from its clinical importance in placenta prævia, the opening up of the internal os is of little importance before labour, the fact remaining that the greater part of the cervical canal remains unaltered.

Vagina.—The increased vascularity already described in the cervix affects the vaginal walls a little later, so that they show the violet coloration right down to the vulva. This coloration, due to venous congestion, is an important sign of pregnancy, but it is occasionally seen in connection with pelvic tumours when there is compression of the veins leading from the lower part of the vagina. It was originally called the "port wine colour" of Jacquemier, but as a rule it is more violet in tint than port wine colour. It is very like the colour which the lips and mucous membranes assume in the cyanosis due to heart disease and pulmonary disease.

Along with this vascularity the tissues of the vagina become relaxed, loose, and hanging in folds. These changes, which are clearly to facilitate dilatation, sometimes occur very late, and it is noticeable that when labour begins in some cases there is very little relaxation. Small varicose veins may be seen near the vaginal orifice, but they are not nearly so common or so obvious as in the vulva (Plate I.).

The watery transudation from the blood which is the true vaginal secretion is increased in pregnancy, and contains more desquamated vaginal epithelial cells. It must not be overlooked that the vaginal secretion is truly a mixture of the secretion of the cervix and body of the uterus, plus that of the vagina itself. The cervix secretes more mucus in pregnancy, and the vaginal transudation is also increased, but the cavity of the body of the uterus, being obliterated by the adhesion of the decidua, secretes nothing under normal conditions in pregnancy. Hence the total vaginal transudation is increased on the whole, and it is pasty, white, and semi-solid from the admixture of large amounts of vaginal epithelium. This differs markedly from the normal vaginal secretion, which has not the pasty character. It is commonly acid in reaction, according to Döderlein, because of the presence of the "vaginal bacillus" which is believed to give rise to the formation of lactic acid.

There is no doubt that the vaginal transudation in pregnancy is markedly bactericidal, and hence it must be regarded as a protective agency against infection. Whether it is the presence of

lactic acid which constitutes the protective medium has not yet been settled. For a fuller discussion of the bacteriology of the vagina, see the companion volume on Diseases of Women.

Vulva.—As pregnancy advances the vulva shares in the increased vascularity and shows some swelling in consequence. The violet coloration is present upon the moist surfaces around the urethra, hymeneal remnants, and inner parts of the labia minora. Varicose veins often appear on the labia majora, especially in the parts near the perineum. The causation of varicose veins on the vulva and in the leg, is commonly said to be the pressure of the pregnant uterus upon the veins in the pelvis. It is, however, not uncommon to see varicose veins appear in the legs as early as the 20th week of pregnancy, when the amount of pressure must be comparatively small. It is highly probable that varicose veins are caused in pregnancy by the mere back pressure in the veins from the greatly increased vascularity of all the pelvic organs. The absence of valves, or inefficiency of the valves in the veins, in some individuals fails to support the venous pressure in the upright position, and varicosity results.

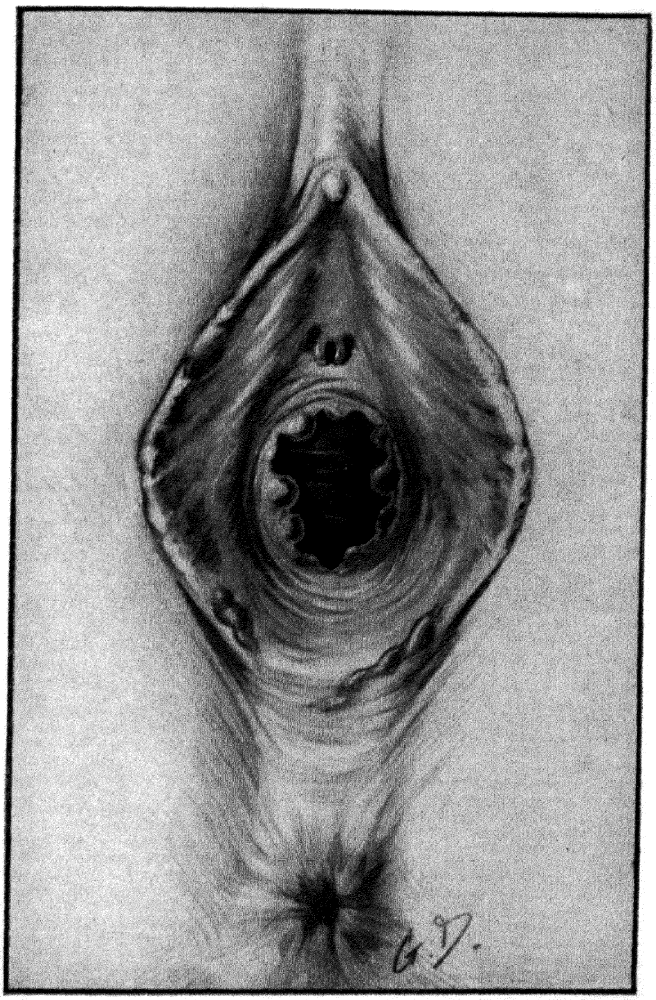
Women do not necessarily get varicose veins in pregnancy, hence the reason for looking for some other cause than the pressure of the pregnant uterus.

Breasts.—Changes begin to show themselves in the breasts early in pregnancy, often as early as the 8th week. These are naturally the result of increased blood-supply to the breasts, consequent upon the commencing activity of the gland tissue. The earliest change is a swelling of the breasts, showing itself chiefly at the periphery. The lobules of the gland can be easily felt and are harder than normal, this change producing a knotty feeling in the breast. At the same time the glands become a little tender and peculiar sensations are experienced in them, often described as "prickly" feelings. The increased blood-supply is shown by a very obvious network of veins just beneath the skin, which appears at the same time that the breasts begin to enlarge. The increase in size is due to congestion first, then to actual overgrowth of the glandular tissue, and also, it is said, to increase in the fat and fibrous tissue of the breast.

As a result of these changes the breasts become more prominent and tend to sag a little, the upper surface becoming flattened while the lower surface becomes more convex.

By about the 12th week, the glands begin to secrete an almost

PLATE I.



TO SHEW THE VIOLET COLOURATION OF THE VAGINA IN PREGNANCY.

clear or slightly opalescent fluid, which can be made to appear at the nipple in droplets, by squeezing the breast towards the nipple. Towards the end of pregnancy this fluid is more copious and becomes thick and creamy in consistence. It is then known as *colostrum*, and consists of water, fat, albumin, and colostrum corpuscles. The latter are cells containing large fat droplets and are really epithelial cells from the gland acini, filled with fat and cast off whole. They have a nucleus, which is thrust on one side eccentrically by the fatty contents of the cell.

When the milk secretion is established colostrum corpuscles are not found because the fat is discharged from the acinous epithelium into the lumen of the ducts, the cells thus broken down remaining behind.

While the whole breast is enlarging and becoming active, the *nipple* and its *areola* show changes peculiar to pregnancy. The nipple enlarges and becomes more readily erectile, its nervous excitability being increased. The areola becomes raised above the surrounding skin and bulges forward, helping to increase the prominence of the nipple. The areola also becomes pigmented to a greater or a lesser degree, being most marked in dark-haired women, least in those whose skin and hair are fair. The pigmentation gradually increases as pregnancy advances and varies in depth of tint in different individuals (Plate II.).

In addition to the swelling and pigmentation of the areola, a number of swollen sebaceous glands, known as Montgomery's follicles, can be seen in the areola around the nipple, generally twelve to twenty in number. These sebaceous glands often remain permanently enlarged after a pregnancy. The epidermis of the areola has a scaly glistening appearance owing to an increased degree of keratinization, drying and desquamation.

At about the 20th to the 24th week pigmentation of the skin shows itself outside the margin of the areola. This forms a second pigmented ring and is known as the secondary areola. It is not a uniform pigmentation, but rather presents a mottled or honeycombed appearance. It is not visible in every case, being more obvious in brunettes than in blondes.

The stretching of the skin of the breasts sometimes produces striæ like those seen on the abdomen.

Occasionally outlying lobules of the breast are found in the axillæ, and in these cases the glandular structures are much more closely connected with the skin, which is consequently not movable over them. These gland structures enlarge in sympathy with the breast activity, and may produce comparatively large swellings

in the axillary skin. As they usually have no ducts opening on the skin, visible secretion does not appear from these swellings. They are apt to become painful when lactation commences, but having no obvious outlet, secretion from them soon ceases, they become inactive, and the swelling subsides.

Developmentally the breasts are highly specialized and enlarged sebaceous glands, and are therefore essentially skin structures. Thus it is not surprising that outlying lobules of the glands are more closely related to the skin than the mammary glands themselves. When accessory mammary glands exist, not an infrequent occurrence, they enlarge and may secrete exactly in the same way as the normal glands. Occasionally a second smaller pair of mammary glands situated lower down upon the chest wall in the same vertical line as the normal glands may be found.

It must not be overlooked that great variation in the degree of development of the breasts exists in different individuals. The changes in the breasts due to pregnancy also vary within wide limits. The presence of secretion from the breasts does not always indicate that pregnancy has occurred, because fluid can sometimes be squeezed from the nipples in women who have ovarian tumours, uterine fibroids, or pseudocyesis.

Heart and Circulation.—Considerable divergence of opinion exists as to the condition of the heart in pregnancy. The general belief is that the heart enlarges owing to hypertrophy of the walls of the left ventricle. It is reasonable to suppose that this may be the case, because there can be no doubt that the heart has extra work to do during pregnancy, to keep the circulation flowing normally through the enlarging uterus with its greatly increased vascular supply.

In addition the increased blood-supply of the breasts, the liver, and the kidneys must all help to throw extra strain upon the dynamics of the circulation. The proof of this cardiac hypertrophy is difficult, but something can be learnt with regard to it from cases of actual valvular disease of the heart. In these, as pregnancy advances, there is often evidence of failure of a heart which previously appeared to be well compensated. Thus respiratory distress, cough, hæmoptysis, enlargement of the liver, swelling of the feet and legs may all occur in cases of heart disease and pregnancy, when previously the disease was apparently well compensated and giving no particular trouble. It seems reasonable to suppose that the extra strain thrown by pregnancy upon the heart is responsible for this temporary breakdown. Under normal conditions the

heart responds to this extra strain by hypertrophy of the wall of the left ventricle.

The bulk of evidence goes to show that the blood-pressure is raised in pregnancy, partly as a result of this hypertrophy of the heart, but it is probable that some substance circulating in the blood is also responsible for the rise of pressure. It may be that there is normally in the blood a small amount of some toxic substance, of fœtal or of maternal origin, which causes a rise of blood-pressure.

The blood itself is profoundly altered during pregnancy, showing an increase in the number of leucocytes, a diminution of red corpuscles, an increase in the watery constituent, and an increase in fibrinogen.

Thus there is anæmia, hydræmia, and leucocytosis, during pregnancy. The total amount of blood is increased so as to supply the growing uterus, the needs of the fœtus, and the activity of the breasts.

The watery condition of the blood may be sufficient to account for those cases of œdema of the feet and ankles which occur so commonly, without any evidence of albuminuria or renal disease. The œdema is probably the result of malnutrition of the vessel walls, thus allowing of increased watery transudation, rather than of a venous stasis from any pressure upon the great vessels in the pelvis.

Palpitation of the heart is often complained of during pregnancy, partly the result of gastric troubles, partly from hypertrophy of the heart and increase in the average number of heart beats per minute, and partly in the later months from encroachment on the thorax by the upward pressure of the enlarging uterus.

The occurrence of varicose veins of the legs and vulva is common in pregnancy, but is a pathological condition rather than physiological. It is due partly to pressure upon the large veins in the pelvis by the enlarging uterus, but also partly to the weight of the blood in the pelvic vessels causing back pressure. This is the more marked when the valves in the veins of the legs are congenitally badly developed. It is very likely that the increased weight of the blood-column and badly developed valves are more responsible for varicose veins than pressure of the growing uterus, because varicose veins often begin to appear so early that it is difficult to believe that there is any injurious pressure upon the pelvic veins.

Skin.—Changes in the skin are seen during pregnancy in several directions. Thus there is the formation of the striæ gravidarum,

the result of stretching of the skin of the abdomen; pigmentation of the skin in several situations; increased activity of the sweat and sebaceous glands; increased growth of hair and deposition of fat in the subcutaneous tissue.

Striæ gravidarum or *lineæ albicantes* are the result of stretching and yielding of the fibrous connective tissue in the corium. They occur in radiating or circular lines concentric with the umbilicus, reaching to the pubes and loins, and not infrequently occurring on the thighs and buttocks. At first these striæ are pink or red in colour, but afterwards they become white as a result of the formation

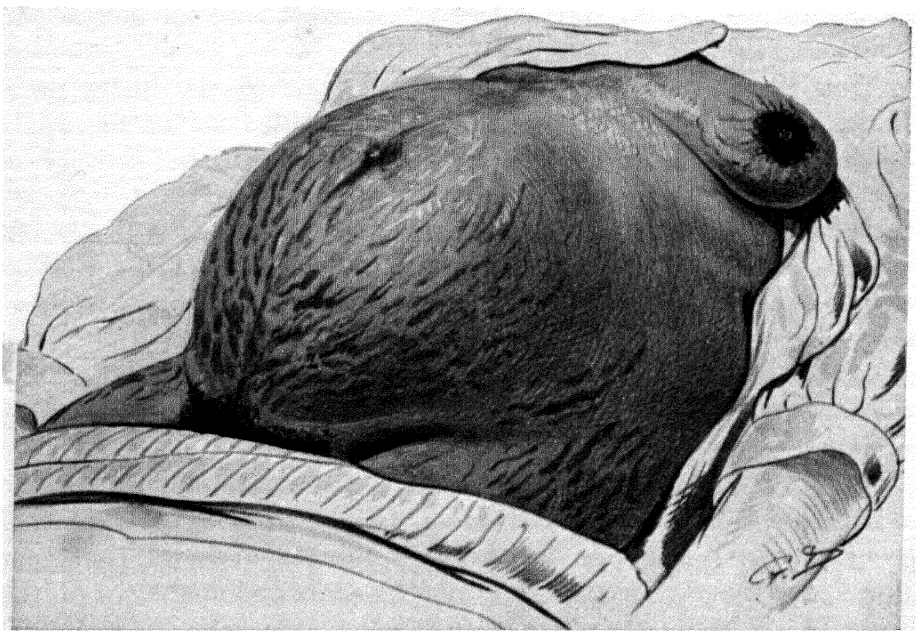


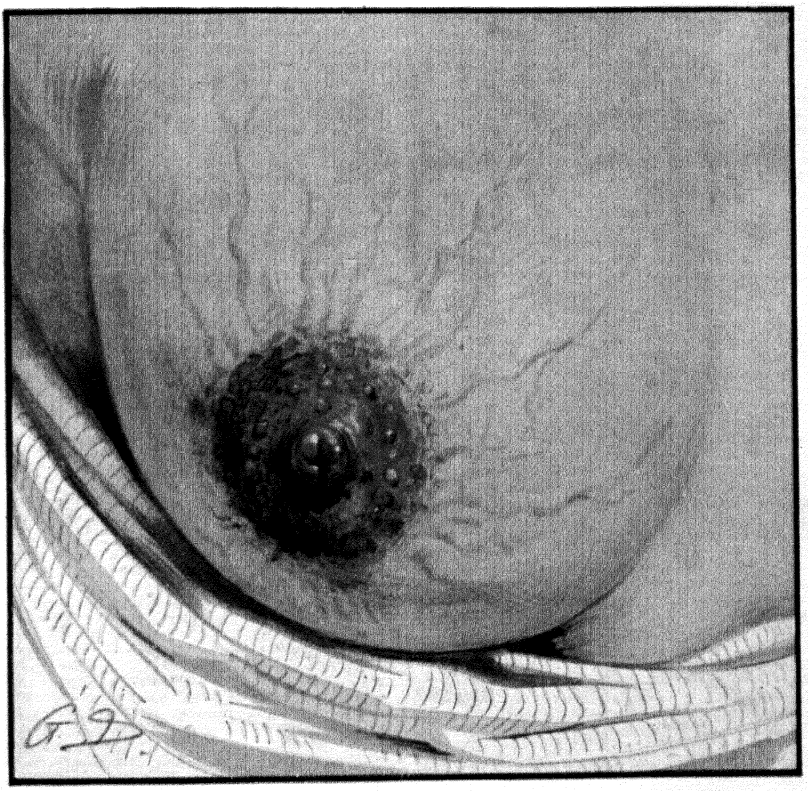
FIG. 27.—LINEÆ GRAVIDARUM.
Note also the pigmentation round the nipple.

of scar tissue. After the first pregnancy the striæ are apt to become pigmented if a second pregnancy occurs.

Although striæ gravidarum are almost invariable in pregnancy, they may not occur at all if the amount of enlargement of the uterus is not up to the average, *i.e.* if delivery is premature. Striæ are seen in other conditions as well as pregnancy in which great stretching of the abdominal walls occurs, such as in ascites, ovarian cysts, or extreme obesity. They are even seen in men occasionally. Their presence, although usually denoting a past pregnancy, cannot be taken as absolute evidence of it (Fig. 27).

Pigmentation of the skin occurs in the nipples and areolæ, in

PLATE II.



SHEWING THE PIGMENTATION OF THE AREOLA, MONTGOMERY'S FOLLICLES AND GENERAL VASCULAR ENLARGEMENT OF THE BREAST IN PREGNANCY. THE SECONDARY AREOLA IS JUST BEGINNING.

a line from the umbilicus to the pubes, the *linea nigra*, and on the face, especially about the forehead, sides of the nose and lips, the so-called *chloasma uterinum*. The amount of pigmentation varies in different individuals, being greatest in dark-haired women and least in blondes. The abdominal pigmentation and the nipple changes persist to a great extent in dark women after pregnancy is over.

The umbilicus in the early weeks of pregnancy is drawn in and flattened, but later the umbilical cicatrix flattens out, becomes flush with the skin surface, or may even protrude.

Body Weight.—The body weight increases during pregnancy quite apart from the increase in the weight of the uterus and of the fœtus. Fat is deposited in the subcutaneous tissues of the buttocks, thighs, and loins, and also in the connective tissue of the breasts.

Urinary System.—In general the amount of urine passed is increased during pregnancy, chiefly because of the hydræmic condition of the blood, the increased blood-pressure, and the increased blood-supply to the kidneys. Since the mother has to excrete for the fœtus as well as for herself, it is only reasonable to suppose that there would be an increase in the amount of urine excreted.

Apart from the increased amount of urine there is usually frequency of micturition in the early weeks and the last weeks of pregnancy. This is commonly explained on mechanical grounds. In the early weeks the enlarging uterus lies on the bladder, while in the later weeks pressure becomes extreme. Possibly, however, pressure is not the only cause. The urine may be of an irritating character owing to some unusual constituent, such as hyperacidity, increase of urates, or phosphates. Some weight is lent to this view by the fact that large doses of alkalies taken medicinally will generally relieve or prevent the frequency of micturition.

The solid constituents of the urine are altered both quantitatively and qualitatively, and although some of the alterations may be regarded as physiological, it is often difficult to draw the line where the physiological state ends and a pathological begins. It is a fact that a small amount of albumin is found in the urine of a small percentage of pregnant women, the actual number of cases per cent. varying considerably. It is difficult to believe that such an albuminuria is physiological, and to be explained by the mechanical effects of pressure upon the renal vessels, or of the general increased intra-abdominal pressure. It is much more likely that all such cases of albuminuria *arising during pregnancy* are really examples of the "pregnancy kidney," and are to be explained on the grounds

of the presence of some toxic substance in the blood which damages the kidney.

The most careful scrutiny must be made of any cases in which albuminuria is found, to be quite sure that there is no old kidney lesion, or that the albuminuria did not antedate the pregnancy. (See "Albuminuria of Pregnancy" and "Toxæmia of Pregnancy.") It is important also to remember that a small amount of albumin in the urine may be due to the admixture of vaginal secretion, consequently when any doubt exists a catheter specimen of urine should be obtained.

Sugar is found in small quantities in the urine of many pregnant women. It is very often lactose, in some way associated with mammary activity, and therefore may be physiological. But if the variety of sugar found is glucose, then the condition cannot be physiological, but must be either an alimentary glycosuria or a true diabetes.

With regard to the nitrogenous products found in the urine, there is a general diminution in the total amount excreted during pregnancy. The amount decreases as pregnancy gets more advanced. Thus urea, uric acid, ammonia compounds, kreatin and kreatinin are all diminished; but while the proportion of nitrogen excreted as urea remains normal, that excreted as ammonia is rather increased.

Inasmuch as this diminished nitrogenous output is found in all pregnant women, it may be regarded as physiological, and the amount lost may be assumed to be made use of in the growth of the fœtus. Nevertheless in pathological states like albuminuria, eclampsia, and toxic conditions generally, the total nitrogen output is still more diminished, so that again the boundary line between a physiological and a pathological state is very hard to define.

The amount of nitrogen excreted as urea towards the end of pregnancy practically never exceeds 1·5 per cent., and as long as this continues constant, the amount of urine is normal, and there is no albuminuria, it must be looked upon as physiological.

It has been stated by various writers that the amount of chloride excreted during pregnancy is increased, but some researches on the point show that the chlorides are actually diminished. This would be expected, for most writers agree that the phosphates and sulphates are diminished.

The peculiar pellicle, known as kiestein, which forms on the surface of the urine in pregnancy, is found in other conditions as well, and may occur in the urine of men. It forms after the urine has been kept for several days, and is believed to be a product of

decomposition. It is composed of crystals of triple phosphates and bacterial masses.

Nervous System.—That there is general increased irritability of the nervous system has long been noted in pregnancy. It is said to be shown by the ease with which reflex nervous disturbances are induced, and the morning sickness of pregnancy has been cited as one of these. It is, however, quite doubtful whether morning sickness is a purely reflex phenomenon. It is highly probable that it is really the result of some toxic substance circulating in the blood, producing vomiting because of the heightened irritability of the nerve centres.

This condition of the nervous system shows itself more commonly by psychical changes. The temperament of the patient becomes altered, generally in an unpleasant manner. She may become emotional, irritable, easily provoked to anger or despondency. There is nearly always a craving for food, sometimes taking a morbid turn, hence the "longings" after unusual articles of food which have been described. Hysteria is not uncommon, and neuralgias of the face become troublesome, especially if any carious teeth are present. Sleeplessness sometimes occurs, but its causation is often difficult to assign, because there are so many sources of discomfort in pregnancy which alone may cause sleeplessness without any alteration in the central nervous system.

On the other hand, some pregnant women alter for the better in their mental attitude. They feel mentally and physically stronger, become more cheerful, less exacting, and altogether have a sense of well-being. Unfortunately, these happy people are in the minority.

Alimentary Tract.—The *morning sickness*, which as a rule begins at about the end of the sixth week of gestation and lasts on an average for two months, is one of the commonest and most regular of the manifestations of pregnancy. It is not strictly due to any actual change in the stomach, but depends upon the increased irritability of the nervous system, and is probably started by the circulation of some toxic substance in the blood. In this sense it is strictly pathological, but as it occurs so frequently, no matter how many pregnancies have occurred, it is commonly looked upon as physiological.

Morning sickness generally shows itself by the patient retching immediately she gets out of bed in the morning, and, as a rule, a little bile-stained mucus is vomited. After this, in a normal

case, the patient has no more nausea for the rest of the day. In many women, however, nausea occurs at intervals during the day, and more mucus is vomited. As long as food is not actually vomited the condition is of no importance. When food is vomited the condition becomes truly pathological, and must be classed as excessive vomiting of pregnancy.

It is curious that some women never vomit at all or experience any nausea, and although it may only be a coincidence, yet this absence of nausea not infrequently occurs in women who do not know or realize that they are pregnant. And this sometimes is the case even when they have experienced the usual nausea in a previous pregnancy. This fact rather bears out the view of the nervous origin of vomiting, and lends some support to the theory that many cases of excessive vomiting are due to hysteria. The women who never at any time experience nausea in pregnancy form a very small group of patients indeed. *Dyspepsia* and *flatulence* are very common and do not necessarily occur towards the end of pregnancy only, when pressure upon the stomach and partial obstruction to the intestines might be expected to be causal agents. Sometimes intestinal or gastric distension occurs very early in pregnancy and causes a feeling of abdominal enlargement, which may give a false idea of the stage to which pregnancy has advanced.

As a rule the appetite is good; more food is required to supply the fœtus and growing uterus, and to store up fat in various parts of the body. Thus a greater strain is thrown on the digestive organs, which they may not be equal to meeting. Often, too, there is a craving for indigestible articles of food, which being freely indulged, naturally causes digestive disturbances.

Constipation is common in pregnancy just as it is in women at all times, but there is no real reason for believing that it is made worse by pregnancy.

Hæmorrhoids arise very frequently, just as varicose veins of the legs and vulva occur so commonly in pregnancy. They are not necessarily associated with constipation, but are made worse by it. They are caused by pressure upon the rectal veins, or pelvic veins in general, by the growing uterus.

Although hæmorrhoids may be very troublesome and give rise to great discomfort, they usually disappear after delivery.

Thyroid.—It is a common belief that the thyroid gland enlarges during pregnancy, but it is a belief which it is difficult to prove. Minor degrees of enlargement of the thyroid are not easily detected,

especially if the condition of the thyroid previous to pregnancy is not known. The supposition is that an increased supply of the thyroid secretion is necessary to healthy metabolism during pregnancy. It is also believed by some authorities that a deficiency of thyroid secretion leads to a toxæmic condition and predisposes to eclampsia. Although this theory is fascinating, and is to some extent corroborated by the good effect of administering thyroid gland substance in pre-eclamptic conditions, yet it cannot be considered to have been absolutely proved.

CHAPTER V

THE DURATION OF PREGNANCY

THE average duration of utero-gestation is 273 days, calculated from cases in which it has been known that a single coitus only has taken place. Although this figure has been closely confirmed by different observers, it cannot be taken to represent the actual period of utero-gestation in the human being, but only the number of days which elapse from the time of a single fertile coitus until the time of delivery. It does not help us to know the actual date of fertilization of the ovum or the time of conception.

It is well known that spermatozoa will live under favourable conditions outside the body for about 10 days, and inside the body under the most favourable conditions for about 18 to 21 days. Thus it is theoretically possible for fertilization to occur at least a fortnight after a single coitus has taken place. It is more than probable, however, that conception occurs on an average within 4 days after a known single coitus.

The possibility of pregnancy being prolonged beyond 273 days is admitted by all observers, and numbers of cases are known in which apparently the period of utero-gestation was prolonged to 308 days, or more, the two best-known instances being to 313 days recorded by Sir J. Y. Simpson, and to 308 days by Prof. A. R. Simpson. These, it will be noted, represent roughly eleven periods of four weeks (308 days, to be exact). These cases were calculated not exactly from a single coitus, but from the death or departure of the husband.

The possibility of pregnancy being prolonged to 300 days or more is of great medico-legal interest, because the legitimacy of a child may depend upon it. In England and the United States of America no fixed period of utero-gestation is laid down by law; in Scotland, France, and Austria a limit of 300 days is allowed. Three hundred days counted from the first day of the last natural menstrual period represents on an average 23 days' prolongation of the period of utero-gestation, and obviously may be explained

on purely physiological grounds. If spermatozoa can live for three weeks in the genital tract, it follows that fertilization may be delayed (theoretically at least) for that period after coitus. Consequently a child born 300 days after the first day of a menstrual period, may not have been conceived until three weeks later, and therefore is not really an example of prolongation of the period of utero-gestation.

On the other hand, clinical evidence is not wanting to show that real prolongation of the period of utero-gestation does occur. The best evidence of this is an abnormal length and weight of the infant, the former being the more important indication. There is now a volume of evidence which proves conclusively that when pregnancy is prolonged (reckoned from the date of the last natural menstrual period) the child is always above the average weight and size. These are known as "post-mature" infants, and are of very considerable clinical importance, apart from the physiological interest of prolonged utero-gestation.

The abnormal size and unusual hardness of the heads of these infants lead to difficult labour, and some of them perish during delivery on this account. A more serious danger, however, is the possibility of the infant dying before labour begins or during the first stage of labour. Cases like this have been reported so often now, that it must be believed that the vitality of the infant suffers through being retained too long *in utero*, although there is evidence (from its weight) that its nutrition does not suffer. The onset of uterine contractions, possibly by cutting off the blood-supply momentarily, leads to the death of the infant whose vitality is impaired. It is also possible that some toxic placental substance is developed in abnormal amounts, and may bring about the death or at least deficient vitality in a post-mature infant.

The deduction from this, however, is certain, namely, that *when a calculation points to undue prolongation of the period of utero-gestation, induction of labour should be performed in the interests of the child.*

Calculation of the Date of Delivery.—Seeing that there is no means of knowing the actual time at which conception occurs, it is usual to calculate the period of utero-gestation from the last natural menstrual period. This method has been adopted because the most fertile period is certainly that which immediately follows menstruation. The first day of menstruation is the date most commonly remembered or noted, and so a calculation is usually made from that day. Allowing four days as an average for menstruation

and three more days before conception occurs, the simplest plan to calculate the expected date of delivery, is to count forward nine calendar months or backward three calendar months from the first day of the last menstrual period and add seven days. This simple method is practically correct, and gives an average of 280 days from the first day of a menstrual period all the year round.

When the date is found, there still may be a considerable error, because conception may not have occurred within the few days succeeding menstruation. If conception, for instance, occurred just before the first missed menstrual period, then the date of delivery might be about three weeks later than the calculated date, without any real prolongation of pregnancy.

One of the difficulties which frequently arises, is that of attempting to find the probable date of delivery, when the date of the last menstrual period is not known, or when conception has occurred during a period of amenorrhœa (*e.g.* lactation). Discrepancies also arise because the patient has made a mistake in the supposed date of the last period. In all such cases attempts have to be made by estimating the duration of pregnancy to date, by the height to which the uterus rises out of the pelvis. Ellice Macdonald's method of measuring the height of the fundus uteri above the pubes and the calculation to be made from it, already mentioned in a previous paragraph, is certainly of some value. It may be remembered shortly thus: the height of the fundus above the pubes in centimetres divided by 3·5 equals the number of lunar months which have elapsed since conception.

The date of quickening may be of some assistance in checking figures arrived at, but it is so variable that it is not of much practical value. At its earliest quickening occurs at the 16th week, but for practical purposes it is better to put it a little later, say the 17th week. If the date of quickening appears to confirm what has already been determined by abdominal measurement to be the duration of pregnancy, then the calculated date of delivery may be looked forward to with some confidence. If, however, there is a wide discrepancy between the date of quickening and the estimated duration of pregnancy to date, the latter is the only figure which can be taken into account.

Attempts have been made to measure the length of the fœtus *in utero* by callipers, and from it to calculate the duration of pregnancy. These measurements, although widely quoted by authors, are not really of as much practical value as those made by Ellice Macdonald's method. Clearly, measurement of the fœtus in utero can only mean the measurement from the vertex to the breech,

and must vary much with the weight of the child and the degree of flexion *in utero*.

The Effects of a Past Pregnancy.—It is sometimes of importance to be able to recognize the effects of a past pregnancy from a medico-legal point of view. This may be required just after abortion or full-time delivery, or it may be rendered necessary at a much later date. The signs of a recent delivery are always clear, but those of an abortion may not be, and further, a full-time delivery leaves marks on the patient which are indelible, for all time, while an abortion may leave no sign at all.

The signs of a recent delivery, say within a week or two, are general and local.

The general signs comprise breast changes and skin changes. The breasts will be full and contain milk, and may show striæ from skin-stretching. The abdominal wall will be lax, the skin pigmented, and striæ gravidarum present. The latter will have lost their pink or pigmented appearance, and have become white and cicatricial.

The local signs are in the body of the uterus, cervix, vagina and vulva. The uterus will be enlarged, the size depending upon the time which has elapsed since delivery, and uterine contractions may be felt. The cervix will be soft and somewhat patulous, probably admitting the finger even after a week. There may be recent lacerations in the cervix, often bilateral, but usually left-sided if single. Inspection of the cervix will show these, and will reveal a reddened, congested appearance of the cervix in general. Secretion will be seen issuing from the cervical canal.

The vaginal walls will be relaxed and thrown into folds, while the normal rugæ are smoothed out, and on inspection through a speculum may present minute tears and small hæmorrhages. The hymen will show deep lacerations extending through its whole thickness, the remnants being swollen and congested.

The fourchette will be torn through in a vertical direction as a rule, and there may be more or less laceration of the perineum and lower part of the vagina. The presence of these lacerations is the most convincing of all evidence that a recent full-time delivery has occurred.

There may be small lacerations of the vulval skin, sometimes at the anterior part round about the meatus urinarius. Any lacerations present will be in a granulating condition or almost healed according to the time which has elapsed.

The vaginal discharge will be more or less blood-stained and

copious in character, according to the degree of involution which has occurred.

It is much more difficult to say with any degree of certainty that a woman has recently aborted. Even at the end of a week after an abortion there may be very little to be found, locally or generally, which could be sworn to as signs of a recent pregnancy. Naturally the more early the abortion, the less likely would it be to leave any positive evidence of its recent occurrence. There would probably be no lacerations or injuries either of the cervix, vagina or vulva. The discharge may have ceased, and the parts may not be congested.

The uterus would certainly be enlarged, but it is impossible to say definitely that a slight enlargement of the uterus is due to a recent abortion. It might have been due to a long past pregnancy. So that unless the patient was seen and examined within a day or two of an *early* abortion, it is hardly likely that any positive signs would be present.

Signs of a Past Pregnancy and Delivery near Full Time.—The general signs are mammary and abdominal. The breasts are usually rather flabby and apt to be pendulous, the nipples prominent, the areola well marked, and even remnants of a pigmented area representing a secondary areola may be seen. All these appearances are apt to be much modified if the woman has not suckled a child, and the pigmentary signs may be entirely wanting in a fair-haired woman.

The abdominal walls are always somewhat relaxed and more prominent, but it must be remembered that chronic constipation and flatulent distension of the bowels may produce a prominent abdomen. Striæ gravidarum persist indefinitely in the form of white silvery streaks, the lineæ albicantes; occasionally, however, they are quite absent, for instance in cases in which premature delivery has occurred, and even after full-time labour. Also it must not be forgotten that these marks may be the result of simple obesity (even occurring in men), and may result from any abdominal distension by ascites or tumours. In the latter case possibly an abdominal scar may be present, showing that an operation had been performed.

Locally the uterus is permanently enlarged, but the amount of enlargement is so slight that it cannot be distinguished from that which is due to chronic metritis.

The cervix is enlarged and the os uteri is altered in shape. Instead of a circular or oval opening it is almost always converted

into a transverse slit. It may show notches, the result of laceration, left-sided and unilateral, bilateral or starred. It must be remembered that notches in the cervix may be the result of a former operation for sterility or dysmenorrhœa.

The vaginal walls are smooth and have lost their natural rugæ. The hymen shows the scars of deep lacerations, extending through its whole thickness and leaving small knobs and protuberances, the *caruncuIæ myrtiformes.* Coitus, apart from delivery, injures the hymen, but the lacerations made by it are superficial and do not completely break it up. The hymen may be dilated only as a result of coitus, without any laceration at all. The fourchette is always torn in a full-time delivery, and the fossa navicularis is flattened out, ceasing to exist as a distinct hollow. A scar in the perineum and general relaxation of the vaginal outlet are very suggestive signs of delivery.

A past abortion in the early weeks of pregnancy quite commonly leaves no signs at all, and from what has already been said, if it is not easy to recognize the signs of a recent abortion, it will be practically impossible to recognize any of a long-past abortion.

Signs of Virginity.—It sometimes happens that an opinion has to be given as to the virginity or otherwise of a woman. This may be a matter of extreme simplicity or may be absolutely impossible to decide. For instance, if on vulval examination it is seen that the hymen is absolutely intact, that it only admits the finger-tip, and has a sharp edge which firmly encircles the finger, it is clear that no penetration of anything larger than the finger-tip can have occurred, and a definite opinion can be given that the patient is *virgo intacta.* If, however, the hymen easily admits one or two fingers, this is not an absolute proof that sexual connection has occurred. If the hymen is notched in several places, is lax and dilated, and one or two fingers pass in easily without the patient flinching, experiencing pain, or making any comment, it is highly probable that coitus has occurred.

It must not be forgotten that pregnancy may occur although no penetration has taken place.

It must be remembered, however, that the hymen may be dilated and even notched in this way merely by the passage of a finger during an examination, that the patient may have had an operation or examination in which a speculum was used, and that even the constant passage of a douche nozzle may produce the same effect. All that can be said, therefore, in such a case is that something has been passed through the hymen sufficient to stretch or notch it,

but it does not follow that these appearances are the result of sexual connection.

The signs of a recent first coitus may be more positive. There may be recent unhealed lacerations of the hymen, the parts may be reddened and swollen, and may also be acutely sensitive. In the case of a recent attempt at rape it is usual to look for the presence of spermatozoa in the vagina, or on the clothing of the woman or child. A dried stain on a garment may show the presence of spermatozoa quite unmistakably when examined by proper methods.

CHAPTER VI

THE DIAGNOSIS OF PREGNANCY

THE recognition of the presence of pregnancy is often a matter of considerable difficulty, at all events in the early weeks when positive signs are wanting. Nevertheless it is often of importance for social reasons or to distinguish some pelvic lesion from a possible pregnancy.

It must be clearly understood that the diagnosis of pregnancy, before positive signs are present, such as the recognition of the fœtal heart or fœtal parts, depends upon a symptom-complex rather than upon any one sign. It is the combination of several signs and symptoms which makes the diagnosis of early pregnancy possible. The symptoms and signs of pregnancy are best discussed in the order in which they occur.

Amenorrhœa.—Amenorrhœa is the earliest sign of pregnancy and is of great importance, particularly in the case of women in whom menstruation was previously quite regular. The sudden cessation of the monthly periods is a very significant sign, *and the presumption in a healthy woman who was previously quite regular is that conception has occurred.* Naturally it is not of the same importance in a woman whose periods have been irregular or who has occasionally missed a period for some pathological reason. It must not be forgotten, however, that pregnancy has been known to occur—

1. Before menstruation has begun,
2. After the menopause,
3. In the absence of menstruation due to illness or lactation, this latter being a comparatively common occurrence.

On the other hand, it has long been believed that one, two or three menstrual periods may occur after conception has taken place. This is at least theoretically possible as far as the uterus is concerned, because there is a potential surface of endometrium from which menstrual blood might flow, up to the time when the

decidua vera and capsularis adhere to one another, about the 12th week.

It is an undisputed fact that a pregnant woman may have bleedings from the uterus, and such cases are extremely common. If, however, a careful scrutiny of these bleedings is made, it will be found that they have neither the regular periodicity of menstruation, nor is the quantity of the blood lost the same. In fact, the bleedings in all these cases represent threatened abortion and not menstruation. It is an axiom to assume that a pregnant woman may bleed but does not menstruate except in rare cases of double uterus. *A woman who is pregnant cannot menstruate.*

When amenorrhœa is the only symptom complained of, a careful examination of the patient must be made to exclude all the pathological causes of amenorrhœa, if the signs of pregnancy are not incontestable.

Breast Signs.—In the first four weeks the breasts commonly begin to show some fullness. Tenderness of the breasts is a very early symptom, but as a rule positive breast changes do not begin until the third four weeks. It must not be overlooked that tenderness of the breasts is not uncommon during menstruation, but does not occur in amenorrhœa apart from pregnancy.

Morning Sickness.—Morning sickness commonly begins about the sixth week, and lasts for two months on an average. Pregnancy, however, is not the only cause of morning sickness. It may be a sign of alcoholism, dyspepsia, or cirrhosis of the liver.

Enlargement of the Uterus.—Enlargement of the uterus on bimanual examination can usually be appreciated in the second four weeks, but this naturally depends to some extent on the toleration of the patient, the thickness of the abdominal wall, and the expertness of the examiner (see p. 43).

Hegar's Sign.—It is particularly from the 6th to the 10th week of pregnancy that Hegar's sign of pregnancy is found. This important sign depends upon two factors, namely, that at this period the ovum usually occupies only the upper part of the body of the uterus, and also that the lower part of the body of the uterus is markedly softened. Hegar's sign may be defined as *the varying consistence of the fundus, lower uterine segment, and cervix in the pregnant uterus from the 6th to the 10th week* as estimated by a bimanual examination.

Hegar's sign is elicited by placing one or two fingers in the vagina in front of the cervix, and then, with the other hand depressing the abdominal wall, palpating the uterus bimanually. The upper part of the body of the uterus is globular and elastic, the lower segment is so soft that it feels almost as if the fingers of the two hands can be made to meet through it, while the cervix itself is as yet unsoftened. These three features constitute Hegar's

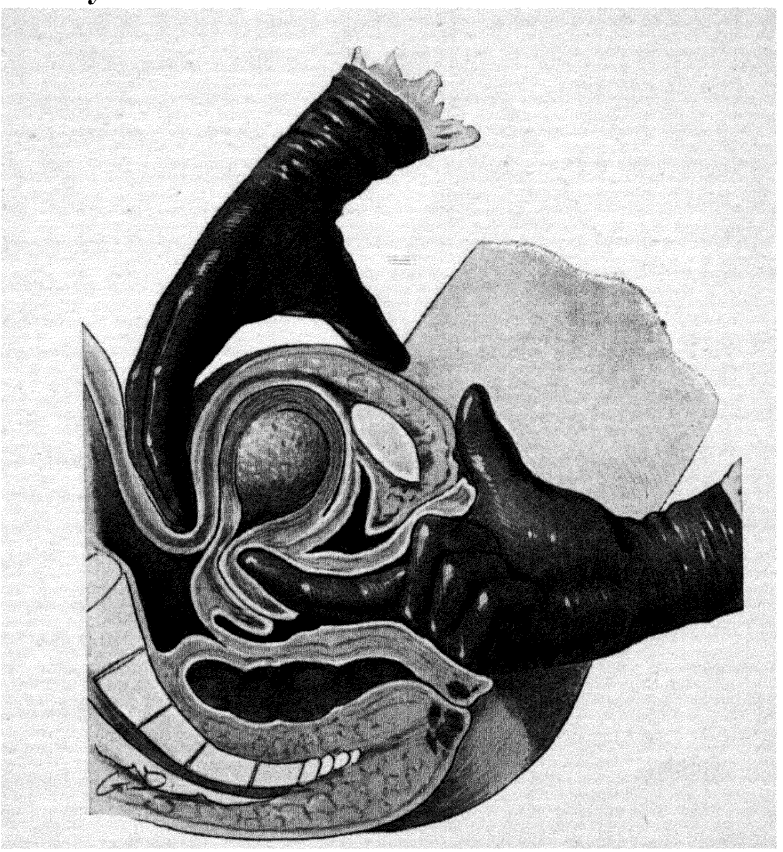


FIG. 28.—HEGAR'S SIGN OF PREGNANCY.

The upper part of the body of the uterus is globular and elastic, and the lower part is empty, almost allowing the fingers to meet. Compare with the next figure.

sign, and not merely the softening of the lower segment, as is so often stated. The softening of the lower uterine segment is occasionally felt in cases of subinvolution of the uterus, and the unpractised hands might be deceived by it. But the subinvoluted uterus never gives the full Hegar's sign with its three characteristics, so that when these are really present they mean pregnancy and nothing else (Figs. 28 and 29).

The third four weeks are characterized by the establishment of well-marked breast changes, and pigmentation of the areola begins

at the end of this period. It is obvious, however, as early as this only in brunettes; in fair women pigmentation may be much less obvious and occurs at a later date. A secretion can be squeezed from the nipples at this time as a rule. It is at this period an opalescent fluid without the thick creamy character which it has towards the end of pregnancy.

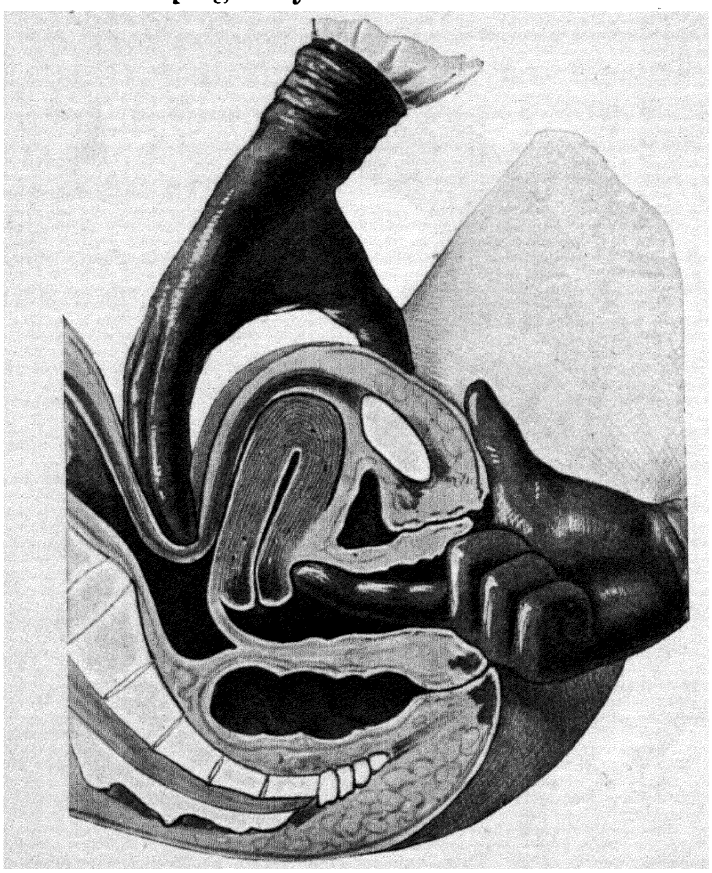


FIG. 29.—BIMANUAL EXAMINATION OF THE SUBINVOLUTED UTERUS.
The upper part is not globular, and the lower part is not unduly soft.

Coloration of the Cervix and Vaginal Walls.—This appears at about 12 weeks. Beginning a little earlier in the cervix it gradually spreads down to the vaginal entrance. It is very variable both in extent and in the time that it becomes obvious at the vulva. It is due to venous congestion, and is a bluish-purple colour, contrasting clearly with the normal colour of the vaginal walls. This coloration is more likely to be caused by pregnancy than anything else, but it has occasionally been seen in quite typical form, in conjunction with fibroid tumours of the uterus and with ovarian cysts, and even with a distended bladder.

Quickening.—Quickening occurs as a rule at the end of the 17th week. This means the first time that *the mother is able to appreciate* fœtal movements. It does not mean the first fœtal movements. It is very characteristic and usually feels like a sharp tap on the uterine wall from within. It has been known to produce emotional disturbance and even faintness in some women.

It is sometimes simulated by other conditions besides pregnancy, thus flatulence and peristaltic movements of the intestines are sometimes thought to represent fœtal movements by women who fancy themselves pregnant or wish to be pregnant. It is a prominent symptom of pseudocyesis. True fœtal movements can be felt by the hand placed on the uterus at this time.

Uterine Souffle.—The uterine souffle is a musical or blowing murmur heard with the stethoscope over the sides of the uterus. It usually can be made out as early as the 16th week, but it is not always present, and may not even be heard at any period of pregnancy. The souffle is synchronous with the mother's pulse, and is believed to be produced in the uterine arteries as the blood flows through the slightly narrowed part where the vessels enter the uterine muscle. It is believed to be produced in the same way as murmurs in valvular diseases of the heart, on the "veine fluide" theory.

The uterine souffle is not absolutely pathognomonic of pregnancy, as it has been heard in some cases of fibroid tumours of the uterus. It is sometimes heard better on one side of the uterus, often the left, because that side of the uterus approaches nearer to the abdominal wall. It can usually be heard after labour, even after the expulsion of the placenta.

Fœtal Heart.—The sounds made by the fœtal heart-beat can rarely be heard before the 18th week, and not often then. The sounds are much the same as those of the adult heart, having a double character, but of course fainter. They are commonly said to resemble the ticking of a watch under a pillow. The rate of the fœtal heart is roughly double that of the mother's pulse, but varies considerably. It is commonly from 120 to 160 beats per minute, and it is believed that larger children have a lower rate of beat, and hence that males have a lower rate than females.

An attempt has been made to try and diagnose the sex of the fœtus from the rate of its heart-beat, the idea being that a persistently low rate indicates a male, while a high rate means a female.

Seeing, however, the great variations which can normally occur, this attempt at sex-diagnosis is often quite fallacious.

In the early weeks the fœtal heart is most often heard in the centre of the abdomen below the umbilicus, *i.e.* near the fundus. In the later weeks in vertex presentations it is heard best about one-third of the distance along a line from the umbilicus to the anterior superior spine of the ilium.

In breech presentations it is best heard above the umbilicus on the upward prolongation of this line on either side. It is heard above the umbilicus in breech cases because the breech does not enter the pelvic brim before labour begins, and consequently the fœtus lies higher up in the abdomen as a whole.

In listening for the fœtal heart, it is said that an old-fashioned single stethoscope is better than the modern binaural instrument, but individual observers have their own preference. It is essential, however, that the pressure of the stethoscope on the abdominal wall should be varied; some fœtal heart sounds being best heard with light, others with firm pressure on the abdominal skin. The rapid rate, different from that of the mother's pulse, is the best indication that a double sound heard is the fœtal heart.

Ballottement.—From the end of the 16th week onward until about the 30th week, the sign which is known as ballottement can be elicited. This sign depends upon the fact that during the middle period of pregnancy the fœtus is floating in a relatively large amount of liquor amnii. It may be elicited by vaginal examination, when it is spoken of as internal ballottement, or by abdominal examination alone—external ballottement. In either case ballottement is the sensation imparted to the examining fingers, when the fœtus is jerked upwards by them and then falls back upon them.

Internal ballottement is felt by placing one or two fingers in the vagina with the patient lying on her back. The fœtal head is felt through the anterior vaginal fornix. It is then pushed upwards with a jerking movement, and can be felt to fall back on the finger with a distinct tap.

External ballottement is elicited by placing the patient on one side, with the hands spread out over the abdomen, one above and one below. The lower hand jerks the fœtus upwards and recognizes the impact as it falls back.

After the 30th week there is rarely sufficient liquor amnii for the fœtus to float freely. However, the fœtal head can be "ballotted" quite late in pregnancy, when it lies above the brim

or anywhere but actually in the brim of the pelvis. At the fundus, for instance, in breech cases, the head can be grasped between the two hands and "ballotted" between them. No other part of the fœtus can be served in this manner, because the head is the only part which moves freely on the trunk.

Stirrage.—This is the name given to the peculiar sound which is heard with the stethoscope, due to the movements of the fœtus. It can sometimes be detected at the 16th week.

Uterine Contractions.—Rhythmical painless contractions occur throughout pregnancy, and can be appreciated by placing the hand flat on the uterus. Although they occur even in the first few weeks they are not easily recognized until the uterus has risen above the pelvic brim. At the 16th week the uterus can easily be grasped from the abdomen and a contraction may be recognized as a hardening of the uterus, lasting a few seconds and then passing off. Sometimes the contractions are partial, and so produce a distorted contour of the uterus. Sometimes the intervals between the contractions are very prolonged, so that some patience is required before this sign can be felt. It is, however, a very important positive sign, and although it cannot be said to be absolutely pathognomic of pregnancy it is very nearly so. It is occasionally felt in fibroid tumours of the uterus.

Pulsation in the Vessels.—Pulsation in the vessels at the vaginal roof can often be made out earlier than the 16th week, but about that time it becomes marked. It is simply due to enlargement of the uterine arteries and their vaginal branches.

Secondary Areola.—This extension of the pigmentation of the nipple areola to the surrounding skin of the breast occurs at the end of the 20th week as a rule. It has already been described, also the swollen sebaceous glands, Montgomery's follicles, which are well marked on the areola by this time.

Softening of the Vaginal Portion of the Cervix.—This, which begins at an earlier period, is usually well marked by the 20th week. It varies in different women in the time at which it is well marked, but at the 20th week it is very obvious and is an important sign of pregnancy.

Linea Nigra.—This pigmentation, which has already been mentioned, is usually present by the 20th week, at all events

in dark-complexioned women. It very soon, however, becomes much more obvious, and by the 24th week is well marked.

Cutaneous Striæ.—Striæ gravidarum begin to appear at the 24th week and increase in size and multiply as pregnancy advances.

Funic Souffle.—The funic souffle is a sign which is but seldom heard. It is a soft blowing murmur, synchronous with the fœtal heart. It is said to be heard with the stethoscope, only when pressure can be made with the "chest-piece" directly upon the cord, or when the cord is wound rather tightly round the body of the fœtus. It is believed to depend upon a "veine fluide" produced at some constricted part of the cord.

Chronological Order of the Signs and Symptoms of Pregnancy

First four weeks.—Amenorrhœa and some discomfort in the breasts.

Second four weeks.—Amenorrhœa, morning sickness, Hegar's sign, commencing pigmentation of the nipple areola.

Third four weeks.—Amenorrhœa, morning sickness, uterus reaches pelvic brim, pigmentation of the areola, secretion can be squeezed from breasts, softening of cervix, coloration of cervix and vagina.

Fourth four weeks.—Amenorrhœa, morning sickness disappearing, uterus halfway between pubes and umbilicus, pigmentation of areola, Montgomery's follicles, quickening, uterine souffle, ballottement, softening of the cervix, coloration of the vagina.

Fifth four weeks.—All the signs and symptoms mentioned under fourth four weeks; also the fœtal heart sounds, secondary areola, uterine contractions, uterus nearly to umbilicus.

Sixth four weeks.—All the above, uterus just above the umbilicus, striæ, linea nigra.

Seventh four weeks.—Uterus reaches one-third of the distance between the umbilicus and the ensiform cartilage. All the positive signs, fœtal heart, fœtal movements, uterine contractions well marked.

Eighth four weeks.—Uterus reaches almost to the ensiform cartilage. Possibly the funic souffle.

Ninth four weeks.—Uterus reaches the ensiform cartilage.

Tenth four weeks.—Uterus sinks again to about the position it had reached at the eighth four weeks.

THE DIFFERENTIAL DIAGNOSIS OF PREGNANCY

From the foregoing it is clear that there must be several abdominal conditions in which tumours are concerned, which may be mistaken for pregnancy or *vice versâ*. The distinction between the pregnant uterus and the various tumours rising out of the pelvis is often a matter of extreme importance, in view of the necessary treatment. Naturally the difficulties in diagnosis arise chiefly in the first 24 weeks, when the positive and conclusive signs cannot usually be detected. If a fœtal heart is heard and fœtal parts are felt, clearly no other signs or symptoms are necessary, the patient must be pregnant. In the absence of these it cannot be too strongly insisted, that the establishment of the presence of pregnancy depends upon several symptoms and signs occurring together and forming a symptom-complex, such as cannot occur with other pelvic or abdominal tumours. It therefore follows that the diagnosis of pregnancy cannot be made on finding one or more symptoms and signs without others equally essential. Thus pregnancy cannot be diagnosed on the presence of amenorrhœa alone, or even on amenorrhœa with an obvious abdominal tumour, for such a combination of two main signs might be found with an ovarian cyst. On the other hand, amenorrhœa, morning sickness, and abdominal tumour, breast changes and vaginal coloration combined, practically always mean that pregnancy is present, even though no positive signs like fœtal movements or the fœtal heart can be established.

Suppose, however, that the patient has a tumour reaching only to the umbilicus, the common question which arises is whether the tumour is a pregnant uterus, an ovarian cyst, or a uterine fibroid. It is astonishing how often mistakes are made between these three, and how often the abdomen is opened on a mistaken diagnosis and a pregnant uterus found. This mistake cannot occur if the above-mentioned rules as to a symptom-complex are borne in mind.

The chief cause of such mistakes in diagnosis is the want of a routine examination. Mistakes are most common in first pregnancies, in which a routine examination would have revealed marked changes in the breasts which would at once suggest pregnancy. Another factor in the formation of a mistaken opinion is the common fallacy that ovarian cysts often cause amenorrhœa.

A definite diagnosis of pregnancy should not be made unless one of the absolute signs of pregnancy is found, *viz.* internal and external ballottement, palpation of the fœtus, fœtal movements, and fœtal heart sounds. If the medical attendant has strong suspicion of

the presence of pregnancy, because of the history and the signs and symptoms, but yet cannot be sure of any one of the absolute signs, he should explain his position to the patient, and ask her to come to him again in a few weeks. A patient will nearly always understand, and give him credit for being a careful man who is not given to rash diagnosis, but will on the other hand resent a wrong diagnosis which probably puts her to unnecessary trouble and expense and may make her a laughing-stock to her friends.

An ovarian cyst, when single, is very seldom associated with amenorrhœa. It is only double ovarian tumours with complete destruction of ovarian tissue which cause amenorrhœa. Also ovarian tumours rarely cause breast changes of the pigmentary type, though it must not be forgotten that if the patient has had a child the areola may remain pigmented to some extent, and there may even be fluid in the breasts. Also there would be no morning sickness, no vaginal coloration, no softening of the cervix, no uterine souffle, and of course no positive signs.

It is also most unusual to be able to elicit fluctuation or a thrill in a pregnant uterus (except in hydramnios), while these two signs are the rule in ovarian cysts. Uterine contractions, too, would naturally never be found in ovarian cysts. Very often a careful bimanual examination will reveal the small unaltered uterus, separable from the main tumour.

Uterine fibroids when soft produce much the same boggy consistence as a pregnant uterus, but should never be mistaken for it They are far more commonly associated with menorrhagia, but failing that, always with normal menstruation, not amenorrhœa. They produce no breast changes, no vaginal coloration, no morning sickness, and again no positive signs. They may cause a uterine souffle, but this is very rare. A patient with a fibroid menstruates regularly, and if the axiom be remembered, that a pregnant woman may bleed but does not menstruate, diagnostic mistakes are unlikely to occur.

Pregnancy associated with an Ovarian Cyst or Uterine Fibroid.—Far greater difficulties arise when pregnancy is complicated by the presence of an ovarian cyst, or a patient who already has a uterine fibroid becomes pregnant.

In the case of pregnancy plus an ovarian cyst, the symptom-complex of pregnancy will be present and unaltered. There will, however, be two tumours found in the abdomen, and unless the time has arrived when the positive signs of pregnancy are present, there

may be some difficulty in saying which tumour is the pregnant uterus and which is the ovarian cyst. In any case there should be no difficulty in saying that the patient is pregnant, but the nature of the additional tumour may be obscure. It is only likely to be an ovarian cyst or a fibroid, though naturally there are other abdominal tumours which might complicate pregnancy, such as hydronephrosis, pancreatic cyst, malignant growth of the bowel, and growths of the sacrum or os innominatum. These tumours will have characters of their own which need not be gone into here.

Pregnancy complicated by one or more uterine fibroids may present great difficulties in diagnosis unless the patient was known to have fibroids before. In the latter case the sudden cessation of menstruation and the progressive signs of pregnancy make the diagnosis clear enough. The most difficult case is that in which there is one large fibroid low down in the uterus, previously unsuspected, in addition to the pregnancy.

In such a case the abdominal tumour has peculiar characters, the signs of pregnancy are clear enough, and there may be a solid hard mass to be felt in the lower uterine segment which completely obscures, at least for a time, the actual pregnancy. The continuity of the pelvic mass with the enlarging uterus serves to distinguish it from an ovarian or other extra-uterine tumour.

Distended Bladder.—In certain circumstances the bladder becomes enormously distended along with a pregnant uterus, usually at the third to fourth month when the uterus is retroverted. The signs and symptoms of pregnancy are present, the patient complains of inability to pass urine, or there may be dribbling of urine (distension of the bladder with overflow). The patient may unintentionally mislead concerning the latter, calling it "frequent passing of water". The picture presented by such a case is very characteristic, and the passage of a catheter will at once clear up the diagnosis.

PSEUDOCYESIS

This is the term given to that curious condition of the abdomen which is known as "spurious pregnancy" or "phantom tumour". In such a condition the woman believes herself to be pregnant, usually because she wishes to have a child. It does not necessarily occur in the barren, but may happen to women who have already had children. It is most likely to occur near the menopause, but has been seen in much younger women who wished for a child, and very occasionally in women who wilfully attempt to deceive

their husbands and pretend that they are pregnant. As a rule, however, there is no question whatever of wilful deception; the woman honestly believes that she is pregnant.

The history of such cases may actually point to a possible pregnancy, as there may be amenorrhœa and morning sickness. Both of these symptoms, it must be noted, may be caused by pathological conditions quite apart from pregnancy. There is also no reason why a woman with amenorrhœa at the menopause should not have morning sickness due to some form of dyspepsia.

Usually, however, the history at once shows some discrepancy. Thus it is quite common for pseudocyesis to occur with normal regular menstruation, which at once shows that pregnancy, at all events, is not the cause of the tumour. In other cases one period or more may have been missed, while the patient says and believes that she is seven or more months pregnant. Quickening is often said to have occurred when no pregnancy exists, flatulence and intestinal movements probably accounting for the sensations which are misinterpreted. Breast changes are simulated, by enlargement from the deposition of fat, and painful sensations from chronic lobular mastitis. Thus, leaving out possible discrepancies, the history may be such as quite reasonably to warrant the patient in believing that she is pregnant.

The "phantom tumour" shows itself by enlargement of the abdomen to almost any size. Certainly to look at, some of these abdomens appear to be the size of a full-time pregnancy. The shape, however, is never that of a pregnant uterus as seen through the abdominal walls. It looks more like a uniform distension of the abdomen as if it were blown up with air in the peritoneal cavity. On examination the abdomen is resonant all over and no solid swelling can be felt in it.

On bimanual examination the uterus can be felt, sometimes quite easily, and not enlarged; but in some cases the great distension of the abdomen prevents this. There is, however, no softening of the cervix and no vaginal coloration.

If the uterus can be felt to be not enlarged, the question is settled that the patient is not pregnant. If, however, the uterus cannot be satisfactorily palpated, the question must either be settled on general grounds, and the history and abdominal resonance will generally do this, or an anæsthetic must be given, when the tumour will disappear. If there is much insistence on the part of the patient, it might be advisable for the husband or a relative to be present during the anæsthesia, so that the disappearance of the tumour could be demonstrated.

What then is the cause of the phantom tumour, and why should it disappear under anæsthesia? The tumour is caused by diaphragmatic contraction, pressing down upon the abdominal contents and making them bulge the relaxed abdominal wall forwards. Any woman, or man for that matter, can produce at will a protuberant abdomen, and a woman with relaxed abdominal walls from previous pregnancies can produce an enormous swelling. Under anæsthesia the diaphragmatic contraction gradually relaxes and the abdomen becomes flat and supple.

It might be supposed that this diaphragmatic spasm is really voluntary, but there is no doubt that it is not entirely so. No person could voluntarily keep up such a muscular effort as is required to produce the enormous swellings seen. It is strictly a condition in the same category as hysterical fixation of a joint. An intelligent patient, who can be made to understand the condition, can relax the diaphragm at will and make the abdomen become flat. It is merely a question of natural breathing with the diaphragm, instead of fixation of the diaphragm and costal breathing only.

If nothing we can say or do will convince a woman that she is not pregnant, and this sometimes happens, we can only tell her to wait until the supposed full time of pregnancy. If she is not convinced then she must be considered to be suffering from a delusion.

CHAPTER VII

ANTE-NATAL HYGIENE

NORMAL pregnancy is a physiological condition, and supposing the woman's mode of living to be a healthy one there is no necessity to suggest any alterations in it. It must always be remembered, however, that the various organs of the body are subjected to an increased strain during this period, more particularly in the case of a primigravida, and therefore a pregnant woman may be properly given advice on various matters with a view to increasing her comfort and decreasing the chance of a breakdown. In addition every pregnant woman should be examined when she is seven and a half months pregnant, to determine the presentation of the child, the position of the child, and the relative size of the head and the pelvis. In the case of a primigravida it is safer to make an examination of the pelvis with a view to determining its size when she is first seen.

A primigravida more particularly should be given advice on the following points :—

Dress.—The bands of the petticoats and skirts should not press heavily on the waist; and corsets, if worn, should not press on the nipples, and should be made so that they can be expanded with the progress of the pregnancy. Some women find they are much more comfortable without corsets, and with their petticoats and skirts suspended from the shoulders. This method is indeed ideal, but is taboo to the modern civilized woman. If the woman has a pendulous abdomen, which is not uncommon in multiparæ, a properly fitting abdominal belt should be ordered. As the heart, lungs, liver and kidneys have extra work to perform, anything in the nature of tight clothing which might hamper their action should be avoid If garters are usually worn, suspenders should be substituted for them, and if, in spite of this, the veins of the leg tend to become varicose they should be carefully bandaged. The best material for underclothing is wool.

Diet.—A pregnant woman will require rather more nourishment than when she is not so placed, and in most cases will take it. It is better for her to have meat only once a day, and she should avoid all rich, indigestible and highly-seasoned articles of food in order to decrease the amount of waste products to be excreted. With a view to helping the elimination by the kidneys, she should be encouraged to drink plenty of water. Alcohol is best avoided, and strict moderation must be counselled if the patient insists on taking it.

Exercise.—The natural tendency for a pregnant woman is to rest more than usual, particularly as full time is approaching. This desire must be combated up to a point, since it is essential that the patient should have plenty of fresh air and walking exercise daily, not only to keep her in health during her pregnancy, but also to fit her for the increased muscular efforts that will attend her labour. All exercise of a violent nature, however, should be avoided on account of the risk of miscarriage. Such recreations therefore as tennis, dancing, and riding are best avoided, especially in the earlier months, but croquet, which is very congenial to some women, and short approaching with a mashie may be indulged in.

Especially must exercise of an active nature be avoided during the time the period would normally have appeared, since there is undoubtedly an increased risk of miscarriage at this time. If the patient is accustomed to sea-bathing or swimming, she may be allowed to do so in warm weather with moderation.

If for some reason the woman is unable to take walking exercise, she should, if her circumstances permit, be massaged daily, and go for quiet drives in a carriage or motor-car.

Baths.—For those women to whom such advice is not an impertinence, a daily bath should be ordered. The free use of soap will assist in the elimination of sweat by keeping the skin open. Some pregnant women complain of fatigue after a bath, in which case it is better for them to take it at night, and afterwards to go straight to bed. Special care should be taken to keep the vulva clean.

Regulation of the Bowels.—Constipation is a troublesome complication in most pregnant women. It should, however, be avoided at all costs, since there is no reason to doubt but that the risk of toxæmia of pregnancy is enhanced by constipation. Strong purgatives must be avoided since they are liable to cause a miscarriage.

If by attention to the diet, which should include plenty of vegetables and fresh fruit, a proper and daily evacuation of the bowels can be ensured, well and good; otherwise mild aperients, such as cascara sagrada, liquorice powder, confection of senna or an infusion of senna pods must be prescribed. Paraffin also may be usefully prescribed.

Treatment of the Nipples.—This is discussed on p. 540.

Morning Sickness.—Nausea or a little sickness is so common with primigravidæ that it has come to be regarded by pregnant women as a normal result of their conception. Its treatment is dealt with on p. 140.

Examination of the Urine.—The urine of a pregnant woman should be examined once a month for the first eight months, once a fortnight for the ninth month, and once a week during the tenth month. It is only by careful and repeated examination of the urine that the first indications of pregnancy albuminuria can be detected, and many a woman has lost her life owing to the neglect of this simple precaution. Diminution in the amount of urine passed *per diem* should attract more than a passing notice.

Nervous System.—A pregnant woman should be shielded as far as possible from all worry and excitement. Sleeplessness, which is at times a somewhat troublesome complication, may be treated, if severe enough, with suitable hypnotics; but it will often be found that, if the patient's circumstances will permit, a change of climate or quiet drives in a motor-car will obviate their use. Massage, also, is often useful.

Although it has been the practice in treatises on Midwifery to devote a separate chapter to the subject of the management of pregnancy and ante-natal hygiene, sufficient emphasis has in the past been laid but rarely on the-far reaching importance of this subject. It is for this reason that in the present edition of this book a special article on ante-natal treatment has been included in the hope that this vital subject will be appreciated better both by students and thus in time by the mothers themselves, and will be taken up more scientifically by medical practitioners.

The consideration of but a few facts will demonstrate the importance of this matter from the national point of view. It has been estimated that the number of notified still-births—that is to say, deaths after the 28th week of gestation—is about 3 in every 100

for the whole of England and Wales; this figure ought certainly to be higher because the unnotified cases must also be included. Adopting the moderate estimate of 4 abortions to each still-birth (for some districts this figure is too low), it is probable that the ante-natal deaths are, at the lowest possible estimate, in the proportion of 1 to every 9 births.

When to these figures is added the number of infants who die within their first year, which for England and Wales is 95 per 1000 births, partly as the result of faulty ante-natal conditions, the loss to the nation is seen to be enormous, without taking into account potential loss due to the artificial prevention of conception.

A very large proportion of the dangers to which the unborn babe is exposed during its nine months of intra-uterine life, and of the subsequent risks during its birth are preventible.

Further, many of the risks during childbirth, such as arise from malposition of the fœtus or contracted pelvis, are also avoidable, and can be prevented in many cases by timely interference, thus diminishing the intra-natal fœtal loss as well as the risk of infection and injury to the mother.

These facts cannot be emphasized too strongly, and it must be our aim in ante-natal treatment to spread this knowledge, and to help both the mother and child in order to minimize these dangers as much as possible.

From this standpoint, therefore, ante-natal investigation is to be regarded as a part of preventive medicine, its object being to maintain the mother in health of body and mind, to preserve her pregnancy to term, to avoid difficulty and complication in labour, to ensure the birth of a living and healthy infant, and to help the mother to rear the infant.

It is the duty, therefore, of a medical practitioner, on being asked to undertake a confinement case, to point out the necessity of examining his patient and of keeping her under supervision prior to the actual labour in the interest both of the mother and the child. Any objections that may be raised can be dispelled easily by a few kindly words of explanation, and if, as frequently happens, we can assure the patient that there is no evidence of any abnormality, and that she can expect an uncomplicated confinement, she will feel relieved of anxiety and amply repaid for any inconvenience to which she may have been subjected. If on the other hand some abnormality is found as, for example, in the condition of the urine, the presence of a purulent vaginal discharge, malposition of the fœtus or a contracted pelvis, treatment can be begun at the earliest and most favourable moment so as to avoid a possible disaster later on.

The investigation should be carried out in a systematic manner.

In the first place the history of the patient should be taken. It is important to know whether she has had scarlet fever, rheumatic fever, chorea, or chronic renal disease.

If she has been pregnant before, she should next be questioned with regard to the details of former pregnancies and labours, for these may provide information of the greatest value. For example, a history of repeated abortions or repeated premature labours, especially with dead or macerated fœtuses, will suggest syphilis or chronic renal disease, while a history of albuminuria, œdema, and convulsions will indicate previous toxæmia of pregnancy, and therefore the need for special precautions.

The obstetric history of previous labours is the most important guide as to what is to be expected at subsequent labours. If the patient has had a long labour requiring anæsthesia and instrumental delivery, resulting possibly in the birth of a dead or injured child, or one which has died shortly after birth from intracranial damage, it is extremely probable that she has some pelvic contraction or bony deformity. A history of repeated malpositions in previous pregnancies and labours would also suggest the same condition.

Great importance should also be attached to the knowledge of the child's birth weight, and to the circumference of the fœtal head taken immediately after birth before the moulding has had time to alter, for this is the best guide as to the amount of space in the pelvis and the shape of the bony birth canal.

It is important also to know whether the children were breast or bottle fed, whether they survived, and the cause of death in any that died subsequently. If the patient has been unable after previous labours to nurse her children, or has been able to do so for only a short time, it is often possible in such cases by special attention to ensure the breast feeding of her infant, or avoid failure to continue nursing. If the previous children have died as a result of diarrhœa and vomiting, this may be avoided on a subsequent occasion by educating the mother in the care of her infant, and by supervision of her and her infant after labour.

The history of the present pregnancy should then be investigated, having special regard to the date of her last regular menstrual period and to any abnormal symptoms.

The general examination is then made. The height and development are noted together with the gait and any deformity. The heart and lungs are examined for evidence of disease, and cyanosis or breathlessness are noted. The thyroid is palpated for signs of enlargement, and the eyelids, hands, and ankles are investigated for evidence of œdema. The urine is examined particularly for albumin,

casts, pus and sugar. This examination of the urine must be carried out at frequent and regular intervals (see p. 82), and in cases in which albuminuria is found to occur it must be investigated by other methods (see p. 108).

It is important to remember that the general health of the patient must be raised to the highest possible level, and any condition which tends to reduce this must be guarded against. The teeth are liable to decay during and after pregnancy, and they should therefore be inspected and, if necessary, thoroughly overhauled. Not only is this of importance with regard to the maintenance of general health, but also because septic teeth or gums may form the focus for subsequent infection. Not only the teeth and gums but the tonsils and fauces also need examination. Streptococci may be present.

It is necessary to include in the general examination an estimation of the patient's mental and nervous state. Pregnant women are specially liable to be nervous or to have apprehensions of trouble which can be allayed or even dispelled.

The local examination is then undertaken in the routine way as regards the breasts, abdomen, and pelvis. It has been stated, and justly, that the physician who neglects pelvimetry is comparable with one who attempts to treat pulmonary diseases without the aid of auscultation and percussion. As a general rule external measurements will suffice, but the pelvis should be examined internally if these are smaller than the average, and, even if the measurements are normal, whenever the head does not engage during the last month of a first pregnancy. Pelvimetry alone is not sufficient because it takes no account of the other unknown factor, *i.e.* the size of the fœtal head. What is of greater importance is the proportion between the size of the fœtal head and that of the mother's pelvis, and in this sense the head is the best pelvimeter. We possess no direct means of measuring the child's head. The best method of ascertaining the relative sizes is by Munro Kerr's bimanual method (see p. 425).

A vulval and vaginal inspection should also be made to exclude any abnormal discharge or sores, and as a part of the routine examination in order to prevent puerperal sepsis. A vaginal examination must be made at some time previous to the onset of labour in order to exclude the presence of a cyst or tumour, which, if not detected, might result in an obstructed labour. On making a vaginal examination during pregnancy the same strict antiseptic technique must be observed as for an abdominal operation, or as is undertaken at the time of delivery, for neglect to use such precautions might give rise to infection of the birth canal, and if labour came on shortly after might give rise to puerperal infection.

The patient ought also to be advised to notify her doctor at once should any of the following conditions arise :—

1. Scanty micturition.
2. Persistent headache.
3. Disturbance of vision.
4. Swelling of the face or ankles.
5. Bleeding.

In addition much national good can and is already being effected by the holding of instructional classes in ante-natal hygiene for prospective mothers, especially in the case of those who are pregnant for the first time.

This instruction might well include, in addition to advice on the management of normal pregnancy (see p. 80), such other matters as the importance of personal hygiene in all its branches, and the preparation of the home both for the mother and the infant. Possibilities will thus be given for emphasizing the enormous importance of the effect of sanitation and proper ventilation on the health of the mother during her pregnancy. She should also be taught the advantage of breast feeding, and how to manage the newly born child.

ABNORMAL PREGNANCY

CHAPTER VIII

THE PRESSURE SYMPTOMS OF PREGNANCY

1. Varicose Veins.
2. Hæmorrhoids.
3. Œdema.
4. Cramp.
5. Frequency of Micturition.

1. Varicose Veins.—A varicose condition of the veins of the legs is liable to occur during pregnancy. It is more frequent in women who have already born several children, and occurs usually in the later months of pregnancy. The varicosity may extend up the thighs (Fig. 30), and may involve the veins of the vulva so that the labia majora are much enlarged and swollen. The extent of the varicose condition is sometimes extreme, as is well illustrated in Fig. 31. The varicose veins are due to obstruction of the venous return from the distal portion of the limbs, the obstruction being caused by the pressure of the pregnant uterus upon the iliac veins at the brim of the true pelvis.

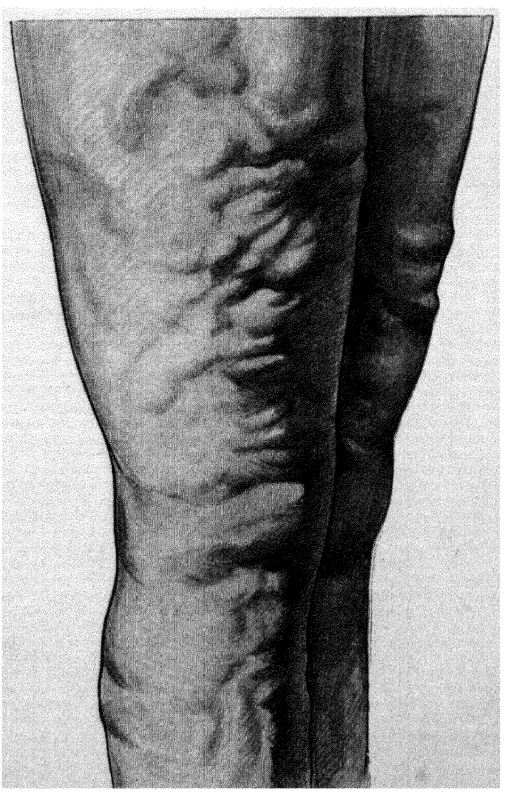


FIG. 30.—VARICOSE VEINS OF THE LEG.

No operative treatment is to be advised for the condition while the patient is pregnant. She should rest with her legs up and wear supporting bandages.

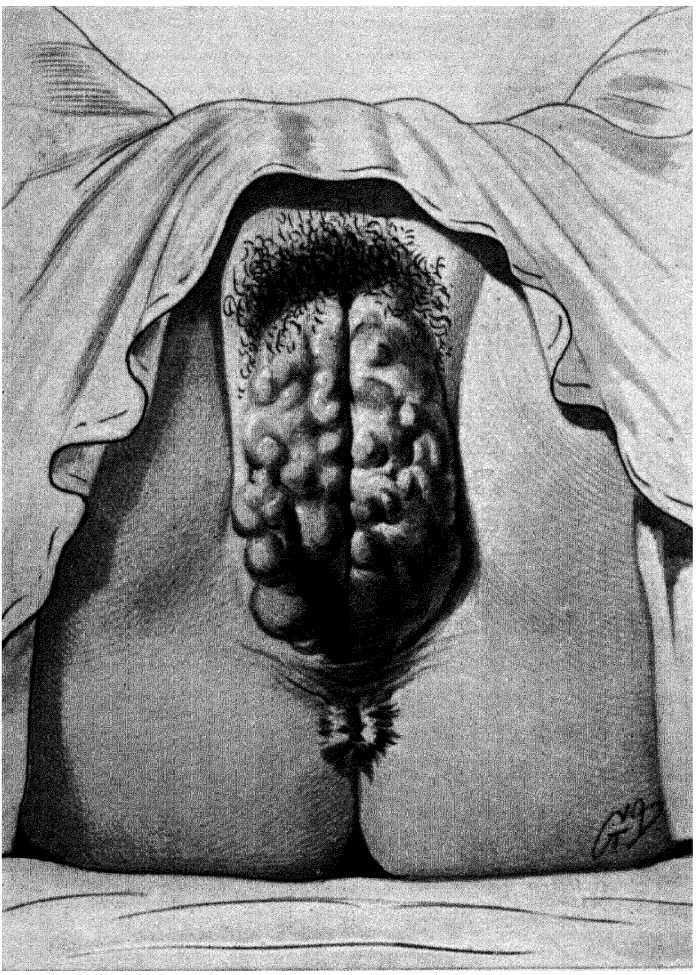


FIG. 31.—VARICOSE VEINS OF THE VULVA.

A drawing from a case of unusual severity.

2. **Hæmorrhoids.**—Hæmorrhoids may first appear during the pregnancy, or may become worse owing to the increased venous pressure due to pregnancy.

During pregnancy hæmorrhage and inflammation are more likely to occur. During the puerperium, and especially if the perineum has been lacerated, any hæmorrhoids present may become acutely inflamed and cause great distress.

A thorough and daily action of the bowels must be ensured,

mild aperients being given, since strong ones are apt to cause a miscarriage.

Locally the parts should be kept very clean and regularly swabbed with boric lotion. Any prolapsed hæmorrhoids should be reduced above the sphincter.

If the hæmorrhoids become inflamed, the patient should be kept in bed and hot fomentations applied to them. If they bleed, every attempt should be made to arrest the hæmorrhage by the application of hamamelis and hazeline, or adrenalin in the form of ointment or suppositories, since their surgical removal, unless this should prove an absolute necessity, is strongly contra-indicated on account of the severe bleeding which may result and the risk of producing abortion.

After the pregnancy has terminated the condition improves.

3. **Œdema.**—Slight œdema of the legs not infrequently occurs towards the later weeks of pregnancy. It may be demonstrated best as a pitting on pressure upon the inner side of the leg near the ankle, but the condition may also involve the thighs and the lower part of the abdominal wall.

The cause is the pressure of the pregnant uterus upon the veins and lymphatics at the brim of the pelvis, thus giving rise to an obstruction to the lymphatic return, possibly aggravated by the hydræmic condition of the blood (see p. 53). The condition is therefore more marked if the uterus is unduly large, as in cases of hydramnios or multiple pregnancy. The œdema may also involve the thighs. Although, however, some œdema is not an unusual feature towards the end of pregnancy, it is necessary to bear in mind that there are other and more important causes which must be included. These are œdema due to

Heart failure.
Toxic albuminuria of pregnancy.
Eclampsia.
Chronic Bright's disease.
Pelvic tumours complicating the pregnancy.

4. **Cramp.**—Cramp in the muscles of the legs is often present during the last weeks of pregnancy. It may occur either during exercise or spontaneously when the patient is lying down. The muscles usually affected are the calf muscles, and sometimes the muscles at the back of the thigh.

It is probably due to pressure upon the nerves of the lumbo-sacral plexus as a result of the gradual sinking down of the fœtal

head which takes place towards the end of pregnancy. The best treatment is to stretch the cramped calf muscles, by extending the leg at the knee and forcibly extending the feet (dorsal extension), and to massage them.

5. **Frequency of Micturition.**—Some frequency of micturition may be noticed during the early months of pregnancy, and again during the last few weeks. Early in pregnancy it is due partly to the pressure of the enlarged and heavier uterus. This pressure is the more marked because the enlarged body during this early stage of the pregnancy is more anteflexed, and therefore comes to lie upon the bladder. Frequency of micturition again occurs at the end of pregnancy owing to the sinking down of the fœtal head which takes place at this time as the lower uterine segment softens and relaxes.

The patient must not try to relieve her symptoms by reducing the amount of fluid she is accustomed to take, but rather she should drink plenty of water.

CHAPTER IX

THE TOXÆMIAS OF PREGNANCY

Introduction

Pregnancy is essentially a physiological condition. But although it is not a disease and is to be regarded as a normal function of the body, it differs from other physiological functions in that it is carried out for the benefit of the race and not the individual, and the boundary between what is physiological and what is pathological is ill defined. Thus, vomiting during the early months occurs so commonly that it is looked upon as a normal phenomenon, yet all gradations of vomiting occur, and probably even in its milder degrees, as undoubtedly in its severer forms, it is the result of a pathological process, *i.e.* a toxæmia. Fat, nitrogen and water are retained in considerable quantity, especially towards the termination of pregnancy; the amount of nitrogen excreted as urea is diminished, while there is an increase in the nitrogen excreted as ammonia compounds and as undetermined nitrogen; the urine contains less chlorides, while it may contain small amounts of acetone and glucose, even in a pregnancy, which otherwise pursues a normal course. Moreover, it is probable that the maternal excretory organs have an extra strain put upon them in that they have to eliminate the products of fœtal metabolism as well as the maternal. Indeed, the local and general changes which take place in the maternal organism, as the result of gestation, are so marked that by many the fœtus is looked upon as a parasite.

The pregnant woman is exposed to many risks, some of them serious, due to her condition entirely, and to others which may be regarded as accidental complications only and may have existed before the pregnancy began.

The pathology of pregnancy, as our knowledge has increased, has therefore come to assume large proportions, including not only morbid conditions of the mother but also those of the ovum. It is necessary, therefore, to adopt some classification in order to simplify the study of the subject.

Classification

The affections of pregnancy may be divided into two main groups :—

1. Diseases due to the Pregnancy.

In this group are those conditions which are brought about by the pregnancy, which is the essential factor in their causation, examples being the toxæmias of pregnancy, and hydatidiform mole.

2. Diseases associated with the Pregnancy.

In this group are conditions which may have arisen in the course of the pregnancy, but which are not the result of the pregnancy; they may have existed before the gestation began, and have been made worse after its onset. Examples of this group are such diseases as acute specific fevers, tuberculosis, cardiac disease, chronic renal disease, and most of those mentioned under the Pressure Symptoms of Pregnancy.

DISEASES DUE TO PREGNANCY

The Toxæmias of Pregnancy.—Under the heading of the toxæmias of pregnancy a group of diseases will be discussed the causation of which is obscure, though they are regarded as toxic in origin.

It is believed that the clinical manifestations of this toxæmia may vary in nature and severity according to the variety, amount, and rapidity of production of the toxin. Many of the minor ailments of pregnancy, such as morning vomiting, nausea, salivation, pruritus, and neuralgia, which are commonly grouped together under the term "reflex disorders," are in all probability also of toxic origin, as well as more serious conditions such as neuritis and insanity.

Certain well-marked diseases are regarded as definitely toxic, *i.e.*—

Hyperemesis gravidarum.
The Pregnancy Kidney.
Eclampsia
Icterus gravis gravidarum.

It must be remembered that in some patients these conditions are not clearly marked off from one another, and the pathological lesions found post-mortem are similar. It may be, therefore, that there is only one toxin or more than one toxin responsible for the toxæmia, and that the different toxins may under certain conditions affect chiefly the liver, and under others the kidneys.

The Toxæmic Theory.—This theory is based upon the work of Bouchard, who in 1887 drew attention to the possibility that certain diseases of pregnancy were due to auto-intoxication. The theory supposes that in health the body contains various toxic substances derived partly from the processes of digestion and tissue metabolism or ingested with the food. These waste products are normally disposed of either by excretion through the kidneys, intestines and skin, or are transformed into non-poisonous substances by means of the liver.

If the woman becomes pregnant, an excess of waste products is produced, for the maternal organism has now, in addition to the excess of waste products derived from the changes in her own metabolism during pregnancy, to eliminate those derived from the ovum and the enlarging uterus.

In order to cope with this extra amount of waste material it is necessary that the maternal organs should maintain their functional activity, or even increase it above what is ordinarily required of them.

If therefore toxins are produced in excessive amount, or if they are not excreted rapidly enough, a condition of toxæmia or auto-intoxication will result.

The theory of a toxæmia during pregnancy is based upon assumption, but although it is not a proved fact, and although the toxins have not been isolated as yet with precision, and their composition, their modes of action, and the sites of their formation are still unknown, the evidence accumulated from experimental research and from pathological and clinical observations, points to the conclusion that many diseases of the pregnant woman are due to the presence of a toxin or toxins circulating in her blood.

Some of this evidence may be mentioned as follows:—

It is known that lesions, similar to those found in the disorders included under the term "toxæmia of pregnancy," can be produced by the absorption of certain substances known to be toxic in nature. Thus lesions in the liver very similar to those found in icterus gravis gravidarum may be caused by poisoning with chloroform or phosphorus; and kidney lesions resembling those of eclampsia by cantharides or phosphorus. Further, in cases of death from snake-bite the liver and kidneys show the same changes as in eclampsia, and it is known that snake-venom contains toxic substances. Death may occur from a known auto-intoxication in women quite apart from pregnancy and also in men; a post-mortem examination of the kidneys of such patients shows appearances almost identical with those seen in eclampsia.

From the clinical point of view the theory is supported by the

fact that severe cases of vomiting during pregnancy may be associated with paralysis, and similar paralysis occur as the result of the absorption of toxic drugs.

The following case is of interest from this point of view. A post-mortem examination was made upon a pregnant woman who had suffered from severe vomiting and multiple neuritis. Degenerative changes were found in the liver and kidneys and also in the nerve trunks; the wide distribution of the lesions suggests the presence of a poison circulating in the blood-stream.

The recent investigations which have been carried out upon dead infants born of eclamptic mothers show that the lesions are not confined to the mother, but that similar changes may be found within the liver and kidneys of the fœtus, pointing to the probability that they are due to a toxin which has passed from the mother to the fœtus.

Mention may also be made as to the character of the lesions no less than to their wide distribution. The changes in the tissues are not those of inflammation, but of degeneration and necrosis, and are similar to lesions produced by chemical poisons.

The experimental work of many investigators has shown in some instances that the blood of women suffering from eclampsia is highly toxic to animals. It has also been shown that the urotoxic dose is larger, that is, the amount of urine which injected into an animal is required to kill it. These observations tend to support the theory, for they show that there are less toxic substances excreted in the urine, but an accumulation within the blood of these toxic substances in cases of eclampsia. An objection to these experiments is the fact that the injection of blood serum into an animal of another series is usually followed by reaction such as hæmolysis and agglutination. To overcome this, rabbits have been immunized to normal human serum before the blood from eclamptic women was injected into their circulation; none of these animals had convulsions, but characteristic lesions were found in the kidneys and liver.

Origin and Nature of the Toxins.—Granted the existence of a toxæmia during pregnancy it becomes necessary to investigate the source from which these toxins are derived, their nature, and their mode of action. A number of theories have been advanced from time to time, many of which have no sound basis and therefore will not be discussed.

The subject is far from being settled at the present time, but two views require consideration.

The Maternal Theory.—(*a*) The view has been brought forward that the toxin is derived from disturbances of the maternal metabolism.

Normal pregnancy, as has been mentioned already, is attended by marked alterations in the maternal metabolism.

It must be clearly borne in mind, however, that the normal physiological activity of the various structures and organs of the body produces toxic material, which should be got rid of by the kidneys after it has been altered and rendered innocuous by the liver.

(*b*) It has been suggested that the toxins are produced in the intestine during digestion. In many cases, especially those of marked toxæmia such as eclampsia, the most obvious anatomical lesions are found in the liver, and are situated around the portal vessels and at the periphery of the lobules. Now, it will be remembered that the blood from the intestinal tract is carried by means of the portal system to the liver, so that the toxins reaching the liver from the intestines would affect mainly the outer zone of the lobules. Clinically also it has been found that constipation is associated with an increase in the symptoms of toxæmia, which are often relieved by free purgation. Further, it has been shown that the intestinal contents of toxæmic patients are more toxic to animals than are those of normal women; and that the urine, in addition to the changes in the amount of urea and total nitrogen excreted and in the ammonia-coefficient, shows the presence of such substances as urotoxyl, skatoxyl, aromatic sulphates, phenols, and sarcolactic acid. Founded on this last observation, an attempt has been made to attribute the toxin of eclampsia to the presence of lactic acid, for in this condition the acid has been demonstrated within the cerebro-spinal fluid as well as the urine. This view must be received with caution, however, for the lactic acid may be only the result of the muscular action incident to the convulsive movements.

(*c*) The relation between the ductless glands and metabolism has led some observers to assume that the toxæmia may result from thyroid insufficiency, and thyroid extract has been recommended in the treatment of eclampsia. Enlargement of the thyroid is known to occur in normal pregnancy, and it is supposed that it indicates an increased functional activity, the absence of which predisposes to a condition of toxæmia (see p. 59).

The Ovular Theory.—A great deal of research has been undertaken from which there is some evidence that the toxin may be derived from some part of the ovum.

The fœtus itself cannot be the source, for the pregnancy kidney

and eclampsia occur sometimes in connection with a vesicular mole, in which condition there is no fœtus as a rule, and eclampsia occasionally develops at a considerable interval after the death of the fœtus or during the puerperium.

The marked proliferation of the coverings of the chorionic villi, *i.e.* the syncytium and Langhans' cells, in cases of hydatidiform mole, suggests rather that the toxin is derived from these coverings than from the fœtus. Other evidence in favour of this may be brought forward. It is definitely known that these coverings, or more rarely, whole villi, pass into the maternal circulation, and post-mortem examination of the viscera of women who have died during pregnancy has proved their deposition as emboli in the pulmonary and other capillaries. These chorionic emboli have been shown to occur in unusually large numbers in cases of eclampsia.

The anatomical relations of the placenta are such as to bring the chorionic villi into close relation with the maternal blood-stream. Further, it is known that the placenta contains many ferments, and within the placentæ of eclamptic patients chemical changes have been found which point to an increase of ferment activity. The injection of placental extract derived from both eclamptic and normal women has produced in animals conditions similar to eclampsia.

According to some observers, the presence of chorionic elements in the blood leads to the formation of specific antibodies which have been called syncytio-lysin. They regard the cells derived from the placenta as toxic in nature, and believe that a condition of toxæmia will result if an insufficient amount of syncytio-lysin is present in the maternal serum to antagonize it. Normally an antibody is produced which can destroy the syncytio-toxins, and failure to produce this antibody results in toxæmia. Other observers come to similar conclusions, but hold, on the contrary, that the toxæmia results not from an insufficiency but from an over-production of the syncytio-lysins, or that by the action of syncytio-lysins upon the chorionic cells syncytio-toxins are produced.

Recent research has resulted in so much evidence which is contradictory that it is impossible in the present state of our knowledge to decide whether the toxæmia has its source within the placenta or in some profound metabolic disturbance within the mother. On the whole the known facts tend to confirm the view that the toxæmia of pregnancy is not due to an auto-intoxication, and to show that the toxic substances which have been isolated and regarded as the cause of the toxæmia are not really the cause.

The subject is at present obscure, but the most probable theory is

that the toxæmia results from the passage into the maternal circulation of ferments and autolytic products from the placenta.

With regard to the mode of action, it is generally accepted that the cause of the toxic albuminuria found in cases of "the pregnancy kidney" is the degenerative changes in the renal epithelium. The first step is an anæmia of the cells from an arterial spasm produced by the toxin circulating in the blood. On account of the degenerative changes shown by the passage of albumin and casts, the functional activity of the kidney is impaired, and this in turn leads to an aggravation of the morbid condition of the maternal blood.[1] The accompanying anæmia and œdema can also be explained by the toxic condition of the blood, and the occasional death of the fœtus *in utero* may be attributed to the same cause. The eclamptic condition when it supervenes upon toxic albuminuria is regarded as the result of an increase in the toxic state of the blood which produces the characteristic lesions of the liver. This view explains the clinical association between toxic albuminuria and eclampsia which undoubtedly exists in some cases. In other instances the kidneys of eclamptics show no recognizable changes, nor has there been any preceding albuminuria; in these it is the liver which is the seat of marked changes. Such cases are known as eclampsia of the hepatic type in contradistinction to that of the renal type; in them the toxin affects the liver mainly, and the kidneys are only secondarily affected in the process of excretion of toxins and the products of the liver metabolism.

Some interesting experiments have been made recently which throw light upon the mode of production of the degenerative changes within the liver and kidneys. They showed that the injection of hæmolytic and agglutinative sera into dogs and rabbits produced changes in these organs similar to those of eclampsia, and it was found that thrombosis and destruction of red blood-corpuscles occurred in the hepatic capillaries after the injection of sera just as in eclampsia. They also demonstrated that the characteristic lesions seen in the eclamptic liver, *i.e.* degeneration and necrosis, depended upon the type of toxin. Preponderance of the hæmolytic toxin produced much degeneration and little necrosis, while the converse was the case if the agglutinative toxin was in excess. It has already been mentioned that lesions similar to those of eclampsia are found in the liver and kidney of patients who die from the result of snake-bite, and the poison in this instance contains hæmolytic and agglutinative toxins.

[1] For a description of the clinical tests for renal efficiency, see page 109.

CHAPTER X

THE TOXÆMIAS OF PREGNANCY (*continued*)

In this chapter reference will be made to the total nitrogen excreted in the urine, the amount of urea and the ammonia-coefficient with their variations in the toxæmias of pregnancy. Acidosis will also be discussed.

It is hoped that a brief review of the manner in which nitrogen is excreted from the normal body and of the oxidation of fats, followed by a statement of the modifications in disease, may help to make plainer to the student the meaning and importance, from the point of view of midwifery, of this complicated subject.

NORMAL PROTEID METABOLISM

The protein that is taken in with the food is converted by digestive processes, first into proteoses and peptones and then into amino-acids.

Of these amino-acids a portion is resynthetized and used to replace protein waste in the tissues; a small portion is converted into oxy-butyric and diacetic acid, and the remainder is converted straight away into ammonia, carbon dioxide and water. The carbon dioxide is excreted by the lungs, the water by the kidneys. Most of the ammonia is converted by the liver into urea, the rest being used to neutralize the mineral acids (sulphuric, hydrochloric, phosphoric) and the fatty acids (oxy-butyric and diacetic) which in the latter case appear if there is a deficient carbohydrate diet, so maintaining the normal alkalinity of the blood and thus preventing their toxic effects.

The resynthetized protein is broken down by the body activities into a number of nitrogen bodies, and these, together with the urea already mentioned and ammonia bases, are excreted in the following forms and proportions :—

Taking the Total Nitrogen in the Urine as 100

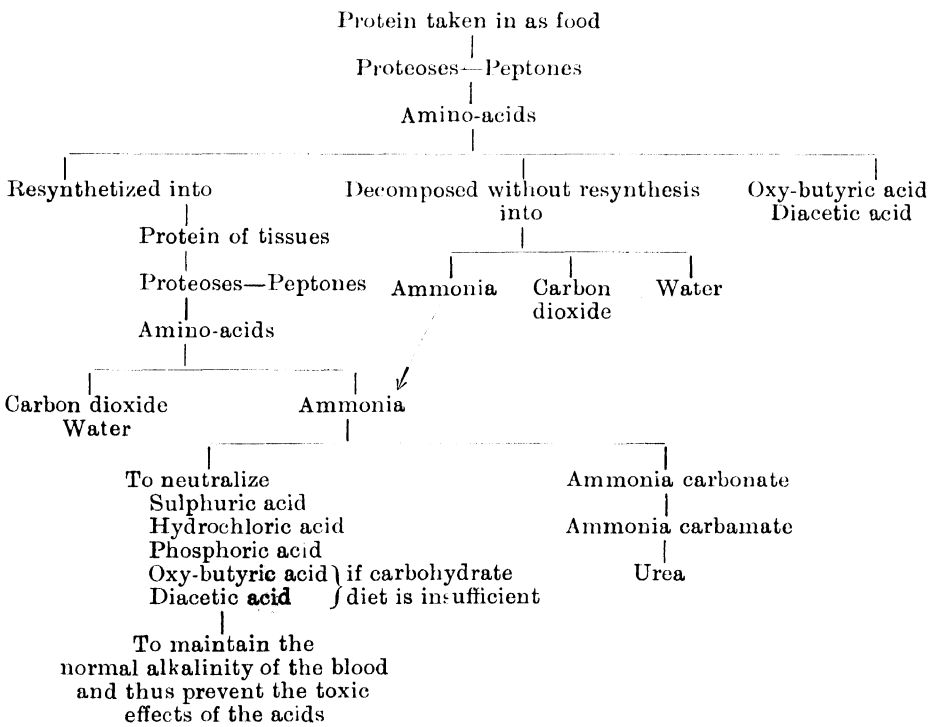
Urea	85 to 90 per cent.
Ammonia salts	3 „ 5 „ „
Creatinin	3 „ 5 „ „
Uric acid	1 „ 5 „ „
Undetermined nitrogen	3 „ 5 „ „

In the above table the undetermined nitrogen includes a small amount of nitrogen in the form of amino-acids and pigment; the remainder includes the nitrogen, the exact combination of which cannot be determined, after the other forms mentioned, which are readily estimated, have been subtracted from the total nitrogen excreted.

It will therefore be seen that the ultimate destruction of the nitrogen is as follows:—

1. Excreted in various combinations in the urine.
2. To maintain the normal alkalinity of the blood, and thus
3. To neutralize the toxic acids.

TABLE REPRESENTING PROTEIN METABOLISM

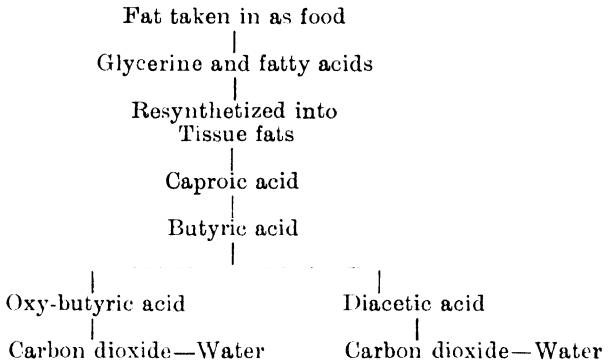


NORMAL METABOLISM OF FAT

The fats of the food are converted by the processes of digestion into fatty acids and glycerine. These are absorbed and built up again into the tissue fats of the body.

These tissue fats, in their turn, are oxidized into the lower fatty acids and finally to carbon dioxide and water, which are excreted by the lungs and kidneys respectively.

TABLE SHOWING FAT METABOLISM



TOXÆMIA

As has been shown the body normally metabolizes proteins in such a manner that approximately 85 to 90 per cent. of the total nitrogen resulting is set free in the blood in the form of urea, the remaining 15 to 20 per cent. being in other forms of nitrogen.

In the various toxæmias of pregnancy and in some other diseases, the normal metabolism of the proteins, and therefore the forms in which the nitrogen is excreted are altered, as is also the normal metabolism of the fats which stops short at the production of oxy-butyric acid, diacetic acid and acetone. Thus:—

1. More nitrogen is excreted as ammonia salts at the expense of the amount excreted as urea; the ammonia being used to neutralize the toxic effects of the circulating acids, particularly the oxy-butyric and diacetic acids, with a resulting depletion of the alkaline bases.

2. The damage to the kidney epithelium by the circulating acids diminishes the selective action of the kidney and so prevents the normal excretion of the nitrogen.

3. Diacetic and oxy-butyric acids are not further oxidized but circulate through the body and act as poisons, a portion of them being excreted by the lungs and kidneys.

4. The acetone is chiefly formed by oxidation of the diacetic acid in the urine after the latter has reached the bladder, a small amount only being found in the blood and this is excreted by the lungs.

It will thus be seen that acetonuria is a misnomer and that the condition should be called diaceturia.

Thus a condition of acidosis results, acidosis being a condition in which the body has to deal with abnormally large amounts of acid.

ACIDOSIS

This is essentially the result of a complete carbohydrate starvation, because all stored-up glycogen in the liver and tissues has been used. As a result of the deficiency of circulating carbohydrate, fat from the tissues has to be oxidized so rapidly, that the process is incomplete and consequently the three substances above mentioned appear in the urine. In its simplest form therefore it occurs in cases of actual starvation from any cause, such as in cases of gastric ulcer or carcinoma, stricture of the œsophagus, intestinal obstruction, diarrhœa and vomiting in infants, as well as in excessive or pernicious vomiting of pregnancy and sometimes in eclampsia and uræmia. It is particularly, however, in diabetes mellitus that acidosis is most commonly seen, and constitutes a grave feature of the case. When acetone appears in the urine in a case of diabetes, the patient is in some danger of the supervention of coma. Surgical anæsthesia, whether induced by chloroform or ether anæsthesia, is often followed by acetonuria, because the patient is starved beforehand and may vomit afterwards. Whereas, however, the diaceturia in most of such cases is transient, slight and of little importance, it may be progressively increasing, of the gravest significance and constitutes the chief symptom of delayed chloroform poisoning. In such a case the diaceturia must be a symptom of a total failure of the hepatic metabolism and not merely the result of a transitory carbohydrate starvation. The appearance of the liver tissue in delayed chloroform poisoning is closely allied to that seen in eclampsia and acute yellow atrophy, and the gross changes present indicate a serious disorganization of the liver tissues themselves as well as of the hepatic functions.

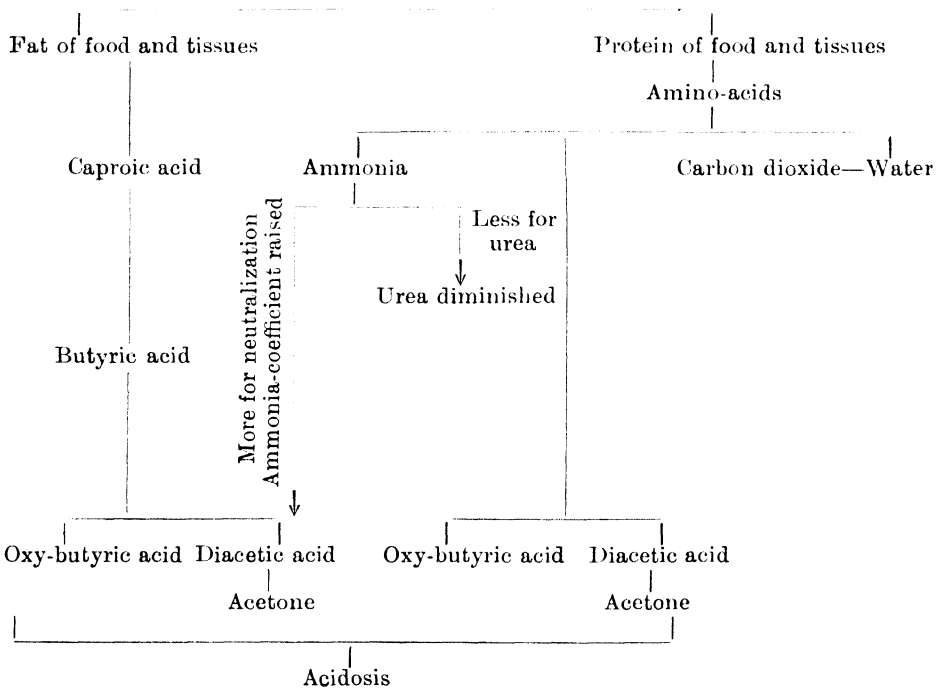
Thus from the obstetric point of view "acidosis" is the term used for the general condition of the patient in pernicious vomiting of pregnancy, eclampsia and acute yellow atrophy, and may also occur in cases in which chloroform has been used for many hours during labour. In these obstetric cases it is of the gravest import and often precedes a fatal termination. The one indication for treatment of the condition of acidosis itself, apart from the obstetric cause, is to supply the patient with carbohydrate by the mouth, rectum or intravenously, and to neutralize the acid blood condition by bicarbonate of soda. Glucose in the form of a 15 per cent. solution should be given per rectum, ℥ xv. to ℥ xx. being slowly infused every four hours.

Dextrose solution, 6 per cent., may be administered intravenously up to three pints. Bicarbonate of soda may be given by the mouth in large quantities, or as a 3 per cent. solution may be infused intravenously. The amount of bicarbonate of soda given must be that quantity which is sufficient to render the urine alkaline.

In acidosis a greater proportion of the ammonia derived from the broken-down proteins and which would normally be converted into urea is required for the neutralization of the circulating acids. Consequently there is less ammonia to be converted into urea so that the amount of urea excreted in the urine is much less than normal.

On the other hand more of the ammonia will appear in the urine as ammonia salts resulting from the neutralization of the acids.

TABLE SHOWING METABOLISM IN TOXÆMIA



Thus it will be seen that there are two factors in the alteration from the normal :—

1. **Alterations of the proportions of nitrogen** which are due to the action of toxins on the metabolism of proteins, *e.g.* :—

(*a*) Excretion of a large proportion as ammonia salts and less as urea in eclampsia, due probably to the formation of acid in the body.

(*b*) Excretion of increased amounts of amino-acids in acute yellow atrophy of the liver. These amino-acids arising from proteins are in

the normal body converted by the liver cells into urea. In acute yellow atrophy, however, they are excreted unchanged owing to the marked destruction of liver cells in this disease.

2. **Retention of nitrogen** in the blood, due to damage to the renal cells. It is claimed by some observers that the amount of urea is affected first, *i.e.* the proportion of the nitrogen present as urea in the blood, rises before the total nitrogen.

This renders the estimation of urea in the blood the most useful index of damage to the renal cells that we possess. This estimation must be made subsequent to the lapse of a long interval, at least four hours, after a meal.

The estimation of the excretion of nitrogen in the urine is more difficult to interpret as it is much more influenced by the food intake.

Thus it will be seen that there are four main alterations which occur in nitrogen metabolism during pregnancy and the disorders of pregnancy :—

1. Alteration in the ammonia-coefficient, *i.e.* the ratio of nitrogen excreted as ammonia to the nitrogen excreted as urea. Normally this is between 3 to 5 per cent., whereas in acute yellow atrophy, eclampsia and toxic pernicious vomiting it is markedly raised and may be as high as 30 to 50 per cent.

Similar changes take place during starvation and in diseases associated with severe vomiting but not to so marked a degree. Thus in the neurotic vomiting of pregnancy, the ammonia-coefficient does not rise beyond 10 per cent., and the effect upon it of treatment varies markedly in the two conditions, for it persists at a high degree if the cause is toxic, but falls rapidly in the neurotic form. A high ammonia-coefficient is usually accompanied by the presence of diacetic acid in the urine.

2. The increase in the amount of amino-acids excreted as such in the urine in acute yellow atrophy—an index of the impaired activity of the liver cells.

3. The appearance of creatin as well as creatinin during pregnancy. The significance of this is obscure.

4. The increase in the amount of nitrogen in the blood which has already been mentioned.

It is possible that the combination of nitrogen or urea in the blood will give much valuable information as to the onset and progress of those toxæmias of pregnancy in which the kidney is damaged, and that it may give earlier information than can be obtained from examinations upon the urine.

CHAPTER XI

ALBUMINURIA AND PREGNANCY

ALBUMINURIA is a symptom and is not of itself a disease.

The presence of albumin in the urine does not necessarily indicate that the kidneys are affected, but it does point to the probability that this is the case, and it is not infrequently an early warning of the possibility of grave complications. Hence the urine must be repeatedly examined during pregnancy, and if albumin is found further investigation and often prolonged observation should follow.

Albuminuria is stated to occur in about 5 per cent. of all pregnant women.

The Tests Employed :—

(*a*) The ordinary method by means of acetic acid and boiling.

(*b*) The cold acetic method: to 10 c.c. of urine the addition of 6 drops of 33 per cent. cold acetic acid gives an immediate white cloud.

(*c*) The distilled water test of Roberts.

(*d*) The salicyl sulphonic acid test: add 6 drops of a 40 per cent. solution to 5 c.c. urine, when a white cloud appears.

This test is the most delicate and certain.

When albuminuria is suspected care must be taken to confirm the evidence of its presence in a catheter specimen of the urine, and also to exclude the presence of mucin as this substance will also give a cloud with acetic acid, but the addition of NaOH will cause it to disappear.

THE SIGNIFICANCE OF ALBUMINURIA

If the presence of protein in the urine has been established the next step is to consider in what conditions this complication may occur.

Two groups are usually described.

One is the group in which the kidneys have been previously damaged or diseased, and have broken down afresh as a result of the

extra strain placed upon them during pregnancy. They were able to carry out their functions under normal conditions, but cannot function sufficiently when the waste products from the fœtal as well as the maternal organism have to be eliminated. This group is to be looked upon, not as due to the pregnancy, but as made worse by the supervention of pregnancy. This group is illustrated by chronic nephritis.

In the other group there has been no previous kidney lesion, and the condition is solely due to the pregnancy and labour. In a series of 3780 labours the urine was found to contain protein in 469 cases without other symptoms or signs. Whether the condition is altogether due to labour is not certain as these figures may contain examples of the very mildest cases of chronic nephritis. Recent investigations have shown that in a certain proportion of these patients the albuminuria does not clear up after labour, but it does so in most cases. Whether the albuminuria is present because of the pressure on the ureters or renal veins is not known, but in some cases the albuminuria first appears when the intra-abdominal pressure is greatest and disappears after the birth of the child. It is stated also to be more common in patients in whom the intra-abdominal pressure is greater than usual, *i.e.* hydramnios and twin pregnancy.

Albuminuria is also more frequent in pregnancies complicated by vesicular mole and accidental hæmorrhage. It is known that in these conditions toxæmic symptoms are likely to be present, and accidental hæmorrhage is by many observers regarded as a manifestation of the toxæmia of pregnancy.

Apart from these conditions albuminuria may occur in either the toxic albuminuria of pregnancy (the pregnancy kidney or pre-eclamptic toxæmia) or in eclampsia and acute yellow atrophy.

Classification of Albuminuria and Pregnancy.—The following classification may therefore be attempted:—

Group i. Albuminuria *associated* with pregnancy,
e.g. Chronic interstitial and chronic parenchymatous nephritis, pyelitis and cystitis. Morbus cordis.

Group ii. Albuminuria *due to* the pregnancy:—
(*a*) That in which there are no other symptoms and signs,—simple albuminuria.
(*b*) Accompanying hydramnios and twins.
(*c*) Accompanying accidental hæmorrhage and vesicular mole.

(*d*) Toxic albuminuria (pre-eclamptic toxæmia) which may be further sub-divided into—
  (1) Cases with no special risk of eclampsia.
  (2) Cases with special risk of eclampsia.
(*e*) Eclampsia.
(*f*) Acute yellow atrophy.

Of all the conditions enumerated above two only give rise to difficulty both as regards their differentiation and prognosis, *i.e.* (*a*) albuminuria due to chronic nephritis, and (*b*) albuminuria due to toxæmia of pregnancy.

The practical importance of differentiating between these two conditions lies in the fact that in chronic nephritis the albuminuria tends to occur early in pregnancy, the damage to the kidney is permanent, made worse by a succeeding pregnancy, and albuminuric retinitis common, while abortion or death of the fœtus *in utero* frequently accompanies the condition; in the toxæmia of pregnancy the albuminuria occurs later in pregnancy, may cause no permanent damage, and does not necessarily recur in another pregnancy, while the eye changes are due mainly to œdema and are temporary.

There should be therefore less compunction in the termination of pregnancy when complicated by chronic nephritis than when the complication is due to toxæmia of pregnancy.

The differentiation, however, between these two groups is often a matter of great difficulty and on clinical grounds alone it may not be possible to tell to which group the patient belongs. The symptoms of the two groups may show considerable overlapping so that the patient may present some of the features of both groups and not be typical of either. A possible explanation is that toxæmia of pregnancy may develop in a patient who is already the subject of chronic nephritis.

Recent research has shown that by means of various laboratory methods of examination the differentiation may be considerably facilitated.

Laboratory Methods

The Urine.

(*a*) *Urinary Proteins.*—The amount of protein in the urine is not of itself an index of the severity of the condition. It is necessary to know not only the amount of protein but the variety. The protein may occur either as albumin or globulin. In chronic nephritis and pregnancy there is a relatively greater proportion of albumin than globulin; in toxæmia of pregnancy there is a relatively larger amount of globulin. The ratio of albumin to globulin is about 6 to 1 in chronic nephritis, and about 2 to 1 in toxæmia.

(*b*) *Diastase.*—The number of c.c. of 1 per cent. solution of starch which ordinary urine will digest in half an hour at 37° C. is 20 c.c. This is taken as the standard. Variations are normally 10 to 33·3 c.c.

A 24 hours' specimen is usually taken, and should be examined as soon as possible: if delay is unavoidable, the urine may be preserved by the addition of a few drops of toluol.

In toxæmia of pregnancy striking divergences from the normal up to 50, 100, or even 1000 c.c. may occur. Apart from diseases of the pancreas, the toxæmia of pregnancy is the only condition in which diastase is so high. Attempts, however, to incriminate the pancreas fail, because, whereas in pancreatic disease the blood diastase is increased, this is not so in toxæmia. The explanation, therefore, is that no excess of diastase is formed in the blood, but that it is leaking through the kidney, owing to damage either of the glomeruli or tubules. The amount of diastase in the urine is, therefore, an index of the extent of the damage. In chronic nephritis and pregnancy the diastase content of the blood is increased, while the amount in the urine is less.

Though the diastatic reaction is not constant, it is of some value in the differential diagnosis.

(*c*) *Urea Concentration.*—The patient having emptied the bladder, is told to drink 100 c.c. of fluid containing 15 grams urea. Collect the total urine after 1 hour, and again after 2 hours. The percentage of urea in these two specimens should exceed 2·5 per cent., and the volume of urine in the second specimen should be less than 150 c.c. A concentration below this, or a volume in excess of 150 c.c., points to a renal lesion.

In chronic nephritis and pregnancy there is a lower urea concentration than in toxæmia of pregnancy.

It is important that the urea concentration in the urine should be taken in conjunction with that of the urea in the blood.

Reliance upon urea urine concentration alone may give rise to misleading results, for the damaged kidney may allow the usual amount of urea to pass through if the blood contains an excess of urea, although it would be unable to do so from blood containing the normal amount of urea.

The Blood.

(*a*) *Urea Concentration.*—The normal blood urea in non-pregnant women is 0·02 to 0·05 gram per 100 c.c. During pregnancy, particularly from the fourth month onwards, the blood urea is usually below the expected values, *e.g.* figures of 0·018 gram to 0·02 gram per 100 c.c. are the general rule.

In toxæmia of pregnancy there is no striking deviation from that found in normal pregnant women.

In chronic nephritis and pregnancy the contrary is found: the blood urea content is raised; it may even rise to 0·8 gram per 100 c.c., but at this figure the issue is fatal. As a general rule, the maximum blood urea content compatible with life is at or about 0·3 gram per 100 c.c.

(*b*) *Plasma Tests of Hepatic Function.*—Damage to the liver cells causes them to lose their normal property of converting urobilin into bile pigments, and, as a result, it accumulates in the blood, and is excreted in the urine.

Fouchet's Reaction.—To 3 drops of serum on a white porcelain dish, 3 drops of the reagent are added. A white coagulum results from the precipitation of the serum proteins by the trichloracetic acid contained in the reagent. If the reaction is positive, the coagulum turns a greenish blue colour, reaching a maximum in about 20 minutes.

Ehrlich's Aldehyde Reaction.—To 5 c.c. of urine, 2 drops of a 3 per cent. solution of paradimethylamino-azobenzaldehyde in 50 per cent. HCl are added. If the test be positive, the resulting mixture becomes deep red, and it shows the presence of a pathological amount of urobilinogen.

CHAPTER XII

THE TOXÆMIAS OF PREGNANCY (*continued*)

THE PREGNANCY KIDNEY (Pre-eclamptic Toxæmia)

ONE of the most frequent varieties of the toxæmia of pregnancy is a condition characterized by headache, œdema, and the presence of albumin in the urine to which the term "the pregnancy kidney" has been given. It is named "pre-eclamptic toxæmia" by some authors because eclampsia may supervene. Fortunately, however, the condition is, as a rule, amenable to treatment.

The "pregnancy kidney" occurs in about 5 per cent. of primigravidæ; it is by no means so common among multiparæ. It has been noticed that the condition is commoner in cases of hydramnios, twins and hydatidiform mole than in ordinary pregnancies.

It is believed that the condition is due to a toxin or toxins circulating in the mother's blood, and that this toxin is probably derived from the fœtal elements of the placenta. In pregnancy complicated by hydatidiform mole the clinical symptoms of the kidney of pregnancy are often present. This observation is of importance when we remember that in this form of abnormal pregnancy there is to be found a marked proliferation of the coverings of the chorionic villi, the fœtus being very rarely present.

Other factors beside the toxæmia probably have some influence in the causation of this condition. These factors are mechanical in nature. It has been recognized for some time that compression of the ureters at the brim of the true pelvis is commonly present during pregnancy, and as a result of this pressure some dilatation of the ureters and the renal pelvis may follow. The functional activity of the kidney may be further hampered by the increased intra-abdominal pressure due to the presence of the pregnant uterus; this is borne out by the fact that the pregnancy kidney occurs more commonly in cases of twins and hydramnios, in which the uterus is unduly large, and also in primigravidæ, in whom the abdominal muscles are usually still tense and not lax as in multiparæ.

Symptoms

The condition occurs usually during the second half of gestation; in some rare cases it may manifest itself in the early months.

The symptoms vary very much in their severity; they may pass almost unobserved, or the patient may be profoundly ill. Headache is frequent, and is usually referred to the frontal region; it is often persistent. The patient may complain of dimness of vision, flashes of light in front of the eyes, and, rarely, sudden blindness. On ophthalmoscopic examination there are no evidences characteristic of albuminuric retinitis, and complete restoration of vision is the rule when the patient recovers. The only lesions found are those due to œdema, and in rare cases partial detachment of the retinæ. Œdema about the eyelids, hands, and ankles are very common. Patients may notice this, or that their boots are becoming too tight for them. Œdema of the vulva, lower abdomen, and back also occurs. It has been noticed that œdema may be present for some days before any albumin can be detected in the urine.

Vomiting is not uncommon, the patient complaining of a return of the morning vomiting. It may be accompanied by constipation or diarrhœa. Epigastric pain is sometimes present.

The Urine.—In the cases of slight severity, the amount of urine is not greatly diminished, and there are only traces of albumin. In more severe cases the quantity is markedly diminished; the amount of albumin increased up to even 4 per cent.; hyaline and granular casts may be found; the total nitrogen output is decreased, but there is usually little or no rise in the ammonia-coefficient (see p. 109); the percentage of urea is low, and acetone and diacetic acid are frequently present. The relative proportions of urinary protein are 2 of albumin to 1 of globulin. The diastase is raised, the urea concentration is raised, while the blood urea is not. The plasma tests of hepatic function may show evidence of liver damage in the more serious cases.

Patients rarely die from this condition, unless there is some further complication, but when a post-mortem examination has been made, the kidneys show the same lesions as in eclampsia, but to a less extent.

Diagnosis

The diagnosis has to be made from albuminuria due to old-standing kidney disease (Bright's disease). It is necessary clearly to understand that there are two distinct groups of kidney disease

during pregnancy. One is the group due to the toxæmia of pregnancy, of which the pregnancy kidney is an example; in this there has been no previous kidney lesion, and the condition is solely due to the pregnancy. This is the group which may terminate in eclampsia. The other is the group in which the kidneys have been previously damaged or diseased, and have broken down afresh as a result of the extra strain placed upon them during pregnancy. They were able to carry out their functions under normal conditions, but cannot function sufficiently when the waste products from the fœtal as well as the maternal organism have to be eliminated. This group is to be looked upon not as due to the pregnancy, but as made worse by the accident of pregnancy, and it does not end in eclampsia. It is because of failure to separate these groups that so much confusion has arisen in considering kidney disease and pregnancy.

It must be borne in mind that the distinction between these groups is not always an easy one, and, moreover, that a toxæmia may be superimposed upon a case of old-standing kidney disease.

As a rule a differentiation may be made by a consideration of the following points:—

In a case of albuminuria due to old-standing kidney disease, a history of scarlet fever or of diphtheria may be obtained frequently; the patient may have complained of attacks of œdema accompanied by the passage of a smaller quantity of urine on other occasions apart from the pregnancy.

Further, cardio-vascular changes, such as thickened arteries, raised blood-pressure, and cardiac hypertrophy are usually to be found. This class of patient is less often a primigravida; the symptoms occur usually in the earlier months of the pregnancy. The urine before the pregnancy is often increased in amount and of low specific gravity, and contains a trace of albumin, and during the pregnancy the amount of albumin is not much increased. Compare this with the patient suffering from the kidney of pregnancy; in this group there is often no history of any acute specific fever, and no evidences of cardio-vascular change; the patient is usually a primigravida, and the symptoms do not occur until the later half of the pregnancy; the urine showed no abnormality before the gestation began, but now is less in quantity, and contains albumin and acetone.

Prognosis

Two types may be distinguished—

(*a*) Cases with no special risk of eclampsia.

(*b*) Cases with special risk of eclampsia.

The disease is rarely fatal of itself, and the prognosis, which is usually good for the mother, depends upon the degree of toxæmia.

(*a*) In the great majority of cases, if the diagnosis is made early and treatment instituted in good time, there is a rapid improvement in the symptoms within the space of a week to ten days. Occasionally, however, even if there is improvement, the symptoms persist in a modified degree until the pregnancy has ended. Rarely are the kidneys permanently damaged.

(*b*) If the degree of toxæmia is profound, or if under treatment there is no evidence of improvement in the symptoms within a week, eclampsia is likely to supervene, and the pregnancy must be terminated at once to avoid this.

As a general rule, the disease does not recur in succeeding pregnancies: it is more prone to do so when the second pregnancy follows quickly.

With regard to the child, the prognosis is bad; a large number of the children are born dead, and labour is often premature.

Treatment

The urine of the pregnant woman should be examined for albumin at frequent intervals during the second half of the pregnancy. The observance of this rule is of special importance in cases of primigravidæ. When albumin is discovered a catheter specimen of the urine should be obtained to exclude contamination by vaginal discharge, and the urine again examined.

In addition to this precaution, the patient should be told to notify her doctor at once if she notices headache, dimness of vision, swelling of the legs, or a return of the vomiting.

Once the condition is diagnosed, treatment must immediately be instituted. The patient must be kept strictly in bed, where her diet can be under proper control and her urinary output under observation.

The diet must consist only of milk in severe cases, but in milder cases fish, eggs, bread and butter, tea, cocoa, milk puddings, junket, and custard are allowable. The effect of this diet must be kept under careful observation, and a more stringent diet given if the albumin or other symptoms do not diminish. It is wiser to forbid meat or food containing much nitrogenous material, in order not to overwork the damaged kidneys. The patient should be encouraged to drink large quantities of barley water or imperial drink.

The toxin present within her system may be eliminated by the bowel by means of free purgation, such drugs as magnesium sulphate

or jalap being specially indicated, as they produce a fluid motion. Active diuretics should not be employed, on account of the condition of the kidney epithelium; it is better to rely on a large fluid intake and the administration of rectal salines. The skin may be encouraged to act by means of drinks or hot baths.

While this treatment is being carried out, the total amount of urine passed must be measured and noted in each twenty-four hours, together with the amount of albumin and urea present. The amount of urea is, however, not of much value unless the total nitrogen excreted and the food intake are known. A careful watch must also be kept for any of the warning signs of eclampsia, which will be found described in the section upon Eclampsia.

When the condition does not improve, the pregnancy must be terminated in order to remove the source of the toxin. How this is to be done varies with the view of the physician; some prefer to dilate the cervix with metal dilators, until a de Ribes's bag can be introduced, and then when the cervix is fully dilated to complete the delivery by the forceps or by version; others, on the other hand, prefer to terminate the pregnancy more rapidly by Cæsarean section or vaginal hysterotomy, in order to shorten the time and the risk of a sudden onset of eclampsia.

ECLAMPSIA

Eclampsia is an acute toxæmia occurring in the pregnant, parturient, or puerperal woman, characterized by convulsions and by certain hepatic, renal and other lesions, and is due to the presence of a toxin or toxins circulating in the mother's blood.

Frequency.—Statistics show that eclampsia occurs about once in every 500 labours. With better methods of supervision this figure should become less. It is difficult, however, to determine the frequency with a great degree of accuracy, as many cases are not followed through in private practice, but are sent into hospital. The hospital figures may therefore give an exaggerated idea; thus the figures of the lying-in hospitals show a frequency of about one in every 100 labours.

Eclampsia may occur at three periods. It may be—

Antepartum,
Intrapartum,
Postpartum.

Of these the first two are the most common. About 60 per cent. of the cases arise during pregnancy, 20 per cent. during labour, and 20 per cent. after labour. The condition usually supervenes

during the second half of pregnancy, and becomes more frequent as term is approached. It may, however, occur in the early months of pregnancy, and a case has been recorded as early as the third month.

A woman in her first pregnancy is more liable to the disorder, 70 to 80 per cent. of cases being in primigravidæ.

There is said to be some association with hydramnios and twin pregnancies. Hydramnios has been noted in 8 per cent. of cases of eclampsia, whereas the usual figure for all labours is only 1·5 per cent. In a series of 1524 cases of eclampsia the percentage of twin pregnancies was 4·7, whereas the average percentage of twin births is about 1·2, so that the liability of twin pregnancies to eclampsia is about four times that of single births. Eclampsia has been observed in the false labour which may accompany extra-uterine pregnancy. Cases have been reported of its occurrence in association with hydatidiform mole.

Clinical History

Two distinct classes can be recognized. In one eclampsia occurs after only very brief warning or no warning at all. This has been found to occur in 15 per cent. In other cases the symptoms begin as in the toxic albuminuria of pregnancy already described, which has therefore been termed by some pre-eclamptic toxæmia. These symptoms will be briefly recapitulated. The patient is usually in her first pregnancy, and may during the earlier months have suffered from hyperemesis gravidarum. During the later months, very commonly about the seventh month, she seeks advice on account of headache, vomiting and œdema of the legs; and the urine is found to contain much albumin. If this patient does not improve, she is liable to eclampsia. In cases which end in eclampsia, the symptoms usually become more marked before the actual convulsions occur. Of the cases above described only a certain percentage get eclampsia.

Warning Signs of Eclampsia

In a series of 743 cases of eclampsia recently collected and investigated, warning signs varying in degree and duration were present in 85 per cent.

1. Headache is severe and constant. It is especially felt in the frontal region.

2. The patient complains of puffiness of the eyelids and of flashes of light in front of her eyes; she may only see the half of objects, or she may see double. She may become suddenly blind, and this may occur without any other warning sign whatever. The eyes show no changes, except intense œdema and sometimes partial detachment

of the retina; retinal hæmorrhages are not common, and these changes totally disappear if the patient recovers.

3. Epigastric pain and vomiting.

4. The œdema becomes more marked, especially about the legs and the vulva, which may be swollen (Fig. 32).

5. The urine shows characteristic changes. The quantity is much diminished. Instead of the average amount of 50 ozs. in the twenty-four hours, she may pass as little as 4 to 8 ozs., and in some

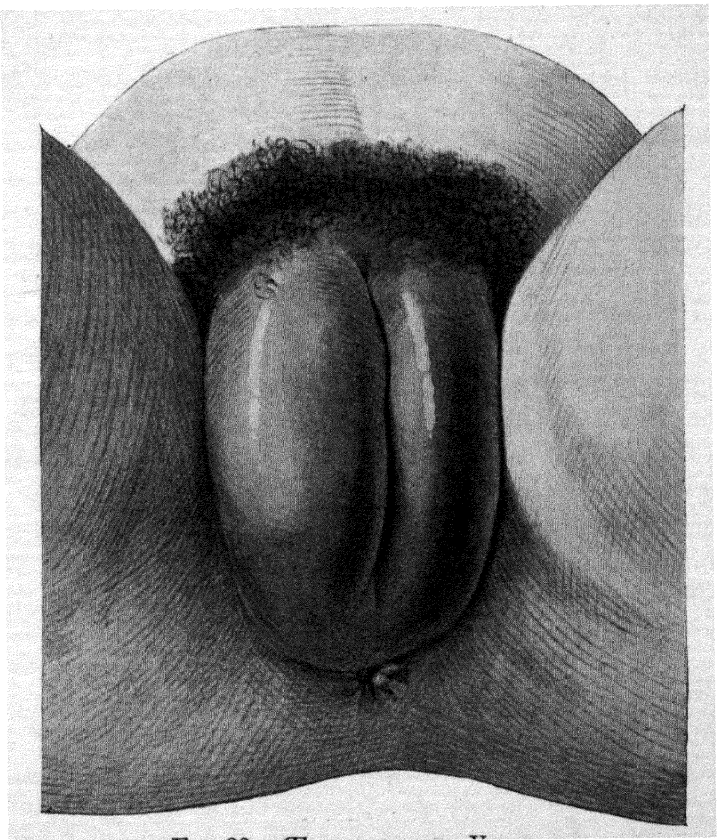


FIG. 32.—ŒDEMA OF THE VULVA.

cases there may even be total suppression. On examination the urine is found to be almost solid with albumin, and this may amount to 10 grams per litre, and in severe cases to 30 or 40 grams. The albumin is composed of both serum-albumin and serum-globulin; according to some observers the latter variety predominates.

Various types of casts are found, the commonest being the hyaline and granular. Some epithelial casts may be found, and a few renal cells. Blood is very frequently present. Acetone and diacetic acid are generally present.

The ratio between the nitrogen excreted as ammonia and that excreted as urea, that is the ammonia-coefficient, is high.

6. A rise in the blood-pressure.

If these symptoms develop, unless proper treatment is at once instituted, and often in spite of it, they increase in severity, and the patient may at any moment have an eclamptic seizure.

Fortunately these "warning signs" are present as a rule, but it must be remembered that they may be absent. Cases have been recorded in which the first symptom has been sudden blindness, followed by the rapid onset of fits, and others in which the first sign has been the onset of the eclamptic convulsion itself.

Description of the Fit.—Eclampsia may come on at any time; it may occur while the patient is asleep. A single fit only may occur. This is the more likely to be the case if the fit be intrapartum or postpartum. As a rule it is a warning of others to follow, and the tendency is for the fits to recur. In mild cases the fits may occur only from one to three times; in some cases very great frequency may be noted, such as from 5 to 10 or even as many as 20, and in the most severe cases 100 or more. They may follow each other so frequently as to appear almost continuous. The number of the fits is not necessarily an index of the severity of the condition, but cases with many fits are usually serious.

It is customary to describe the fit as occurring in several stages, but it must be realized that there is no pause between these stages. The patient is unconscious throughout the fit. In general terms the fit is very similar to that seen in epilepsy.

Premonitory Stage.—As a rule the fit begins in the face. The patient will be noticed to roll her eyes, and there may be slight twitchings of the hands and face. This stage only lasts from 15 to 20 seconds, and is not always observed.

Tonic Stage.—The patient is rigid owing to the spread of the muscular contractions. The face is cyanosed from fixation of the chest muscles and the diaphragm. This stage does not last longer than half a minute, and is followed by the clonic stage. The tongue may be bitten between the clenched teeth.

Clonic Stage.—The muscles are now spasmodically contracted and then relaxed, so that this is the stage characterized by the convulsive movements. The jaw-muscles share in these movements, so that the patient may bite her tongue. By the jaw-movements the blood-stained saliva is beaten up into a froth, and the patient is said to foam at the mouth. The face is congested, the breathing

stertorous, and the patient deeply unconscious. This stage may last from half a minute to two minutes. It is usually followed by a state of coma.

State of Coma.—As a rule, after the convulsion is over the patient sinks into a comatose condition. This may continue for several hours, and then the patient awakes to consciousness. In other cases the coma may be only of short duration, and be broken by the occurrence of another fit. In severe cases the fits succeed each other in such rapid succession that there is no time for this stage. During the attack the temperature generally rises considerably. A temperature of 104° F. or 105° F. is not unusual. Whitridge Williams has recorded a fatal case, in which it rose to 109·5° F. just before death. The causation of this rise is not certain. It is believed by some to be due to the toxin of eclampsia stimulating the thermic centres, but by others it is regarded as the result of excessive heat production from muscular action. The patient may remain comatose after one fit.

The blood-pressure shows a marked increase during the fit. The pulse is full and bounding, and the arterial systolic pressure may be as high as 250 mm. of mercury or more.

A marked feature of this rise of blood-pressure in eclampsia is that after the attack it falls rapidly to normal. This is contrary to the behaviour of the blood-pressure in cases of chronic nephritis, in which it remains high even after delivery.

The Urine.—The changes in the urine which have already been described are usually more evident during the eclamptic seizure. The amount is invariably diminished; it may be suppressed. Various types of casts are present, usually the hyaline and granular. Epithelial casts and isolated renal cells may occur but rarely; blood is nearly always present.

Protein is present in increased amount, which may be so great that it is necessary to dilute the urine in order to determine correctly the amount by means of Esbach's tube. In extreme cases 30 to 40 grams per litre have been found, and the urine may be almost solid with albumin. Serum-albumin and serum-globulin are both present, and the serum-globulin is relatively greater in amount.

This high albumin-output is only of temporary duration. It may be accounted for by the increased muscular exertion. Usually within 48 hours after delivery it falls to less than a gram per litre, and then rapidly diminishes, leaving only a trace of albumin. This trace of albumin may continue for several weeks. High grades of albuminuria are not necessarily associated with marked renal

lesions. The total amount of nitrogen in the urine is markedly diminished. The amount of urea, which is normally 2 per cent., is much reduced. There is, however, an increase in the amino-acids and creatinin. The ratio therefore between the amount of nitrogen excreted as ammonia, and that excreted as urea, that is the ammonia-coefficient, is high. It is stated that with the onset of convulsions a decrease in the ammonia-coefficient usually occurs; that this decrease is followed by a marked rise, which may be maintained for several days and is of favourable prognosis. In several fatal cases it was found that the ammonia-coefficient was low. The ammonia-coefficient is markedly raised in hyperemesis gravidarum also.

The amount of chlorides in the urine is diminished. Acetone and diacetic acid as a rule are present, but they may be absent. The diastase content is also raised.

It is a striking fact that after the attack the quantity of urine is usually increased for about 48 hours—large amounts such as 4 to 5 pints may be passed; the amount then gradually returns to the normal (Fig. 33).

The urine during convalescence continues to show an increased nitrogenous content. A similar change is observed after normal labour, however, due probably to the involution process of the uterus. This, increase, therefore, in eclampsia may be due partly to the same cause as well as to the elimination of toxic materials.

URINE TABLE

Disease.	Quantity.	Albumen.	Blood.	Casts.	Urea.	Total Nitrogen.	Ammonia-Coefficient, *i.e.* Ratio of Nitrogen as Ammonia to Nitrogen Excreted as Urea.	Amino-acids.	Aceto-acetic Acid Test.
Pregnancy kidney.	−	+	0	+	−	−	Little or no rise	0	+ sometimes
Eclampsia.	−	+ +	+	+	−	−	+ +	0	+
Toxic hyperemesis gravidarum.	− at end	+	+ at end	+ at end	−	−	+	0	+
Starvation.	−	0	0	0	−	−	+	0	+
Acute yellow atrophy.	−	+	+	+	−	+	+ +	+	+
Chronic renal disease and pregnancy.	0 or +	+	0 or +	+ +	0 or −	0 or −	0 as a rule	0	0

− = diminished. + = increased. 0 = unaltered.

Complications.

As a result of the fit, the patient may bleed from injury to her tongue, due to the unconscious movements of the jaw. If the

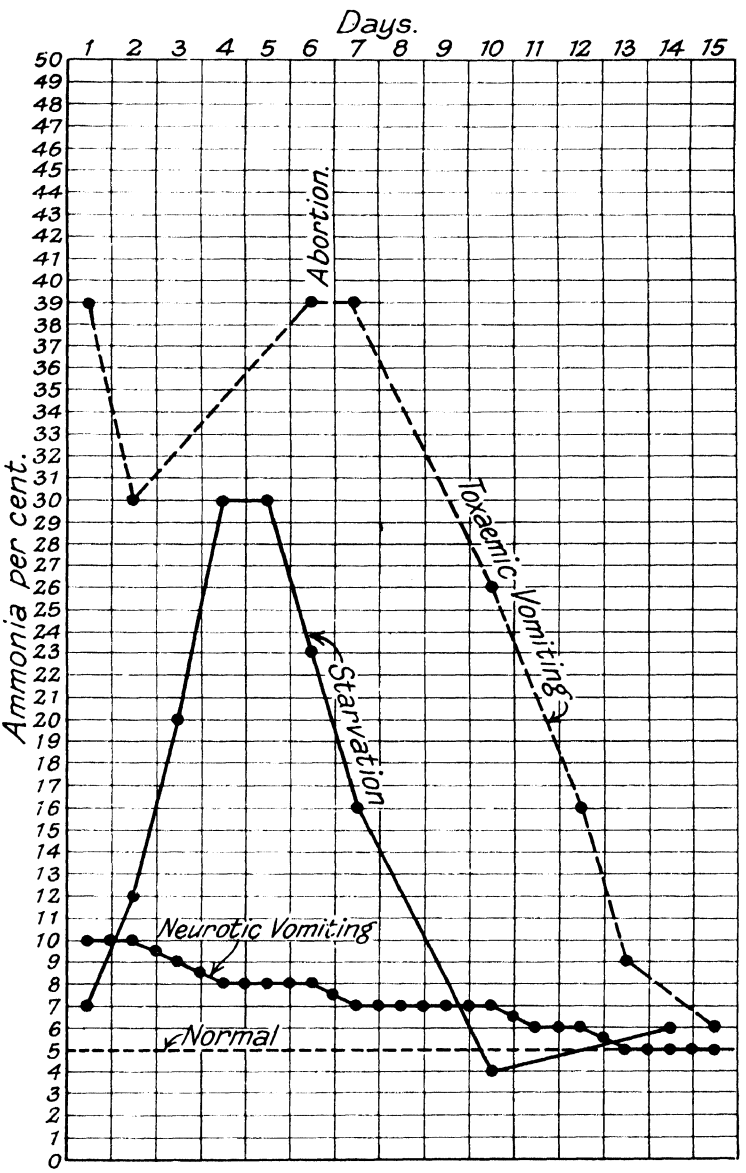


FIG. 33A.—URINE CHART, SHOWING THE AMMONIA-COEFFICIENT IN NEUROTIC VOMITING, STARVATION AND TOXÆMIC VOMITING.

head is not turned to one side she may suffocate during the fit, but she is more liable to develop septic broncho-pneumonia at a later date owing to the inhalation of septic saliva into the air

passages, especially if the teeth are decayed, or there have been attempts at feeding.

The convulsions are always followed by unconsciousness of a shorter or longer duration. When the patient wakes from this comatose state she may have no recollection of the fits, or even of the day or two succeeding it, and this fact may be of importance from a medico-legal aspect.

Mental derangement follows in from 5 to 7 per cent. of cases, but such derangements are, as a rule, of a temporary character only.

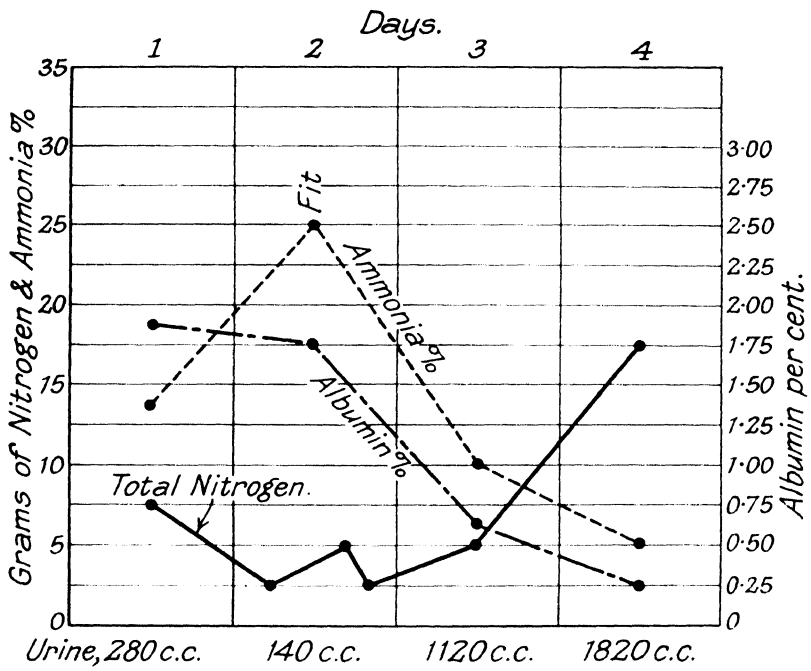


FIG. 33B.—URINE CHART, SHOWING THE ALBUMIN, NITROGEN AND AMMONIA PERCENTAGE IN A CASE OF ECLAMPSIA.

Some patients are muddle-headed for some time afterwards, and are unable to recognize friends.

The eye-lesions as a general rule do not persist, but they may do so occasionally from a partial detachment of the retina. Hemianopsia has been noticed as a result of the cerebral lesions incident to eclampsia.

In some cases the patient becomes markedly jaundiced. This may be noticed during or shortly after the convulsion. This sign is of grave prognostic significance, for it points to serious hepatic involvement.

Antepartum eclampsia is usually followed by the rapid onset of labour. The patient may die undelivered; on the other hand,

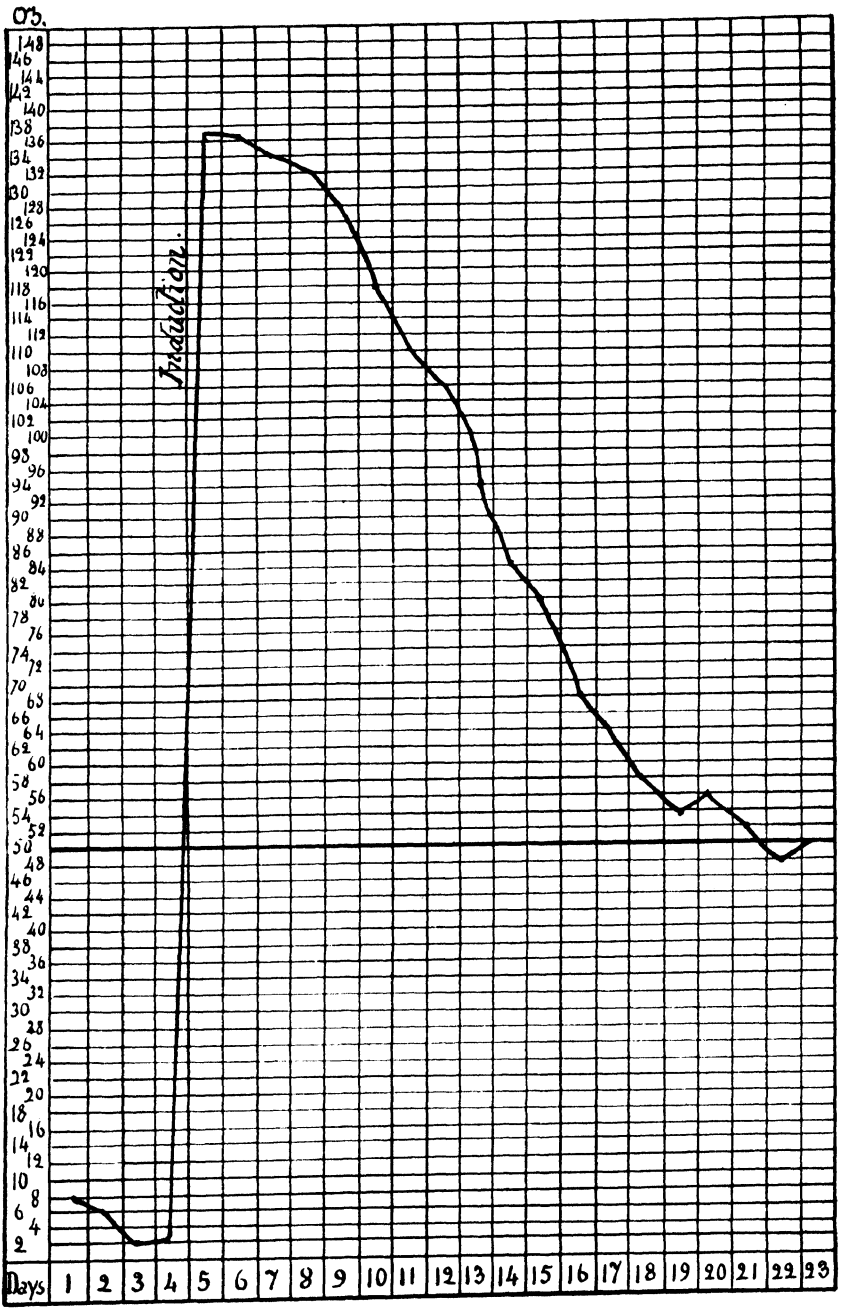


FIG. 33c.—URINE CHART.

Showing an increase in the daily amount of urine passed from 2 ounces to 137 ounces as the result of pregnancy being terminated, followed by a gradual return to the normal.

she may recover without delivery taking place, and at a later date expel, commonly a dead fœtus, but sometimes a live child at

In intrapartum eclampsia the uterine contractions tend to increase in strength and frequency, and so delivery is hastened.

Postpartum eclampsia usually comes on within 48 hours after delivery, but it may be delayed as late as a week. It can be no longer regarded as a benign form. Convulsions may succeed each other rapidly, and in such cases the maternal mortality is stated to be as high as 25 per cent.

Prognosis

(*a*) *The Mother.*—Eclampsia is a grave disease, and is one of the most dangerous conditions met with by the obstetrician. The mortality rate is from 20 to 25 per cent. The total mortality from eclampsia is about 4 in every 10,000 confinements. In the collected cases from the principal hospitals in different parts of the United Kingdom from the 10 years, 1911 to 1920, the following statistics were obtained:—

London,	21·9	per	cent.	(547 cases).
North of England,	24·43	,,	,,	(804 cases).
Midlands,	25·10	,,	,,	(302 cases)
Edinburgh,	25·00	,,	,,	(148 cases).
Dublin,	10·29	,,	,,	(204 cases).

It will be noted that the Dublin figures are lower than those obtained elsewhere, and may be ascribed to their adoption of Stroganoff's methods of expectant treatment. His own figures show a mortality of only 6·6 per cent. among 360 cases. Zweifel, using similar methods, claims to have further reduced the maternal mortality to 5·3 per cent. in a series of 94 cases. Stroganoff believes that, if expectant methods are used early, and the cases are not neglected, the figure is capable of being still further lowered to 2 per cent.

An interesting point in the collected series of cases already referred to is that eclampsia appears to be more serious in one country than another, and also in certain districts of the same country resembling what is known to occur in the case of certain acute infections.

A bad prognosis is indicated if—

1. Coma is present.
2. The pulse-rate is over 120 per minute.
3. The temperature is above 103° F.
4. The number of fits is more than 10.
5. The secretion of urine is markedly diminished or suppressed, and the urine "solidifies" on boiling.
6. If with diminution of urine there is also absence of œdema.
7. The blood-pressure is above 200 mm. mercury.

LIVER FROM A FATAL CASE OF ECLAMPSIA.

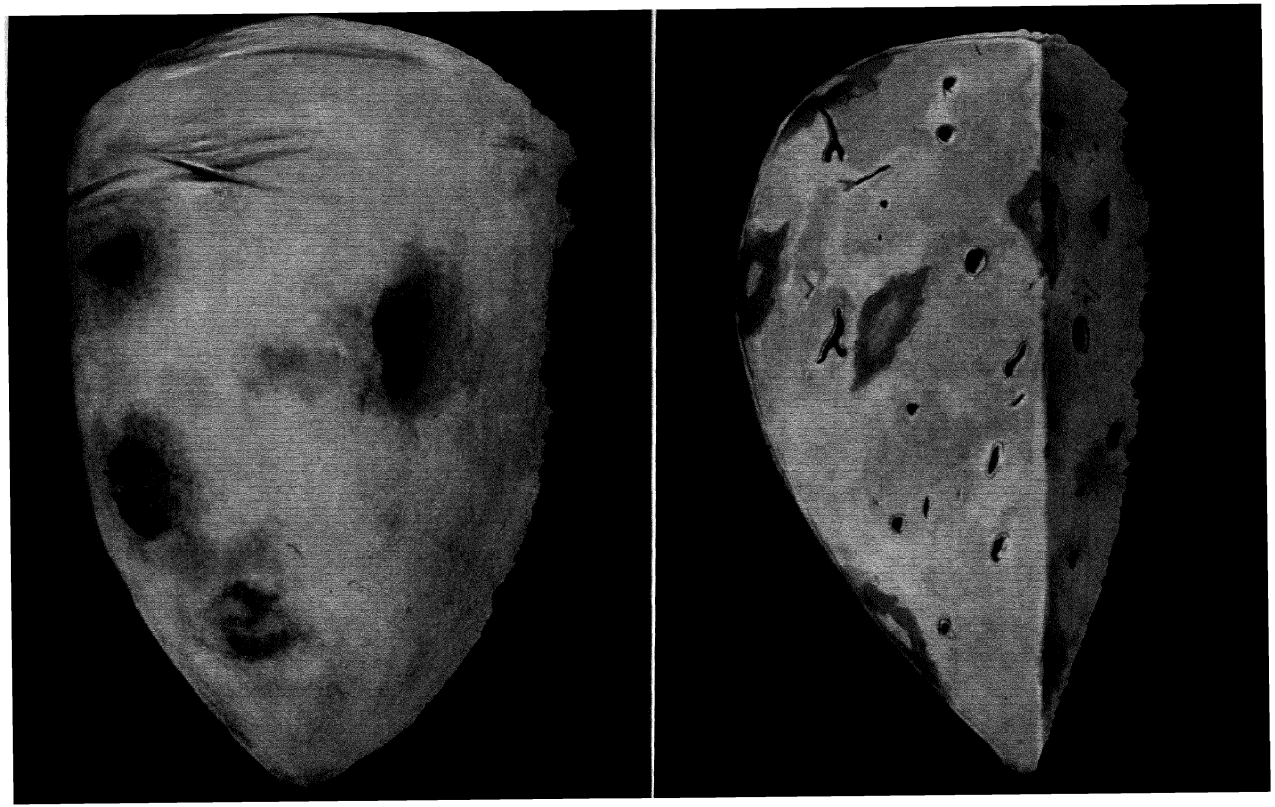


FIG. A. SURFACE OF LIVER. PALE YELLOW SHEWING SCATTERED RED AREAS BENEATH ITS CAPSULE.

FIG. B. ON SECTION THE RED AREAS WHICH ARE DUE TO HÆMORRHAGE ARE SEEN TO HAVE A PALER NECROTIC CENTRAL PORTION.

PLATE III.

The prognosis is worst in the postpartum variety, and more serious in the antepartum than in the intrapartum forms.

Cases which occur in a fulminating manner, without previous warning signs having been discerned, are worse than those in which there have been warning signs, and in which, as a consequence, treatment has been begun.

Eclampsia is graver when the condition supervenes in a patient who has old standing kidney disease, or who has already borne many children. The prognosis in antepartum eclampsia is favourably affected by the death of the fœtus. Usually the fits cease and a rapid improvement follows in the patient's condition. This is not always the case, however, for instances have been recorded in which eclampsia has developed during the expulsion of a fœtus which has evidently been dead for a considerable time.

The immediate causes of death of the mother are numerous. She may die from asphyxia due either to cessation of respiration during the paroxysm, or to the entrance of saliva or blood into the larynx during the fit or while she is in a state of coma; she may die from œdema of the lungs; she may die from cerebral hæmorrhage and from gradually deepening coma, or at a later date from septic broncho-pneumonia or general infection. The immediate cause of death is usually coma.

The question may be raised, if she recovers, as to what will happen in the event of her again becoming pregnant. After the first pregnancy the attack does not recur, as a rule, in subsequent pregnancies. Occasionally the patient suffers from a slight permanent impairment of the renal function and a residual albuminuria. But if it occurs in a patient who has borne many children already, and if she has suffered from chronic kidney disease, the attacks are liable to recur and the prognosis is more serious if she again becomes pregnant.

(*b*) *The Child.*—The prognosis is bad. Forty-nine per cent. of the children are born dead or die shortly after delivery. The total fœtal mortality from eclampsia is from 7 to 8 to every 10,000 labours.

The cause of death may be asphyxia, due probably to interference with the flow of the maternal blood in the placenta during the convulsions; or it may be the result of the toxæmia, the liver and kidneys showing lesions similar to those found in the mother, or as a result of injury from obstetric manipulations carried out to hasten delivery.

Even if the child is born alive it may die later from prematurity, as labour occurs so frequently before full time. Convulsions within a few minutes of delivery are common.

The causation is discussed under the section on the Toxæmia of Pregnancy (see p. 94).

Pathological Anatomy

Fatal cases of eclampsia show lesions in the liver, kidneys, spleen, heart, and brain; these changes are most characteristic in the liver.

Liver.—In a well-marked case the liver is pale yellow in colour; beneath its capsule are scattered red areas. These may be seen to have a paler necrotic central portion. These red areas are due to hæmorrhage, and are as a rule small, but they may attain to a large size (Plate III.). A few cases have been recorded in which the area has involved a large portion of the surface of the liver, and in which the capsule over it has given way, resulting in a fatal intraperitoneal hæmorrhage.

On section the cut surface is also pale yellow, and areas of hæmorrhage can again be seen, showing that this change takes place within the liver substance as well as on the surface.

Microscopic examination reveals that the lesion is situated mainly in the region of the portal veins, which are thrombosed. The red areas consist of degenerate liver cells, which have lost their cell-outline, are fatty, and are invaded and separated by blood cells. The change is most obvious at the periphery of the lobule. Similar lesions occur in the liver lobule in hyperemesis gravidarum, but as contrasted with eclampsia the lesion is more obvious at the centre of the lobule. Even in eclampsia, however, the degeneration may not be limited to the outer part, but may extend and involve the central portion, and the intralobular vein may itself be thrombosed.

Kidneys.—The kidneys are usually enlarged, their average weight being 310 grams, with a maximum weight of 345 grams. Usually both are equal in size, but occasionally one may be considerably larger than the other. They are pale yellow in colour, and effusions of blood may be found immediately beneath the capsule.

On section the surface is yellow, the cortex thickened and pale, forming a marked contrast to the deeply congested and more centrally situated portions; hæmorrhages are not uncommon also between the cortex and medulla.

Microscopic examination shows that all parts of the kidney substance are affected, but the lesions are most marked in the region of the convoluted tubules. These lesions are essentially degenerative and not inflammatory, and are comparable with those found

in kidneys after the excretion of poisons such as phosphorus or cantharides. The lumina of the convoluted tubules are filled with amorphous casts composed of broken-down protoplasm and hyaline material; the cells lining the tubules have no longer a distinct outline, and the nuclei may not be seen. The glomeruli show comparatively slight changes. The veins are engorged and many are thrombosed. The interstitial connective tissue is œdematous, and in rare cases shows small-celled infiltration; fatty masses may often be seen in the inter-tubular connective tissue.

Ureters.—The ureters are frequently found to be dilated, but this is not, however, the cause of the eclamptic condition, for this dilatation is observed in pregnant women quite apart from eclampsia (Fig. 51).

Spleen.—Occasionally lesions similar to those described in the liver may be observed in the spleen. They are by no means so marked and often are absent.

Heart.—Areas of necrosis and hæmorrhage are found in the heart muscle in about 65 per cent. of cases. Granular and fatty degeneration is invariably present. Fatty globules occur within the red blood-corpuscles.

Brain.—Lesions may be observed in about 90 per cent. of cases. The capillaries are thrombosed, there are numerous small areas of hæmorrhage, and the nerve-cells and fibres are degenerate. Subdural hæmorrhages have been noted in some cases. Usually the lesions are situated in the cortex and in the deep nuclei. These changes are the result of the fits and are not toxic in origin.

Investigations carried out upon the infants born of eclamptic mothers show that the lesions are not confined to the mother, for changes of a similar nature may be found in the liver of the fœtus.

Treatment of Eclampsia

This may be considered under two headings, viz. (i) Preventive, and (ii) Curative.

Preventive.—Prophylactic measures are of the greatest importance; they have already been mentioned in the section upon "The Pregnancy Kidney or Pre-eclamptic Toxæmia," in which condition the chief aim in the treatment is to prevent the onset of eclampsia itself. The condition is to be regarded as largely preventable if proper antenatal supervision be adopted. It is easier to prevent eclampsia than to cure it.

The urine of every pregnant woman should be tested for the presence of albumin at regular intervals during the whole of pregnancy (see p. 82). This precaution is especially important in primigravidæ, owing to the greater frequency of eclampsia in women who are pregnant for the first time.

The patient must be warned by her doctor to inform him if the amount of urine passed becomes diminished, or if she has headache, sickness, œdema, or dimness of vision. If any of these symptoms are present the patient must be treated as for toxæmia of pregnancy (see p. 114).

CURATIVE TREATMENT.

The Treatment of the Fit itself.

If practicable, it is better not to move the patient during the fit, but to allow her to remain where she is. This is in order to obviate the risk of bringing on another fit by the stimulation of unnecessary handling.

A gag of some description must be placed between her teeth. False and also loose teeth must be removed or they may be sucked down the throat and into the larynx and cause suffocation. The handle of a spoon or some similar instrument wrapped round with a handkerchief will serve for this purpose; the gag is used in order to prevent the patient from biting her tongue during the convulsive and unconscious movements.

After the fit has passed off the head must be turned on to one side gently, so that blood or saliva may run out of the mouth and none may enter the respiratory passages, for if this occurs the patient may be suffocated, or run the risk of septic broncho-pneumonia. If there is much mucus or the respiration is bubbly or laboured, the head must be brought over the edge of the bed with the face downwards and the back of the pharynx swabbed out. Unless these precautions are observed it is possible for the patient to be suffocated and to drown in her own secretion. It is therefore absolutely essential that a trained attendant should constantly be with the patient. It is also advisable that a supply of oxygen be kept in readiness should cyanosis persist. Restrain the patient gently from injuring herself; place a pillow beneath her head, and loosen the clothing about the neck and chest.

The Prevention of the Recurrence of the Fit.

A case of eclampsia cannot properly be treated at home and calls for hospital resources.

General.—The patient must be placed in bed, her clothing removed gently, and no irritating material allowed in contact with her skin. While in bed all manipulations must be avoided as far as possible, such as vaginal examinations and the administration of enemata, for such measures may bring about a convulsion. The room itself should be preferably in the quietest portion of the building; the blinds should be lowered and the room darkened, sufficient light must, however, be available for the proper supervision and treatment of the patient; no bright light or sudden noise should be permitted, such as the slamming of a door or the ringing of the telephone bell. It is wiser to allow no one in the room other than the nurse and doctor.

Sedative Drugs.—In order to control the explosions of nerve energy which bring about the convulsive movements, various sedative drugs are used. Of these must be considered :—

Morphia.—Morphia has a marked effect in diminishing restlessness and in checking the occurrence of the fits; it tends also to lower the blood-pressure and to retard proteid metabolism. It is contra-indicated in cases presenting anuria or in those in whom the secretion of urine is markedly diminished.

It is given by hypodermic subcutaneous injection in full doses of $\frac{1}{4}$ or $\frac{1}{2}$ gr. combined usually with atropine sulphate $\frac{1}{100}$ gr. to counteract the depressant effect on the respiratory centre. If the patient is not under the influence of the drug in 2 hours, the dose may be repeated, but without the atropin. The doses may be repeated up to a total of 2 grains in the 24 hours, but this is only indicated in those cases in which the convulsions persist. Care must be taken to watch the respiratory rate and the doses must not be continued if this is lowered.

Veratrum viride.—This drug has been warmly recommended by some. In many cases the recurrence of the fits is markedly diminished after its administration. The action of the drug is probably due to its vaso-dilator and diuretic effects; it slows the pulse and lowers the blood-pressure. The dose is 15 min. of the tincture at half-hourly intervals, until the heart-beat has fallen to 60 beats a minute. It is better given by intramuscular injections as veratrone $\frac{1}{2}$ c.c., as the standard of the tincture may vary. On the other hand, if the patient is feeble, there is some risk in using the drug, for it has a marked depressing effect upon the cardiac muscles. Its use should be restricted to patients in whom the blood-pressure is high, the pulse-rate frequent and the fits numerous. It must not be administered without proper and frequent supervision of the blood-pressure and pulse-rate, and the actual dosage will depend upon these factors. If the blood-pressure is above 195 mm. of mercury give 1 c.c.;

if between 195 and 175, ¾ c.c.; if between 175 and 155, ½ c.c.; and if between 155 and 140, ¼ c.c. Under careful supervision it is a valuable aid in controlling the number of the fits; it should not, however, be used in combination with morphia.

Chloroform.—In the past, chloroform has been given in cases of intrapartum eclampsia, and during any necessary obstetric manipulation. It has certain advantages in that its action is quick and it is rapidly eliminated. Moreover, it can be given to a patient who is unconscious or unable to swallow, and it is easy to give. On the other hand, its prolonged administration by the attendant is difficult, for he must be constantly present; it has been shown to cause lesions in the liver identical with those of eclampsia, and occasionally it has no effect upon controlling the recurrence of the fits. Owing to the possible damage to the liver that may be caused by chloroform, and the risk in increasing the already existing acidosis, it is inadvisable to use chloroform in cases of eclampsia. It can be used during any vaginal or uterine manipulations, if ether is contra-indicated.

Chloral Hydrate and Potassium Bromide.—These may be given as substitutes for morphia and chloroform, but they are better given in combination with morphia if necessary.

If the patient is conscious, they are to be given by the mouth, the dose being 15 gr. of each at intervals of an hour until four doses have been taken.

If the patient is unconscious, they are to be given by the rectum in double the quantity combined with starch mucilage.

Should no effect be apparent after four doses have been given, it is better to discontinue their use.

Stroganoff in his expectant method of treatment gives 75 to 130 gr. of chloral hydrate and ⅓ to ⅔ gr. of morphine in combination during the first 12 hours, and he also uses chloroform during this time if fits continue but the patient is in good condition; otherwise the doses are spread over 24 hours.

Thyroid Extract.—An attempt has been made to counteract the hypothetical insufficiency of thyroid secretion by giving the extract in large doses, such as gr. x. three times daily. It is known that thyroid extract can act as a vasodilator and diuretic; it is possible, therefore, that what effect it has may be due to these properties. This drug is of greater use in the pre-eclamptic condition of albuminuria.

Pituitary Extract.—This has also been recommended, but at present we have not sufficient data upon which to form any reliable judgment as to its value.

The Elimination and Dilution of the Toxins.

Toxins are normally eliminated by means of the kidneys, the bowel, and the skin. They may be removed also when present in the blood-stream by venesection and the injection of saline solution, and the elimination of the toxins by any of these methods may be supplemented also by this dilution.

1. *By the Kidneys.*—As the kidneys are already in a damaged condition, no active diuretic must be given, for this would impose more work upon the damaged kidney epithelium. Only mild diuretics such as acetate or citrate of potash or spirits of nitrous ether are allowed. The kidneys should be flushed out by encouraging the patient to drink large quantities of barley water and imperial drink. If the patient is not restless, and is not having convulsions, subcutaneous continuous saline may be given. If this is not possible, the saline may be run in by the rectum, but it must not be used in cases of marked œdema. If the kidneys are powerless to excrete it is useless and even harmful to adopt these measures. If the saline is given it is advisable to add sodium bicarbonate 0·85 per cent.

2. *By the Bowel.*—The bowels must be kept freely open in order to eliminate the absorption of toxic substances from the intestines, the result of proteid metabolism, and also to bring about a reduction in the blood-pressure.

Drugs which produce a watery stool are specially indicated, for by this means also it is possible that some toxin may be withdrawn from the body tissues. Those recommended are magnesium sulphate, jalap, and castor oil. If the patient is unconscious nothing must be given by the mouth except through a nasal or œsophageal tube. Nor must any food be given except water.

The modern method of expectant treatment lays great emphasis upon free purgation and bowel lavage. A rectal tube is passed 18 inches along the bowel, after which water containing sodium bicarbonate ʒ i. to the pint is poured in and syphoned out. This is continued until, firstly, the return flow is fæcal stained, then until it is clear. No soapy water is to be used. It may require upwards of 1 hour before an absolutely satisfactory result is obtained so that large quantities of fluid must be employed. One or two pints of the solution should be left in the bowel. If the patient is too restless to allow of this prolonged procedure it is often necessary to give a preliminary dose of morphia. This method is strongly advocated by the Dublin school but is not regarded as essential by Stroganoff.

3. *By the Skin.*—If the temperature rises as high as 105° F., it should be lowered by means of a tepid bath, when possible, at a

temperature of about 80° F. The patient is allowed to remain in the bath until the rectal temperature has fallen by 2° or 3°; after being removed from the bath she sweats profusely, and the temperature continues to fall. Other methods to obtain a free action of the skin are hot packs and the vapour bath. The drawback to any of the above methods is that they entail considerable handling or irritation of the patient which may induce a convulsion.

Sweating has in some cases apparently caused stronger convulsions and deeper coma. It is by no means certain that the eclampsia-toxin leaves the body in the sweat, and sweating may cause a concentration of the toxin if the patient is not given plenty of fluid.

For the above reasons these methods are not advised, unless it be to lower the temperature in the manner described; and then the toxin should be diluted by encouraging the patient to drink large quantities of fluid, or if necessary by the slow administration of saline per rectum.

Pilocarpine has been recommended, but should not be given, for it causes a secretion from the lungs, and may accentuate any pulmonary œdema which is so often present to some extent in eclampsia.

4. *By the Blood-Stream.*—Venesection in suitable cases has a marked effect upon the occurrence of the fits. It is recorded that after one venesection the fits ceased in 54 per cent. of cases. The blood is taken as a rule from the median basilic vein, and from 10 ozs. to 1 pint of blood removed according to the patient's condition. This is often done as a preliminary to the intra-venous saline infusion, so that the blood-pressure may be lowered.

Suitable cases are those in which the patient is plethoric, has a full bounding pulse and high blood-pressure, or is cyanosed. It is advisable, in addition to venesection, to administer oxygen, and artificial respiration has been required in some cases. Venesection is not to be practised unless the systolic blood-pressure rises up to or beyond 200 mm. mercury and cyanosis is present nor if the patient is feeble and anæmic. If this method is employed not more than 20 ozs. of blood are to be withdrawn and it is better not repeated.

Saline infusion is a valuable aid in diluting the toxin, and is to be recommended unless the patient shows any evidence of pulmonary œdema. It may be given either by intra-venous infusion, by the rectum, or into the subcutaneous tissues. Of these methods the intra-venous is best if venesection is performed, as the saline may be run into the vein immediately after withdrawing the blood. The subcutaneous method is not to be employed if the patient is restless.

Together with the saline a drachm of sodium acetate or sodium bicarbonate to the pint of saline (0·85 per cent.) may be added so as to increase the alkalinity of the blood, which is diminished in eclampsia. In order to combat the acidosis 5 per cent. glucose is also added. This may be given per rectum with the saline if the patient feels too sick to retain it by the mouth. Saline solution is not only of value to dilute the toxin, but it also acts as a diuretic.

Great care must be exercised that the treatment shall not be too drastic or energetic. In the report upon the collected cases already referred to, the following comment was made in this respect: "It is impossible to avoid the conviction that the majority of the fatal cases were over treated, and that in a considerable number the excessive treatment must have been a contributory factor in bringing about the fatal result."

Serum Treatment—The administration of serum is based upon the belief that during pregnancy there are circulating in the mother's blood poisonous proteid bodies which have been derived from the cells of the chorionic villi. It is believed that the pregnant woman forms within her blood-serum a chemical body of the nature of a ferment which is able to counteract these protein bodies, and Abderhalden's serum test for pregnancy is based upon the presence or absence of this ferment. If, however, the toxins are in too great quantity or the protective ferment is not sufficiently produced, then a condition of toxæmia results.

The serum treatment aims at supplying this ferment deficiency by giving the patient serum from a normal pregnant woman. It is given subcutaneously in doses of 15 to 25 c.cm. at intervals of 24 hours. It must not be repeated too often for fear of inducing anaphylactic phenomena, and care must be taken that the serum is obtained from a woman free of syphilis. Good results have been recorded in some cases of eclampsia, and also of hyperemesis gravidarum by the giving of this serum, and benefit is claimed not only by the administration of a pregnant woman's serum, but also serum from a non-pregnant woman, from a man, or even from a horse.

Theoretically there is sufficient ground in favour of this mode of treatment, although the evidence is not conclusive at the present time.

Obstetrical Treatment.—The question of the obstetrical treatment of eclampsia has led to much discussion and difference of opinion. There have been in the past two entirely opposed views; the one claims that the pregnancy must be terminated at once if the toxæmia

is severe, or the patient has had a fit, whether the patient is already in labour or not; the other claims that no obstetrical interference is necessary unless medical measures fail, or the patient is advanced in labour.

In favour of the former view was the experience that, in most cases, recovery was rapid after the uterus was emptied; the belief that eclampsia was a toxæmia, and that the toxin was derived from the ovum; that improvement in the maternal condition followed if the fœtus died *in utero*, and the frequency with which abortion or labour came on when the degree of toxæmia was severe. In consequence, it was argued that the correct treatment was to empty the uterus with as little delay as possible. Hence such measures of induction were employed, and this proving too slow, more rapid measures, such as accouchement forcé and Cæsarean section, were employed.

In favour of the second view, it was urged that the convulsions are not necessarily due to the labour, because the fits occur apart from labour, and labour pains apparently do not stimulate them. It is stated that the fits continue in 57 per cent. of cases after parturition is complete.

These views have found powerful support from the report of the Committee appointed to investigate the treatment of eclampsia in the United Kingdom. Their report has greatly modified some of the views which previously had been held. The tendency until then had grown in favour of the rapid termination of labour often by Cæsarean section. The report was a powerful plea for restraint in regard to obstetric management. Active interference, as represented by Cæsarean section and rapid dilatation of the cervix, was shown to diminish the patient's chances of recovery, instead of increasing them. This was evidenced in the maternal mortality rate of 21 per cent., when rapid delivery was practised, as against 10·29, when expectant or non-operative methods were employed.

The actual figures of the maternal mortality for London and the Midlands was as follows:—

	Mild.	Severe.
(*a*) Natural delivery,	4·5 per cent.	36·9 per cent.
(*b*) Assisted delivery,	5·6 ,, ,,	31·7 ,, ,,
(*c*) Induction of labour,	6·6 ,, ,,	26·4 ,, ,,
(*d*) Cæsarean section,	11·3 ,, ,,	46·3 ,, ,,
(*e*) Accouchement forcé	18·1 ,, ,,	63·1 ,, ,,

These figures clearly demonstrate that the greater the degree of obstetric manipulation the higher will the mortality rate rise, and this point is still more striking when the results of delivery by Cæsarean section or accouchement forcé are compared with those from Dublin (10·29), in which the treatment was medical and not obstetrical.

If the Patient is not in Labour.—In the light of our present knowledge it is considered inadvisable to induce labour, in cases of eclampsia, until medical measures have been given a trial of 48 hours. It is held that labour should not be induced as a routine, and that no operative interference should be made unless called for by some special urgency.

If the Patient is already in Labour.—The labour, if proceeding normally, should be left to nature.

If the second stage is delayed, the forceps may be used under gas and oxygen anæsthesia, or, if there is no evidence of œdema, under ether.

If induction of labour in eclampsia becomes necessary, owing to a continuance of the fits in spite of medical treatment, the method advised is to rupture the membranes, and insert a small rubber bag to dilate the cervical canal, or, if the cervix is wide enough, to use a larger rubber bag, such as that of Champetier de Ribes, or its more modern substitute. Induction by means of bougies is too slow, and requires too long a time for such urgent cases. Cæsarean section is contra-indicated, unless, in addition, there is some obstruction, pelvic contraction, or great disproportion in size between the head and the pelvis. If necessary, craniotomy may be performed as the child's chances of survival are, in any case, very poor.

If a patient recovers from eclampsia under medical treatment before the onset of labour, the question of allowing the pregnancy to continue or not has to be considered. The danger, however, of a sudden fatal eclamptic attack supervening at a later date in the pregnancy must be borne in mind. Therefore, when the patient recovers as a result of medical measures, the pregnancy should be terminated.

Surgical Treatment.—Lumbar puncture and spinal anæsthesia have been practised and recommended. It has been observed in some cases of lumbar puncture that the cerebro-spinal fluid comes out under increased tension, *e.g.* 450 mm. of mercury instead of the normal 120.

At present, however, there is not sufficient evidence to prove that either of these measures has any effect upon the fits.

Decapsulation of the kidney has been performed with a view to relieving intrarenal tension in cases of complete suppression or almost complete suppression of urine. Some successful results have been noted following upon merely incision of the kidney capsule instead of decapsulation. Sufficient knowledge, however, has not yet been accumulated to warrant the routine employment of these operative measures at the present time.

CHAPTER XIII

THE TOXÆMIAS OF PREGNANCY (*continued*)

HYPEREMESIS GRAVIDARUM

A CERTAIN degree of nausea and vomiting commonly affects the pregnant woman in the early part of the pregnancy from about the fourth week to the beginning of the fourth month, after which time these unpleasant symptoms usually subside. Sometimes, however, during this time the symptoms are much more severe and the vomiting persists.

The term "hyperemesis gravidarum" is applied to those cases in which the vomiting becomes so frequent and so extreme that the patient is unable to retain her food and becomes wasted in consequence. All gradations occur from the mild cases of ordinary vomiting up to pernicious vomiting, and it is possible that the same cause underlies them all.

Frequency.—Nausea and the slighter degrees of vomiting are stated to occur in more than 50 per cent. of pregnant women, being more frequent among primigravidæ than multiparæ. Vomiting of such severity as to merit the term pernicious vomiting is rare. The statistics of hospital patients show that pernicious vomiting of this degree occurs once only in every thousand pregnancies. This figure must be accepted with reserve, for the standard of vomiting which merits the term "pernicious" varies with the observer. Among neurotic women of the upper classes it is more common, as also among women of a highly-strung race such as the Jews.

VARIETIES

Vomiting in pregnancy is of two separate and distinct types :—

1. Vomiting during pregnancy.
2. Vomiting of pregnancy.

1. **Vomiting during Pregnancy.**—In this variety the patient vomits on account of some disease which may be looked upon as an accidental complication of, and not as a result of, the pregnancy.

There are several examples of this group, such as that due to the onset of an acute specific fever, to gastritis, a gastric ulcer, or cerebral tumour. Care must be taken not to pass over a case in which the vomiting is really the result of intestinal obstruction, or even of a gastric crisis of tabes.

This variety is sometimes described as associated vomiting.

2. **Vomiting of Pregnancy.**—The patient in this variety vomits because of the pregnancy, and there is no accompanying organic cause to explain it.

The nature of this type of vomiting is not known with any degree of certainty, and many views have been advanced to explain it. It is believed by most observers at the present time to be neurotic in origin in the vast majority of the cases, and that it is a result of the disturbance of endocrine activity which accompanies the fertilization of the ovum. Another view is that the primary cause of the vomiting is to be found in a maternal shortage of hepatic glycogen due in its turn to the needs of the fœtus, and it is claimed that good results follow from the administration of carbohydrates either in the form of glucose intravenously or of lactose by the mouth.

Again many cases of cure have been recorded in which the vomiting ceased after the replacement of a retroflexed gravid uterus, and the treatment of a laceration or erosion of the cervix. Such cases were formerly placed by themselves in a group known as the "reflex," but there is no proof whatever that the vomiting is brought about thus reflexly, for such causes are often present without vomiting, and vomiting may occur in their absence. It is far more probable that the cure may be attributed to the mental effect on the patient of the treatment adopted. The toxic group is now believed to represent only a very small number of cases.

It is usual therefore to subdivide the *vomiting of pregnancy* into two forms:—

(*a*) *The common or neurotic.*
(*b*) *The rare or toxic.*

Neurotic.—There can be little doubt that almost all cases are of this nature. Many observations afford evidence that the vomiting may be the manifestation of a neurosis.

Among these may be mentioned the fact that evidences of hysteria are often present in such cases, and that their true nature may be shown by the vomiting ceasing after strong mental impressions. Thus patients who have been anxious to have a child have been cured on the mere threat of terminating the pregnancy, and

cures have also followed upon the simplest medical measures, the administration of an anæsthetic, or even the application of an electric battery which was not working. This view is further supported by such instances as the large number of different drugs which have had their vogue and adherents, the almost invariable and sudden cure upon emptying the uterus, and by those cases in which the patient was cured because she believed, although wrongly, that abortion had been induced.

Toxic.—At one time it was believed that this comprised a large group, and that it was in a minor degree present as the underlying cause in the neurotic group.

The evidence in support of this view is the high ammonia-co-efficient, and the acidosis from the presence of acetone and diacetic acid in the urine; that excessive vomiting frequently complicates a hydatidiform mole pregnancy, in which condition there is a marked proliferation of the fœtal elements covering the villi, and it is from them that the toxin is claimed to be derived; a further fact in support of this view is that in severe cases of pernicious vomiting toxic forms of neuritis have been known to occur.

But in the great majority of cases of vomiting of pregnancy positive evidences of toxæmia are normally absent. It is now believed that the changes in the urine are merely those which normally accompany starvation and water-depletion; they are, in short, effects of the vomiting and not signs of the underlying cause. Biochemists to-day regard such a rise in the ammonia-coefficient as merely an index of acid neutralization, occurring as a safeguard to the body at a time when carbohydrate combustion has sunk to a low ebb. The prolonged vomiting, necessarily leading to carbohydrate depletion, is in itself a sufficient reason for the rise in the ammonia-coefficient, and this chemical change in the urine cannot be taken as evidence of toxæmia.

Nor can the presence in the urine of such substances as acetone and diacetic acid (ketone bodies) be regarded as evidence of toxæmia, for they are the products of the incomplete combustion of fat, and occur in all pathological states in which carbohydrate is being very little utilized. Although, however, the high ammonia-coefficient and the presence of ketone bodies are no longer recognized as evidence of toxæmia they serve as a useful criterion, for they show, whatever be their cause, that the condition of the patient is serious, and that prompt treatment is necessary in her interest.

While it is now held that very few cases of toxic vomiting of pregnancy occur, it is not denied that there are some rare cases of toxic origin in which there may be severe toxic symptoms, a high urinary diastase, and evidences of renal and hepatic disease.

Pathology

Few patients suffering from the neurotic variety of vomiting die, and therefore the description of the pathological lesions is founded on examinations of the severe cases.

Liver.—The liver lesions are very similar to those found in acute yellow atrophy. In some there is a necrosis of the central portion of the lobule, while the periphery remains intact; in other cases, however, there is no necrosis, but the liver shows evidence of marked fatty degeneration throughout the whole organ.

Stress has been laid by several observers upon the fact that the liver changes are dissimilar from those of eclampsia, in which condition the peripheral portion of the lobule is the main portion affected rather than the central portion as in hyperemesis gravidarum, but this limitation to certain areas is not always evident.

Kidneys.—The kidneys may show no change. Those found are entirely degenerative in character, are confined to the cells of the convoluted tubules, which show cloudy swelling, the lumina being filled with granular débris. The areas of hæmorrhage and necrosis so frequently seen in the kidneys of fatal cases of eclampsia are not usually found in this condition.

Symptoms

When the vomiting is due to some associated disease of pregnancy, such as a gastric ulcer or the presence of an intracranial tumour, the symptoms are those of the disease which is present, and it would be out of place to describe them here.

In the *neurotic form* the symptoms begin as in the ordinary vomiting of pregnancy. The vomiting, however, either persists beyond the beginning of the fourth month, the date at which the ordinary vomiting usually ends, or becomes more severe. The patient is sick after every meal and also between meals; she is unable to absorb nourishment; and her rest may be disturbed on account of vomiting at night. This form of vomiting may continue for several weeks, so that the patient wastes and may become so exhausted that her condition is rendered serious. She gradually becomes more emaciated and exhausted; she vomits coffee-ground-like material; she becomes slightly jaundiced, the urine diminishes in quantity and contains an increasing amount of albumin and a high diastase content, and shows a rise in the ammonia-coefficient and a fall in the amount of nitrogen excreted as urea together with the presence of acetone and diacetic acid. Patients in this class may gradually pass into a condition similar to the severe toxic variety, and may die from exhaustion.

In the rare instances of the *toxic form* the patient vomits at frequent intervals both day and night; she can retain no food of any description, even if small quantities are offered at a time. The vomit is at first bile-stained, later it may become brownish in colour from intermingled blood, and the patient complains of epigastric pains. The patient rapidly sinks into a comatose condition; the temperature gradually rises and may reach as high as 103°-104° F.; the pulse-rate becomes more frequent, up to 140 beats per minute, and the condition may end fatally in the course of a week or ten days. Recovery, however, is still possible even in this serious group of cases if the uterus is emptied artificially, or if abortion should spontaneously occur.

Diagnosis

The first step in the diagnosis is to make sure that the vomiting is not due to any one of the *associated* conditions already mentioned, including nephritis. This may be determined by a careful investigation into the history of the vomiting, and a general examination of the patient. It must be remembered also that vomiting is a marked feature of hydatidiform mole pregnancy and acute hydramnios, which conditions must be excluded.

Prognosis

The prognosis is satisfactory in the neurotic group if the patient is properly managed and it is seldom necessary to empty the uterus. Fortunately most cases of hyperemesis are of this variety, but these cases must by no means be regarded as trivial, for they are often a source of grave anxiety and may readily lead to death of the patient. The toxic form is much more rare, but on the other hand the prognosis of the toxic group is bad. Among even the severe forms of vomiting, however, recovery may follow upon abortion, provided this is not too long delayed and the patient allowed to become too weak. It is said that a gradual improvement may occur should the fœtus die even if the patient should not immediately abort. A recurrence of the vomiting is liable to take place in succeeding pregnancies.

Treatment

The ordinary form of vomiting which occurs during the early months of pregnancy can be treated, usually with success, by means of simple remedies. The patient should be told to take a cup of weak tea or hot milk with a dry biscuit or piece of toast as soon as she wakes, so that she is not allowed to feel any faintness which might ensue were she to wait for her breakfast

hour. She should be advised to take her breakfast in bed, and remain in the recumbent position for about half an hour afterwards. Even if she is sick, it is better for her to take food rather than to starve herself. A daily action of the bowels is necessary. She should be encouraged by the knowledge that most pregnant women complain of vomiting and nausea, but that the symptoms are of a temporary character only. It is important that this form of vomiting should not be allowed to drift on unchecked, otherwise, owing to the consequent starvation, loss of fluid and acidosis, her condition may become serious, and once the patient has reached the stage at which there is almost continuous vomiting, rise of pulse frequency, loss of sleep, wasting, and exhaustion, the treatment becomes correspondingly more difficult, and more energetic measures are required. An essential part of the treatment, if it is to be successful, is to remove the patient from her home. Discipline and separation from the interference of too sympathetic friends and relations are important factors in the treatment.

In most cases it is extraordinary how rapidly the vomiting ceases when the patient is removed to hospital or nursing home. She cannot be expected to recover so long as she is surrounded by over-anxious relatives, and a fussy nurse who is continually offering her a basin, and keeps the bedclothes covered with waterproof sheeting. These are direct incentives to vomit; it is obvious to her that she is expected to do so, and the suggestive influence of these surroundings is to make her continue to do so. The patient must not only be put in proper surroundings, but she must also be helped by the mental atmosphere. She must be made to understand that the condition will soon pass, and she will be cured with certainty. It is better not to give her a fluid diet but to put her on to a solid diet from the commencement of the treatment. The amount should be small in quantity and at frequent intervals, for the feeling of nausea will often return if the patient is allowed to become faint from the want of food. She will as likely as not at first refuse to take solid food, but she should be assured that she can do so, and of the better results that follow. She must, therefore, be made to eat it, and the attendant must stay with her until she has done so. As a general rule these methods of treatment give immediate and striking results, for the patient having found she can retain her diet is so impressed and encouraged that very little further persuasion is necessary, and the further progress of the case is towards a rapid and complete recovery. It is inadvisable to begin the treatment by drugs, but occasionally small doses of morphia such as gr. $\frac{1}{8}$ may be given at the commencement of the treatment.

If, however, the condition is of longer standing and does not yield readily to treatment on these lines, it may be necessary to adopt certain additional measures. All food by the mouth should be stopped for 24 to 48 hours, and the patient allowed only sips of water. If at the end of this time she does not vomit a return may be made to an ordinary diet. But should the vomiting return or continue, the treatment by the carbohydrate replacement method should be adopted. All food by the mouth must be stopped for 48 hours and the patient given rectal saline containing 10 per cent. glucose, or if the exhaustion is extreme the glucose may be given as a 10 per cent. solution in normal saline intravenously, 300 c.c. being administered at four-hourly intervals. A daily action of the bowels is necessary to prevent decomposition and any consequent irritation of the intestinal mucous membrane. Purges cannot be given by the mouth, however, therefore high enemata of soap and water should be used, the patient's hips being raised at the time. Usually after 48 hours a gradual return to ordinary diet may be effected. The food should be rich in carbohydrates but the fats should be eliminated, so that milk must in consequence be forbidden at this stage. Sugar can be tolerated by the mouth if given in the form of lactose instead of glucose. Success has often followed the administration of large doses of bromide of potassium and chloral hydrate by the rectum, and these substances may with advantage be included in the rectal saline.

Many other drugs have been used and advocated, such as bismuth, small doses of dilute hydrocyanic acid, oxalate of cerium or minim doses of tincture of iodine given by mouth, but it is doubtful if these have any effect, and if used they should be given more for their suggestive value than any other reason.

The same comment probably applied to the successful results which have been recorded from the subcutaneous administration of serum, whether this serum be obtained from the pregnant woman or from a horse. It is claimed that the serum of a patient suffering from pernicious vomiting is lacking in a protective ferment. The serum if obtained from another pregnant woman, should be taken in the later months of her pregnancy after the stage of vomiting has gone by, and after an investigation to exclude syphilis has been made. The dose is 15 c.c. subcutaneously at intervals of 24 hours. Not more than seven doses should be given for fear of causing anaphylactic phenomena.

It is seldom necessary in practice to resort to any of these more energetic measures. Most patients do not even require rectal injections. The essentials to success are the surroundings of the patient, the attitude of the nurse and medical attendant, and an

atmosphere of certainty and confidence that she will soon recover and the symptoms will not recur.

Operative Treatment.—All treatment of the above description may be of no avail, and the patient become so exhausted that it may be necessary to terminate the pregnancy. It should be remembered that in neurotic cases this measure is but rarely required, and should be adopted only after all other methods have been thoroughly and efficiently carried out. The difficulty in these cases, is to decide when to induce abortion. If it is done too early it will frequently be done unnecessarily, but it should never be delayed if the patient becomes very weak, or the operation, instead of doing good, may be sufficient to turn the scale against her. It is true that the statistics of abortion are unfavourable, but that is because so frequently interference is delayed until too late. Our guide as to the time in neurotic cases must be the amount of feebleness of the patient, and in the toxic cases it must depend upon her reaction to treatment and on the ammonia-cœfficient. It is claimed by some that abortion is indicated if the pulse-rate rises beyond 110 beats per minute.

Before the abortion is induced the practitioner should always consult a second doctor to free himself of any undue responsibility. The abortion is better carried out under ether or some other drug than chloroform, on account of the fact that chloroform may still further damage the liver.

Before the end of the third month the uterus can be most easily emptied by rupturing the membranes, plugging the cervical canal and vagina with gauze and administering ergot. Alternatively the uterus can be emptied forthwith by dilating the cervix with dilators and removing the ovum with forceps.

After the end of the third month the uterus can be most safely emptied by the insertion of a small rubber bag distended with sterile water. It is extremely dangerous to attempt to empty the uterus after the end of the third month by dragging out the ovum, whole or piecemeal, after a rapid dilatation. The uterus may easily be ruptured and may not be completely emptied.

In the extremely rare cases, such as pernicious vomiting and acute yellow atrophy of the liver in which it is imperative to empty the uterus rapidly after the end of the third month it is best, if the operator is skilled, to perform abdominal Cæsarean section or vaginal hysterotomy.

ICTERUS GRAVIS GRAVIDARUM

This is a rare but extremely serious disease which may complicate pregnancy. It may occur at any period of pregnancy; cases as early as the sixth and eighth weeks have been described, but it more usually supervenes during the later months of gestation or in the early period of the puerperium. It is not peculiar to pregnancy and may occur in men.

Pathology

The liver diminishes markedly and rapidly in size, so that within a short time it may be reduced to less than half the average weight. The capsule is wrinkled in appearance and the organ feels softer and more friable than usual. On section its surface is seen to be yellow with areas of orange or reddish tint. Each lobule has a red centre and a yellowish periphery.

Microscopic sections reveal changes which vary with the severity of the disease. In the milder cases the central portion of the lobule is necrotic, the cells at the periphery of the lobule may not show any abnormality, while the cells between show fatty degeneration. In the acute cases the whole lobule is affected, the cells are destroyed and represented by a granular mass of débris, and only a few liver cells can be identified. The interlobular spaces and the portal vessels and bile ducts, however, show little change.

The kidneys show marked evidence of degeneration and occasionally necrosis, especially in the cells of the convoluted tubules. The glomeruli and the cells lining the collecting tubules are but slightly affected.

The post-mortem findings therefore are similar to those found in eclampsia, but are of a greater severity.

Symptoms

The symptoms are the same whether the condition occurs during pregnancy or the puerperium.

Two clinical types may be recognized, the acute and the subacute.

Acute form.—The symptoms come on with alarming rapidity. The patient, who appeared to be in good health previously, is suddenly seized with acute abdominal pain, intense headache, severe vomiting, and diarrhœa. She rapidly passes into a condition of drowsiness or delirium, and this is soon followed by coma, which is sometimes interrupted by convulsions. The patient is jaundiced, the vomit is frequently stained with blood, and the urine, which is diminished in amount, contains albumin, all varieties of casts, often blood, and

shows the same changes as the urine of eclamptics. The amount of urea excreted is diminished, the ammonia-coefficient is raised, and crystals of leucin and tyrosin are present.

Subacute form.—In some cases the course is not so rapid. The case at first begins like one of pre-eclamptic toxæmia, but jaundice soon appears, the patient gradually becomes apathetic and sinks into a state of coma, and the gradual diminution in size of the liver can be traced.

When the condition has occurred during pregnancy the patient usually delivers herself of a dead fœtus.

This group of cases, like the acute form, is fatal as a rule.

Diagnosis

The disease should be suspected if the pregnant patient shows jaundice and diminution of the size of the liver, in addition to marked evidences of pregnancy toxæmia together with pyrexia and severe general disturbance.

A differential diagnosis has to be made from eclampsia if convulsions occur. This is by no means always easy, but reliance must be placed upon the evidence of jaundice and the decrease of the liver-dullness.

Cases of acute onset may be mistaken for poisoning, for similar symptoms are present in phosphorus and tetrachlorethane poisoning; the history of the patient and the condition of the gums must be investigated to exclude this.

It must be remembered, also, that when delivery has been accompanied by prolonged chloroform anæsthesia analogous liver lesions and jaundice may be present.

Treatment

The treatment does not differ from that of the other toxæmias of pregnancy (see p. 114). If the symptoms occur during pregnancy the uterus should be emptied as soon as possible.

MINOR TOXIC MANIFESTATIONS

Under this heading it is usual to include some conditions of minor importance which may occur during pregnancy. They are described frequently as due to some reflex cause, but it is by no means certain that this is true, for no definite proof of such an origin has been demonstrated, and, moreover, evidence is accumulating which

strengthens the opinion that they may be indications of some form of toxæmia.

Pruritus.—This may occur in two varieties. In the first, the symptoms are confined to the region of the vulva; they are of frequent occurrence during pregnancy, and but rarely cause any serious disturbance. The veins of the vulva may be varicose. In the second, the itching is not localized, but is felt over any part or the whole of the body surface. This is a rarer form, and the irritation may prove so distressing that sleep is prevented and the general health suffers. Usually the skin shows no lesion to account for the intolerable itching, but in some instances rashes of an erythematous or eczematous type are present.

Treatment

The urine should be investigated for the presence of glucose in all such cases. The presence of lactose is not important (see Diabetes). The localized variety may be due to some local condition other than the pregnancy, such as a vaginal discharge. If the discharge is purulent it should be treated accordingly (see p. 203); there may be, however, only an excess of the usual vaginal discharge derived from the glands of the cervix, and this is not uncommon during pregnancy owing to the increased vascularity. It is wiser, on account of the pregnancy, not to employ any astringent vaginal douche, and the condition is best treated by keeping the parts affected as dry as possible. The symptom may be relieved by the use of hydrocyanic acid lotion, 10 minims to an ounce of water, carbolic acid lotion 1/80, calomel ointment 30 grains to an ounce of lanoline or vaseline, or by disinfection of the vagina. In the generalized form the patient should be given nerve sedatives, such as ammonium or sodium bromide, and the skin may be bathed with carbolic lotion 1/80. Benefit has followed upon placing the patient on a strict milk diet. In some rare instances it has been found necessary to interrupt the pregnancy prematurely, on account of the patient showing signs of exhaustion from want of sleep and nervous strain. (See also section on "Pruritus" in volume on Diseases of Women.)

Salivation.—An increase in the amount of saliva not infrequently occurs during pregnancy. Other forms of excessive secretion which have been noticed are sweating and lachrymation. It may prove a most distressing complication of the pregnancy to the patient.

The increase occurs, as a rule, during the early part of pregnancy

and coincides in time with the period of morning vomiting. There is a tendency for the symptom to recur in succeeding pregnancies. The amount of secretion varies; it may be extreme, and cases have been recorded where 500 c.c. and even 1600 c.c. have been expectorated within twenty-four hours.

The effects upon the patient are distressing, not only because of the unpleasantness of the symptom, but because she is so constantly disturbed. There may be an accompanying rapid loss of weight from the loss of body fluid; as much as 29 lbs. loss of weight in a week has been noted.

The treatment is to give the patient an astringent mouth wash such as alum ℥ i to the pint. Belladonna and thyroid extract āā gr. ¼ *bis die*, given internally, have been followed by good results. These measures may fail, in which case it is advisable to give the patient a milk diet only.

CHAPTER XIV

DISPLACEMENTS OF THE PREGNANT UTERUS

RETROFLEXION AND RETROVERSION

ALTHOUGH retrodisplacement of the non-pregnant uterus appears to act at times as a barrier to conception, retrodisplacement of the pregnant uterus is a common condition, and in the majority of cases the pregnancy has supervened in a uterus that was previously retrodisplaced. Occasionally the uterus becomes retrodisplaced during the first two months of pregnancy as the result of a violent muscular effort, a fall, or some such cause.

As a rule this backward displacement gives rise to no symptoms that attract attention, and spontaneous reduction occurs during the third month. If symptoms are produced, they usually are due to some interference with the functions of the bladder, with pain and pelvic pressure, and during the third or fourth month of a pregnancy these symptoms should always suggest the presence of a retrodisplacement, and, in view of the possible dangers, should always demand a careful vaginal examination.

Spontaneous reduction generally occurs, but if the posterior wall of the uterus is fixed, by adhesions the pregnancy may still go on uninterrupted for a considerable time, or even to term, when the displacement of the cervix may give rise to obstruction during labour.

Another effect of the retrodisplacement may be abortion, which usually occurs during the first two months of pregnancy, the result of contractions induced by the irritation of the uterine muscle, owing to the pressure to which the uterus is subjected at this time, when it almost completely fills the pelvic cavity. Abortion is particularly likely to occur when the ascent of the uterus is obstructed by a projecting sacral promontory. When abortion occurs with a retrodisplaced uterus it is in the early weeks of pregnancy, before any symptoms arise.

On comparatively infrequent occasions the displacement is not reduced, abortion does not take place, but the pregnancy continues

until the uterus completely fills the pelvic cavity and becomes impacted. This condition is known as incarceration, and is of interest because of the grave results that may be produced on the urinary system if it is not relieved. Producing at first pain in the lower abdomen and back, as the intrapelvic pressure increases, the viscera become more and more pressed upon, and the bladder pushed up into the abdomen and the urethra elongated. With elongation of the urethra retention of urine usually occurs. The

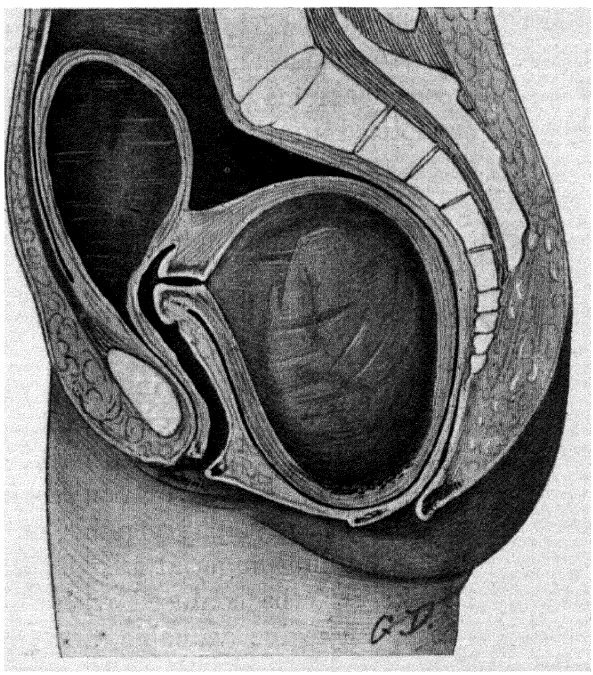


FIG. 34.—INCARCERATED RETROVERTED GRAVID UTERUS, SHOWING RETENTION OF URINE.

The body of the uterus is incarcerated below the promontory of the sacrum. The cervix has gone upwards, lengthening the urethra.

cause of this retention is not known ; it has been ascribed to pressure on the urethra, but this is not the case, as a soft catheter can easily be passed. It is probably due to some interference with the neuro-muscular mechanism of micturition.

When the retention has become sufficiently great, incontinence of urine will follow, the over-distended bladder voiding a little urine at frequent intervals, but never being able to empty itself completely. This condition is generally known as retention of urine with overflow, or the incontinence of retention. If the bladder is not relieved, cystitis develops, the walls of the bladder become œdematous and

thick, gangrene of the mucous membrane may ensue, and this membrane be passed per urethram in part or completely (Fig. 34).

It is not usual for the intestinal tract to be obstructed, although this occasionally happens.

Diagnosis

Any disturbance of the bladder functions towards the end of the third or in the fourth month of pregnancy should direct attention to the possibility of a retrodisplaced uterus. Obstruction to the passage of urine may be sudden and absolute, or frequent micturition with slight incontinence may be complained of. Pain may be entirely absent, or noticed in the lower part of the abdomen and back.

Abdominally, the distended bladder will be detected as a soft fluctuating tumour, which disappears when a catheter is passed and a quantity of urine drawn off. It should be remembered that the degree of distension may be great, and as much as 120 ounces of urine have been drawn off.

On attempting to introduce the finger into the vagina unusual difficulty is experienced, as the posterior vaginal wall is pushed forward by a smooth elastic swelling which occupies the hollow of the sacrum. This is made out to be the uterus, and on seeking the cervix it is found to be high up behind the symphysis pubis, or in some cases cannot be reached by the examining finger at all.

The condition most likely to be confused with this is a pelvic hæmatocele. The history may give valuable assistance, but the diagnosis can be cleared up only by making out that in the latter condition the slightly enlarged uterus lies in front of a soft mass, whereas in the case of a retroverted gravid uterus, the uterus itself is enlarged and retroverted, so that the cervix points high towards the symphysis pubis, and may even not be palpable owing to the great displacement. Another common condition that gives rise to similar symptoms is a fibroid in the posterior wall of the uterus, and if this be associated with pregnancy the differential diagnosis will often be attended with very real difficulty. A single interstitial fibroid causes a symmetrical enlargement of the uterus, and during pregnancy the fibroid frequently becomes soft. But, as the treatment of this condition is identical with that of a retroverted gravid uterus, the differential diagnosis is not of great practical importance (see p. 245).

Treatment

(*a*) Before retention has occurred.

The uterus should be replaced, but it must be remembered that any manipulative interference may produce abortion. If the uterus cannot be replaced, a ring pessary should be inserted, and this as a rule will prove successful in forty-eight hours or so.

(*b*) When retention has occurred.

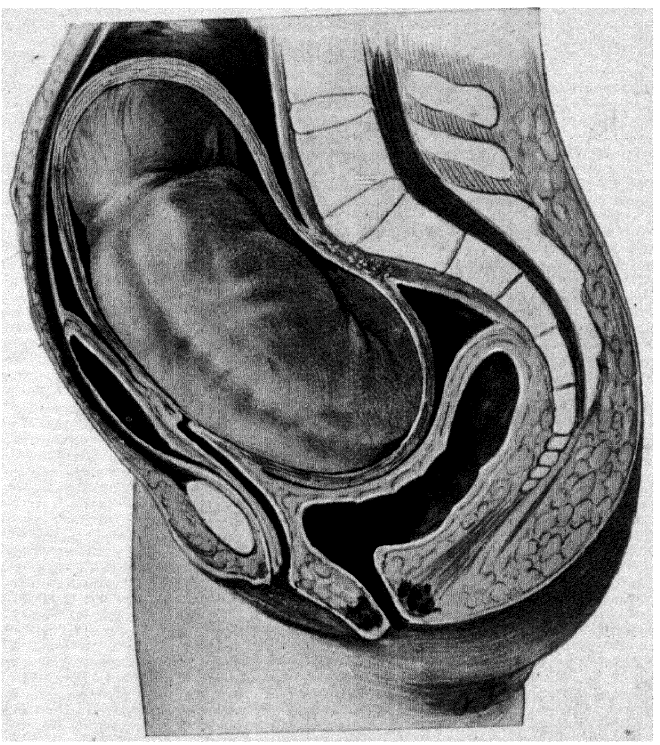


Fig. 35.—Retroversion of the Pregnant Uterus in which Attempts at Reposition failed.

Part of the uterus still occupies the pelvic hollow, forming a pouch. If the uterus does not assume its normal position before the onset of labour, the pouch will be pulled up during the first stage.

The organ that requires treatment is the bladder, not the uterus, the displacement of the uterus being of importance simply because it upsets the function of the bladder for a longer or shorter time. If retention is not relieved there is danger of cystitis. The bladder should be emptied by a catheter at regular intervals, the patient being kept in bed. This will usually be sufficient, and spontaneous ascent will follow. Failing spontaneous ascent, an attempt should now be made to replace the uterus. If necessary, auxiliary traction

may be made on the anterior lip of the cervix with a tenaculum or some such instrument, and such manœuvres may be carried out with the patient in the knee-chest position, or in that advocated by Sims. It may be necessary to administer chloroform. The uterus having been replaced, a ring pessary should be worn until there is no likelihood of recurrence of the retro-displacement, say until the fifth month. If these measures do not succeed the patient should be kept in bed, and the bladder emptied at regular intervals. It is often found then that even if the uterus does not go up spontaneously and cannot be pushed up the patient soon regains control over her bladder. When this has occurred, the gravity of the case is over. If the patient is examined from time to time it will probably be found that, although a pouch of the uterus still occupies the pelvic hollow (Fig. 35), the enlarging uterus can be felt rising higher and higher in the abdomen, and sooner or later the pouch disappears and the uterus occupies its normal position. This may occur as late as during the first stage of labour.

Induction of abortion has been recommended in the past, but is seldom, if ever, justifiable, even in cases of severe cystitis. Laparotomy has also been advised, so that the uterus may be freed from hypothetical adhesions which are binding it down in the pelvis. An adherent uterus is so unlikely to become pregnant that this method of treatment requires little consideration.

ANTEFLEXION AND ANTEVERSION

The normal position of the non-pregnant uterus is one of anteversion and slight anteflexion. Slight exaggeration is of no particular significance during the earlier months of pregnancy. During the later months, if the support of the abdominal wall is imperfect, or if there be a considerable degree of pelvic contraction, the fundus uteri may fall right forward, and the abdomen become unusually prominent. This condition is known as "pendulous belly," and its interest is that it may cause considerable discomfort during the pregnancy, and if not dealt with during labour may cause serious difficulty, which may go on to rupture of the uterus (Fig. 36).

The treatment consists in wearing a suitable abdominal support.

In dealing with this subject it should be remembered that on many occasions serious obstruction to delivery has resulted from ventral-fixation that has been practised for the relief of symptoms produced by a retroverted uterus, in which pregnancy has subsequently intervened. As the result of adhesion, the anterior wall of

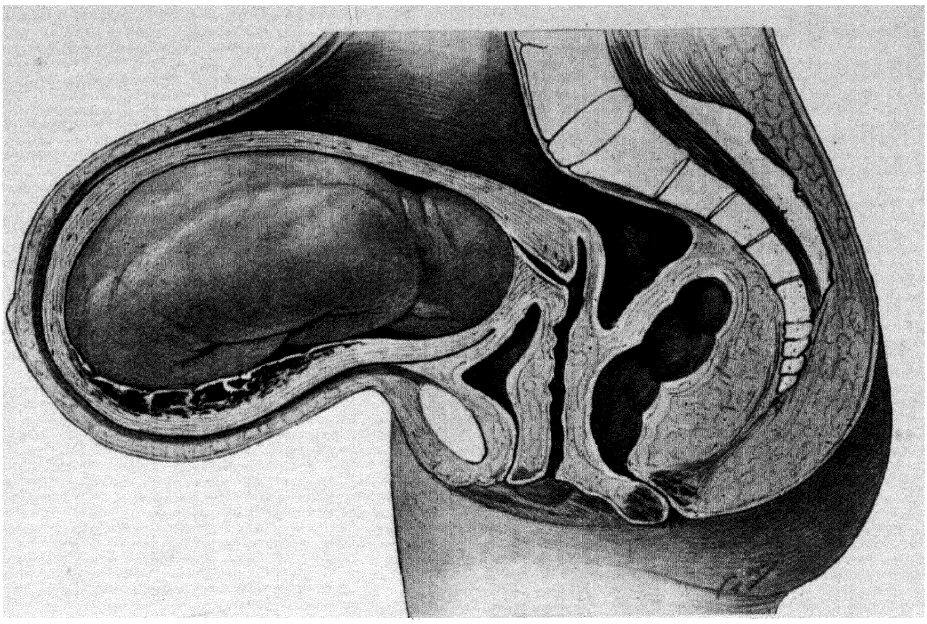


FIG. 36.—ANTEVERSION OF PREGNANT UTERUS, "PENDULOUS BELLY".



FIG. 37.—PREGNANT UTERUS AT TERM, SHOWING ANTERIOR SACCULATION AFTER VENTRO-FIXATION.

The external os is high up behind, just below the sacral promontory. The bladder should be in front of the head and not below it.

the uterus becomes fixed and cannot expand, so that the enlargement of the uterus is effected solely at the expense of the posterior wall. As a result of this, the cervix is gradually drawn up into the abdomen, and the hypertrophied anterior wall lies partly across the pelvic inlet. When labour sets in, the cervix is imperfectly dilated, as the main thrust of the presenting part comes to be on the hypertrophied anterior wall, and so, unless suitable measures are taken, rupture of the uterus may follow (Fig. 37).

PROLAPSE

Pregnancy in a partially prolapsed uterus is not at all unusual. In such cases, as the pregnancy advances the uterus as a rule rises

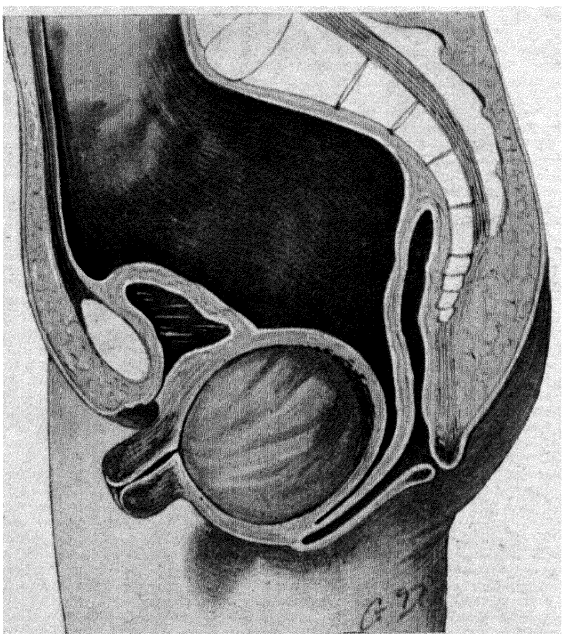


FIG. 38.—PROLAPSE OF PREGNANT UTERUS.

Note the cervix, which is congested and swollen. The body of the uterus will probably rise up into the abdomen, leaving the swollen cervix outside the vulva.

up in the pelvis until it has passed the inlet, and then prolapse is no longer possible.

The minor degrees of prolapse only require treatment until the uterus has risen above the inlet, and a suitable ring pessary is usually sufficient. Pregnancy in a completely prolapsed uterus is a very unusual phenomenon. It cannot go to term. As a rule the cervix becomes retracted when labour sets in, though on rare occasions it has been observed to remain protruding through the vulva, and to become markedly swollen, and so give rise to serious obstruction.

Sepsis should be treated by disinfection with iodine, but the most important point is that the patient should be kept in bed for some days before labour with the cervix within the vagina to allow the œdematous swelling to subside (Fig. 38).

HERNIA OF THE PREGNANT UTERUS

As a general rule herniæ are not made worse by, and do not affect the course of, pregnancy.

On rare occasions the uterus forms part of the contents of an inguinal hernia, and conception has been known to occur, especially when one horn of a bicornute uterus has been drawn into the sac.

Again, umbilical herniæ are common during pregnancy, but they too are usually unaffected by it, as when the uterus is high enough to enter the sac it is usually too large to do so. It is much more common to find the pregnant uterus in a sac caused either by the yielding of an old operation scar to the increased intra-abdominal pressure induced by the pregnancy, or by a marked separation and loss of tone of the recti muscles.

These conditions can usually be quite satisfactorily treated by a suitable abdominal support.

BICORNUTE UTERUS

A woman with a double uterus may become pregnant in one or both horns of the malformed uterus.

Pregnancy in one horn of the uterus is accompanied by an enlargement, softening and formation of a decidua in the other horn, and the pregnancy is generally normal. As a rule labour is normal and there is no need for interference. Occasionally rupture of the uterus occurs during labour, and the non-pregnant half of the uterus has very rarely obstructed the birth of the child.

Diagnosis

Unless the vagina or cervix be double, this malformation is likely to escape notice. The non-pregnant half of the uterus may be mistaken for a fibroid, and when in addition the patient has been septic, the condition has been diagnosed as a septic fibroid following labour, and a hysterectomy has been performed.

CHAPTER XV

ABORTION

ENDOMETRITIS

Varieties

Endometritis may occur in the pregnant woman in two forms, acute and chronic.

Acute Form.—This is a true infection of the lining membrane of the uterus during pregnancy, and is not uncommon. It has been observed in cases of ascending gonorrhœa in pregnant women, and the gonococcus has been demonstrated within the decidual membrane. But acute inflammatory lesions of the decidua by pyogenic organisms frequently follow attempts at abortion by means of instruments, and may follow operative interference with the pregnancy unless due care be used. The presence of cocci and bacilli has been demonstrated within the endometrium on section and by culture, but it is difficult to be certain whether they preceded the abortion or followed it. In these cases the decidua is thickened and the uterine surface is covered by a yellow purulent fluid. On microscopic examination the tissue is seen to be infiltrated with leucocytes, and shows scattered areas of necrosis.

Chronic Form.—In the chronic form we are dealing with a pathological condition of the endometrium which has existed before the occurrence of the pregnancy. The decidual condition represents, therefore, the extension of a lesion already existing at the time of conception in a uterus the site of some form of so-called endometritis. The term is usually a misnomer, as histological examination rarely shows any inflammatory changes. The diseased endometrium when it becomes converted into the decidua may present several forms (Fig. 39).

There may be a diffuse or a local thickening of the decidua.

Sometimes there is a marked hyperplasia of the glandular structure. In rare cases the mouths of the uterine glands are occluded, producing

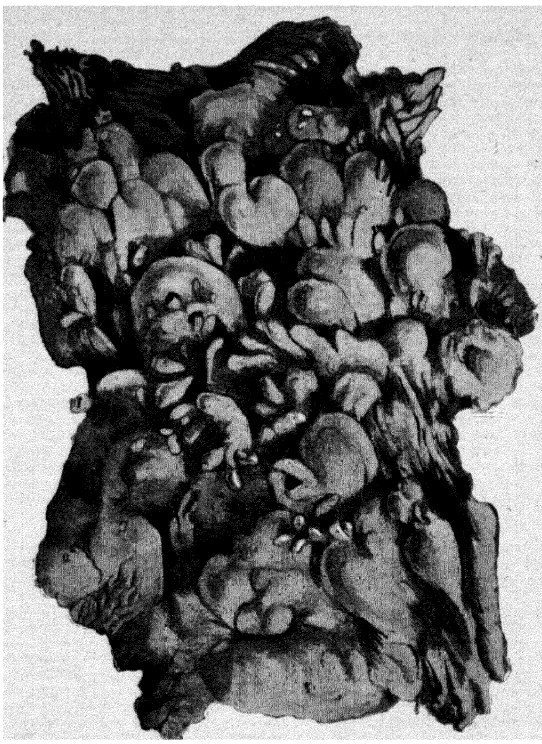


FIG. 39.—DIFFUSE THICKENING OF THE DECIDUA DUE TO CHRONIC ENDOMETRITIS.

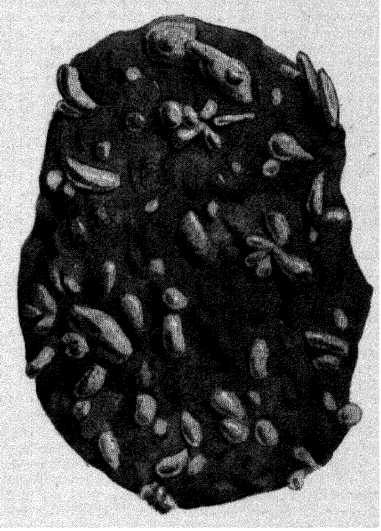


FIG. 40.—GLANDULAR RETENTION CYSTS IN THE DECIDUA DUE TO CHRONIC ENDOMETRITIS.

small glandular retention cysts (Fig. 40). Atrophic changes in the decidua vera and basalis have been described also.

RESULTS

1. Abortion frequently follows upon decidual endometritis. This is due partly to the unhealthy nature of the tissue in which the ovum is implanted. In the acute form there may be thrombosis of the maternal blood-spaces cutting off the blood supply to the ovum.

2. Premature rupture of the membranes is likely to occur in labour with this condition as a result of adhesion of the decidua vera and capsularis, which therefore prevents the descent of the bag of waters in order to dilate the cervix.

3. Adherence of the membranes and of the placenta may occur from the same cause after either abortion or labour.

4. Hydrorrhœa Gravidarum. This is a condition which is more commonly met with in text-books than in practice. It is

stated that it results from the glandular form of decidual endometritis in which the hypertrophied glands secrete a mucoid discharge. The fluid so produced may collect between the membranes and the uterine wall in the portion known as the chorio-decidual space, or if the cervical canal is patent the fluid may escape into the vagina. At times the fluid leaks away gradually, at others there may be a sudden profuse discharge giving the impression that the membranes have ruptured. On examination, however, the membranes are found intact, and the mistake has occurred of then diagnosing a second fœtal sac of a twin pregnancy.

This passage of fluid may occur from the second month of pregnancy until full time, but it has been observed usually during the early months. The amount of fluid expelled at a time varies considerably, but it may assume enormous proportions; thus as much as 500 c.cms. have been reported.

While it is probable that decidual endometritis explains this condition of hydrorrhœa gravidarum, yet it is necessary to consider another view.

According to some observers it is supposed to occur from a premature rupture of the fœtal membranes. The fœtal membranes may rupture and the liquor amnii very slowly leak away, for cases have been collected in which a period varying from 50 to 120 days has elapsed between the rupture of the membranes and the termination of the pregnancy. In these cases the amniotic membrane is retracted away from the fœtal surface of the placenta, pointing to a gradual collapse of the amniotic sac. On the other hand, the fluid has not the same characteristics as the liquor amnii, it does not contain lanugo, albuminous material, or urea, and has a lower specific gravity.

It is important to bear in mind that in addition to hydrorrhœa gravidarum, there are several other causes of a watery discharge during pregnancy. Thus it may also be caused by a hydatidiform mole, premature rupture of the membranes, the serum exuded from hæmorrhage within the uterine cavity (concealed accidental hæmorrhage), and also the fluid may be urine from a urinary fistula or retention overflow in cases of incarcerated retroflexed gravid uterus.

5. Sterility. Endometritis may be a cause of sterility, the abnormal secretion of the uterine glands interfering with impregnation, or with the proper implantation of the ovum.

This is invariable while the endometrium is the seat of an acute inflammatory process; the more chronic forms do not prevent conception, but tend rather to bring about abortion, or

an unhealthy condition of the ovum, for fœtal malformation is not uncommon in such cases.

Treatment

No local treatment is advisable during pregnancy, nor is it possible to ascertain the nature of the condition definitely until the pregnancy is over. When its true nature has been determined the unhealthy mucous membrane must be removed by curettage, and the uterine cavity disinfected in the hope that the new endometrium, when it is formed at a later date, will be of a healthy nature.

DEATH OF THE FŒTUS

In addition to those cases in which the child dies during delivery as the result of pressure and difficult labour, others are frequently seen in which the child dies *in utero* before labour starts.

This is usually followed by the expulsion of the child from the uterus. During the first twenty weeks of pregnancy, as a rule no attempt is made to tell whether the death of the fœtus is the cause of the miscarriage, or whether the miscarriage causes the death of the fœtus. In exceptional cases, however, the dead fœtus is not expelled from the uterus at once, but is retained for months, the so-called "missed abortion".

Cause

The causative factors of ante-natal death are imperfectly understood. They are in all probability very much the same as those of premature labour since, except in rare cases (missed abortion), the death of the fœtus is followed by its expulsion in from 2 to 20 days. In few cases is the cause of death obvious; in others a consideration of the functions of the placenta will point to it being at fault.

The causes of fœtal death may be classified under the following headings :—

1. *Poisons.*
   (*a*) Those due to organisms, such as syphilis, malaria, and the zymotic diseases.
   (*b*) Those not due to organisms, such as the toxins of albuminuria and diabetes.
   (*c*) Chemical poisons, such as lead and alcohol.
2. *Obstruction of the circulation in the placenta,* due to separation of a large portion of the placenta as in antepartum hæmorrhage; to extensive thrombosis or white infarction of the placenta.

3. *Malformations*, such as cystic kidneys, imperforate urethra.

4. *Trauma*, causing direct injury to the child—rare.

5. *Knots of the umbilical cord* occasionally interfere with the fœtal circulation and cause death.

6. *Unknown causes.* In some cases the cause of death cannot be detected. If with no apparent cause a patient gives birth to a macerated child, and especially if this occurs more than once, it is suggestive of syphilis. The fœtal liver, particularly, should be examined for spirochætes, and the Wassermann test applied to both parents' blood.

In cases of fever above 104° F. death of the fœtus is usual, but it is difficult to say whether this is due to toxæmia or hyperpyrexia.

Pathological Anatomy

The fœtus is usually born in a macerated condition, that is to say, its skin is peeling and stained pinkish-brown by the absorption of blood-pigment. The whole body is softened and toneless; the cranial bones are loosened and easily movable on one another. The liquor amnii and the fluid in all the serous cavities contain blood-pigments. Maceration occurs rapidly and may be advanced twenty-four hours after death; it is not necessarily accompanied by offensive odour.

If maceration does not occur the fœtus may dry up and mummification take place, resulting in a so-called "fœtus compressus" or "fœtus papyraceus". This sometimes occurs when one of twins dies: the dead child is then retained, and is born with the membranes of the healthy child.

If the membranes rupture or organisms gain access to the fœtus decomposition may occur.

Symptoms and Diagnosis

The patient herself may notice that the fœtal movements have not been felt for several days or longer, and the breasts may diminish in size and cease to be tender. At the same time vomiting and nausea, if present, may stop suddenly. Other symptoms, such as malaise, languor, foul taste in the mouth, and loss of appetite, are described as occurring in this condition, but are usually absent.

On examination definite signs may be obtained, such as:—

Absence of fœtal heart sounds.—Before the 28th week the heart sounds may be difficult to hear even in a normal case, but after that period of pregnancy has passed, if a skilled observer repeatedly fails to hear them on careful auscultation in a quiet place, it will

be strong presumptive evidence of fœtal death. This is especially so if the heart sounds have been previously heard by the same person. The absence of fœtal movements may be noted at the same time.

Cessation of growth of the uterus.—The uterus may be found to be smaller than the duration of the amenorrhœa would warrant, but it must be remembered that a fallacy may occur, as the patient may have conceived during a period of amenorrhœa. A more accurate test is to note how much alteration takes place in the size of the uterus during a fixed period, *e.g.* a month. To do this the bladder should be emptied and the level of the fundus marked on the skin with ink or silver nitrate. The patient is then examined week by week, and the level of the fundus noted. If enlargement is not observed in four weeks this is almost certain evidence that a dead fœtus is being retained *in utero.*

In some cases the uterus not only ceases to enlarge but actually gets smaller owing to the absorption of the liquor amnii.

Alteration in the consistence of the uterus.—If the liquor amnii is absorbed to any great extent the consistence of the uterus will become firmer and more resistant, and it will lose its elasticity.

Sometimes a free secretion of colostrum in the breasts may occur a few days after the death of the child.

On vaginal examination the discharge of cervical mucus may be coloured brown by altered blood: this is not a diagnostic sign of fœtal death, as it also occurs in concealed accidental hæmorrhage and other conditions. If the cervix is sufficiently dilated to admit the finger and allow the loosened bones of the skull to be palpated, a definite diagnosis can be made: this sign may also be obtained on abdominal examination.

It will thus be seen that death of the fœtus is difficult to diagnose from a single examination of the patient, and usually the safe course will be to watch the case for a few weeks before deciding that the child is alive or otherwise. Very little importance should be attached to the patient's statements about cessation of fœtal movements, since patients often confuse fœtal with intestinal movements.

Treatment

It is probable that in the majority of cases labour soon follows death of the fœtus. There are, however, cases in which the signs of fœtal death are clearly present, but labour does not occur spontaneously even after several weeks. In these cases there is no urgent call for interference, since the patient does not suffer from

ill-health. It is, however, at times expedient to anticipate the natural occurrence of labour, which may be delayed even beyond full time. Labour may be started by introducing sterile bougies into the uterus, or by rupturing the membranes with a sterile sound. In these cases the uterus is slow to respond to stimulation, and if labour does not set in soon after these attempts, a small de Ribes's bag should be inserted.

As soon as the puerperium is safely over, it will be necessary to treat the cause of the death of the fœtus if possible, so as to prevent a similar termination of a future pregnancy.

With the help of the Wassermann reaction and direct examination of the fœtal tissues for spirochætes, it should be possible to make a definite diagnosis as to whether syphilis is or is not the cause. If it is, the patient will require the appropriate treatment. In non-syphilitic cases, potassium chlorate in ten-grain doses three times daily, during the second half of pregnancy, with the idea of increasing oxygenation through the placenta, may be tried. If this drug is administered, the blood and urine should be carefully watched, as hæmatoporphyrinuria sometimes results.

ABORTION

The ovum may be expelled at any time during pregnancy, the earliest date at which the child is considered viable being the 28th week. Expulsion of the child before the 28th week is known as abortion or miscarriage, whereas subsequent to that date it is spoken of as premature labour.

It will thus be seen that there is no sharp line of distinction between a late abortion and an early premature labour—the division is merely one of convenience. Similarly it will be found that many cases of abortion pass gradually into the classes of case that are discussed under the title of "Antepartum Hæmorrhage". In both, bleeding before delivery is a cardinal symptom, the causation is often similar and the surgical principles guiding the treatment identical. In fact abortion and antepartum hæmorrhage might be discussed together, but the arbitrary separation according to the period of pregnancy reached is now sanctioned by long usage and will be adhered to. Nevertheless the senior student is advised to read the chapter on "Antepartum Hæmorrhage" as a continuation of that on abortion, and to note the numerous points of similarity in the pathology and treatment of the two conditions.

Among the laity the term "miscarriage" is in fairly general use, the term "abortion" being held to suggest something rather

in the nature of a criminal procedure. In the medical profession, on the other hand, although an attempt is sometimes made to limit the term "abortion" to cases occurring in the first three months, and miscarriage to those between the third and seventh month, as a general rule no distinction is drawn, the terms being regarded as synonymous, although the earlier expulsion of the ovum is perhaps more frequently spoken of as an abortion.

Frequency.—It is, at present, impossible for several reasons to give an accurate figure of the frequency of abortion. In the first place, only a small proportion comes to a public institution for advice, and consequently figures from such sources give no accurate information. Again, many of the earlier cases are not definitely diagnosed, but are regarded by the patient as a delayed menstrual period or a "flooding". Also, frequently a patient may conceal the fact that she has had an abortion. It has, however, been computed on the available evidence that one in every five pregnancies ends prematurely, and this figure is probably not too high.

Cause

In many cases a definite cause cannot be determined, and even when one is assignable, its method of action frequently is obscure, so that any attempt at classification of the causes of abortion must, in the present state of our knowledge, be to a certain extent unsatisfactory and arbitrary. The basis for the classification here adopted is an anatomical one.

1. **Conditions of Ovum, Embryo, or Fœtus.**
   - *a. Fœtal Conditions.*
     - Some abnormality incompatible with life.
     - Multiple pregnancy.
   - *b. Conditions of Fœtal Appendages.*
     - Torsion of, or knot in, the umbilical cord.
     - Hydatidiform mole.
     - Hydramnios.
     - Rupture of the membranes.
   - *c. Placental Conditions.*
     - Obliterative endarteritis (usually syphilitic).
     - Extensive placental infarction.
     - Premature separation due to any cause.
     - Placenta prævia.
     - Extensive retroplacental hæmorrhage.

2. **Maternal.**

a. General.

Syphilis.
Chronic nephritis, cardiac disease, and pulmonary disease.
Toxæmias of pregnancy.
Acute infectious fevers.
Acute poisoning by phosphorus, lead.
Chronic poisoning, *e.g.* lead.

b. Local.

Uterine Conditions.

Endometritis.
Retroversion of the gravid uterus.
Prolapse of the uterus.
Fibroids of the uterus.
Deep cervical lacerations.
Developmental abnormalities.

Other Pelvic Conditions.

Ovarian tumours.
Pelvic adhesions preventing normal ascent of the uterus.

Conditions which directly irritate the uterine muscle.

Introduction of foreign bodies (induced or criminal abortion).
Handling the pregnant uterus during pelvic operations.

Conditions causing Reflex Uterine Contraction.

Emotion, fright.
Operations.

3. **Paternal.**

Syphilis.

Of this long list the commonest causes are disease of the endometrium and uterine retrodisplacement in the earlier months, and syphilis and chronic nephritis in the later months. The mode of action of the various causes is obscure, and in many of them is but little understood. The fœtal causes act most frequently by causing death of the fœtus, which then becomes a foreign body and is expelled, as a rule, after a short interval. It should, however, clearly be borne in mind that death of the fœtus does not necessarily precede its expulsion, and there is considerable clinical evidence in support of this statement.

Clinical Varieties

In connection with the subject of abortion it is customary to make use of certain terms which describe its clinical varieties or indicate various stages in its process.

(1) *Threatened Abortion.*—When the process of abortion begins but its progress is arrested before it has reached a phase from which a resumption of the normal is impossible, the case is described as one of "threatened abortion". The clinical condition is clearly the early stage of abortion, and is consequently associated with bleeding and possibly some pain in the lower abdomen. A further stage is marked by a dilatation of the internal os. In this connection it should be remembered that in parous women, as the result of previous cervical laceration, the external os is frequently permanently dilated. Hence its condition is in this connection of no diagnostic value.

The determination of the fact that the pregnancy cannot possibly proceed to term is, from the point of view of treatment, of the first importance. It is, however, not always easy to draw a definite border line. Abortion does not necessarily follow even after repeated attacks of quite sharp bleeding, and it is not very unusual to meet cases in which slight hæmorrhage has continued for some time, and yet at term a healthy child has been born. These cases should, on the other hand, always be regarded as serious, since at any time a profuse (and even dangerous) bleeding may take place, which demands interference without regard to the condition of the pregnancy. Dilatation of the internal os, if it be of any marked degree, should be regarded as an indication that arrest of the process of abortion is not very probable, although clinically it has been observed on many occasions to subside, the pregnancy going on without interruption.

Rupture of the membranes and escape of the liquor amnii or any part of the ovum or complete separation of the ovum from the uterine wall indicate that the border line has been passed and the abortion is regarded as inevitable. Hence all cases in which the lower pole of the ovum cannot be felt bulging into a dilated internal os should be regarded as threatened.

(2) *Inevitable Abortion.*—When the process of abortion cannot be arrested it is said to be inevitable. As has been stated above, the clinical evidence of this is afforded by detachment of the ovum, which can be felt in the cervix through the dilated os, or by the expulsion of some part of the uterine contents.

(3) *Complete Abortion.*—A complete abortion is one in which all the products of conception have been expelled.

(4) *Incomplete Abortion* is usually one in which the fœtus has been expelled but the membranes or placenta, either in part or as a whole, are still retained in the uterine cavity.

(5) *Missed Abortion.*—When the embryo dies, signs of abortion appear and then subside, and yet the ovum is not expelled from the uterus but is retained for a time, the condition is known as a missed abortion.

Such terms as spontaneous abortion, criminal abortion, induced abortion, explain themselves.

Morbid Anatomy

In the first two months of pregnancy the attachment of the ovum to the decidua is so delicate that separation may follow on uterine contractions produced by any cause; or the immediate cause of abortion in the first months may be found in a hæmorrhage into the decidua or chorio-decidual space. What the exact cause of that hæmorrhage is we do not know, but its result is to determine a degeneration in the affected tissues and especially in the decidua basalis, so that the ovum becomes loosened and consequently acts as a foreign body and is expelled.

An examination of the structures cast off shows that in the majority of cases the decidua basalis remains in the uterus, and the ovum with a part or the whole of the decidua capsularis is expelled. Occasionally the entire ovum and the entire decidual lining are ejected, and again only the decidua capsularis may be torn through, and the ovum surrounded by chorionic villi is discovered among the material thrown out by the uterus (Fig. 41). The chorion also may be torn through and the fœtus expelled enclosed in its amnion and the liquor amnii, or the amnion also may be ruptured, and then the fœtus escapes uncovered.

After the fourth month, although the ovum may occasionally be expelled entire, as a rule the membranes rupture, the fœtus is delivered, and is later followed by the placenta and membranes. The appearance of the aborted ovum will obviously depend on the duration of the pregnancy. As a rule no recognizable morbid change has taken place. The placenta does not become a definite structure, till towards the end of the third month, but should the products of conception be ejected before that time, on careful examination of the ovum the chorion surrounded by villi can be made out in a recent specimen unless there has been considerable destruction of tissue. The uterine contents will clearly not contain a placenta, but the cavity will be lined by decidua. The fœtus may have

escaped, and is often difficult to detect lying in a cavity surrounded by a white glistening membrane, the amnion, which is in its turn as a rule enclosed in a mass of blood clot. When the placenta is a definite structure, the fœtus will usually be expelled first. It may or may not be dead. It is followed by the placenta and membranes, but it is not unusual for the small placenta to be retained. Such retention may be associated with continued hæmorrhage. Septic infection of the retained products may ensue.

An abortion is in reality only a miniature labour, and in a typical

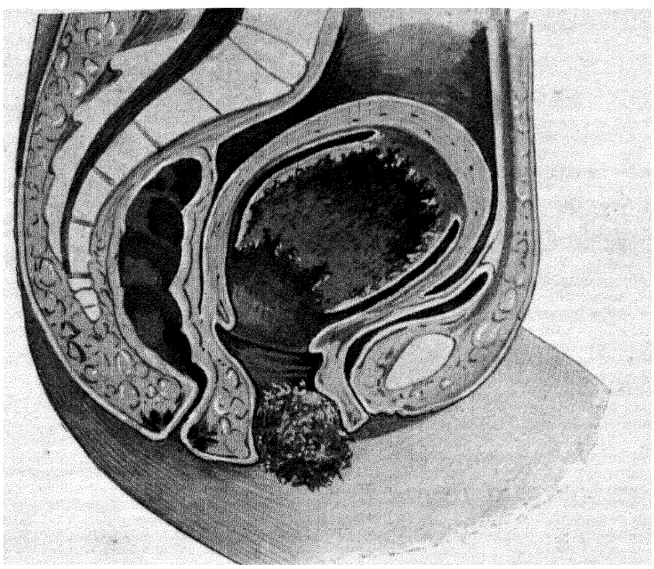


FIG. 41.—RUPTURE OF THE DECIDUA CAPSULARIS WITH ESCAPE OF THE OVUM SURROUNDED BY ITS CHORIONIC VILLI THROUGH THE RENT. ALMOST THE WHOLE DECIDUA IS LEFT BEHIND.

case a process which closely resembles that of labour at term is gone through. The uterus undergoes rhythmical contractions, the cervix dilates, and when the internal os is sufficiently dilated the ovum is expelled entire or in part by the uterine contractions. If the ovum is entirely expelled the pain ceases and the hæmorrhage abates. For several days a blood-stained discharge continues to escape, but eventually ceases and the uterus involutes as after a normal labour.

SYMPTOMS

There are two main symptoms accompanying this process, Hæmorrhage and Pain.

Hæmorrhage is nearly always the first symptom, and is produced

by a separation of the ovum or some part of the decidua from the uterine wall. It is generally slight at first, but later varies considerably in amount, and all degrees of severity up to a fatal loss are met with.

Pain is usually of an intermittent nature, and is produced by the uterine contractions. It is felt in the back and lower abdomen. It is to be remembered that pain may be entirely absent, and in any case it is not nearly so intense as that experienced at term.

Diagnosis

Quite frequently an ectopic gestation is confused with an early abortion. This is a serious mistake, and a correct differentiation is essential, as the former is an urgent condition, and confusion may lead to disastrous results. Both are usually associated with a short period of amenorrhœa followed by uterine hæmorrhage which is irregular both as regards time and character. But the hæmorrhage is, typically, of quite a different nature in the two conditions. In an abortion it is usually bright or accompanied by clots, and is much more profuse than in an ectopic gestation, in which condition the bleeding tends to be slight in amount and is characteristically of a dark "prune juice" colour, and is due to the casting off of the decidua. The occurrence of hæmorrhage in an ectopic gestation is usually associated with severe abdominal pain and varying degrees of shock. The pain recurs in attacks at intervals. In abortion the pain is usually not nearly so severe. If present it is of the nature of miniature labour pains, but it is often absent.

The commonest fate of an ectopic pregnancy is the formation of a tubal mole and pelvic hæmatocele. Consequently a definite mass appears in the pouch of Douglas postero-laterally to the uterus. This is frequently confused with a retroverted gravid uterus, but the position and direction of the cervix and the character of the lump will afford the evidence necessary to distinguish the conditions. If, however, the ectopic pregnancy should rupture, the onset of symptoms is very similar to that observed in other acute abdominal conditions. The severe pain is often accompanied by marked shock. A pelvic mass cannot at first be detected, but a fullness may be felt in the pouch of Douglas. If the amount of internal hæmorrhage is sufficiently great, movable percussion-dullness may be made out in the abdomen and the general signs of loss of blood, *e.g.* pallor, rapid pulse, will be observed. It should, however, be urged that unless it is unavoidable, it is very unwise to wait for the general signs of internal hæmorrhage before arriving at a diagnosis.

Other conditions which are associated with irregular uterine hæmorrhage, *e.g.* intra-uterine polypus, carcinoma of the cervix, are at times confused with abortion. But a careful history and vaginal examination will as a rule make the diagnosis clear. It must not be forgotten that bleeding during pregnancy may be due to carcinoma of the cervix.

Treatment

General Treatment.—When considering the causes of abortion it was stated that in a great proportion of cases no definite cause could be assigned, so that the prophylactic treatment must be based on general principles. In dealing with these unexplained cases there is no doubt that the irritability of the uterus and its response to external stimuli vary considerably in different apparently healthy individuals. It is wise, therefore, in women who show this tendency to abort to run no risks, *e.g.* coitus should be forbidden during the pregnancy, and any over-exertion avoided. If, on the other hand, a cause can be detected, it should be treated before conception has taken place. Endometritis should be treated by curettage, a retroverted uterus should be replaced and retained in position by a suitable pessary. Syphilis should be thoroughly treated, and in this connection it will be well to emphasize again the importance of treating both parents.

The first point to be settled is whether one is dealing with a threatened or an inevitable abortion. In the endeavour to make this distinction it should be remembered that abdominal and vaginal examinations tend to irritate the uterus, and should therefore be made with care and gentleness. If the patient is seen shortly after the onset of the hæmorrhage the distinction can easily be made. If the conclusion is arrived at that the process of abortion has not passed the stage when it can be arrested, the treatment described as suitable for a threatened abortion should be adopted. If, on the other hand, it is clear that nothing can restore the pregnancy to the normal, it should be treated as an inevitable abortion.

If, however, the medical attendant is not called in until later, and is met with a more or less indefinite story of frequent attacks of bleeding of some gravity with the passage of clots, and it is not clear what has been passed *per vaginam*, he must be guided entirely by the general condition of the patient and the information obtained from a pelvic examination. If the size of the uterus corresponds with the history of amenorrhœa and the loss of blood

has not produced any marked symptoms, the case can be treated as a threatened abortion, and frequently such cases go to term in spite of several profuse bleedings. If, on the other hand, the os is dilated and it is clear that some portion of the ovum has escaped, or if some portion of it is felt still protruding through the cervix (these cases are sometimes known as "cervical abortions"), the uterus should be emptied without delay.

Again, if the uterus is still distinctly soft and larger than normal, though not large enough to correspond with the date of the pregnancy, and free hæmorrhage persists, even though the os be not widely dilated, it is safe to assume that some of the products of conception have been retained, and they should be removed forthwith.

As soon as there is convincing evidence that the fœtus is dead the uterus should be emptied, as delay may expose the patient to the risks of hæmorrhage or sepsis.

The Treatment of Threatened Abortion.—Here the guiding principle is to arrest the process, and to that end the patient should be kept at rest in bed and put on a simple diet. There is ordinarily no indication for any local interference, but a quarter of a grain of morphia should be given hypodermically and the patient kept more or less under the effect of opium for two or three days. Bromides and chloral hydrate may be used instead of opium. Strong purgatives and enemata should be avoided. Frequently under this treatment the process will be arrested, but the patient should be kept in bed for at least a week to prevent a recurrence.

Should, however, the bleeding persist in spite of treatment or become serious, it may be necessary to treat the case as one of inevitable abortion.

The Treatment of Inevitable Abortion.—This may be summed up as the treatment of labour on a small scale. Generally no help is necessary, the uterus expelling its contents unaided and involuting in the usual way. All that is required then is a rational technique that bears in mind the grave risk of infection and the possible sources of danger. Care must be taken that anything passed is saved for examination. Ergot may be given in full doses and will frequently be of benefit.

There are three definite indications for interference: profuse hæmorrhage, inability of the uterus to expel its contents unaided, or infection of the uterine contents.

If the hæmorrhage becomes sufficient in quantity the uterus should be emptied; the method to be adopted will be indicted

by the severity of the bleeding and the degree of dilatation of the cervix. In some cases a hot vaginal douche produces such retraction and contraction of the uterus that the ovum is expelled without further bleeding. If this does not suffice, either the vagina should be plugged or the uterus emptied by a rapid method (see p. 731).

Again, if after the lapse of a few hours the uterus has not completely expelled its contents they should be removed. This is particularly necessary in cases in which partial expulsion has taken place. The risk associated with retained products is sepsis, and it is quite irrational to leave them in the uterus for any length of time in the hope that they may be expelled. A rise of temperature is certainly a very definite reason for immediately removing the uterine contents. At the same time it should be urged that it is not in any way desirable to delay interference until infection of the uterine contents has taken place. It must be remembered that the process of abortion is one of miniature labour. The principles of the management of abortion must be those indicated in the management of labour. The greater the part the uterus itself plays in the expulsion of the ovum the better. The object is not to get the uterus emptied as rapidly as possible by dragging out the ovum except in rare cases of hæmorrhage or toxæmia.

The Treatment of Incomplete Abortion.—The gravest risk attached to the process of abortion is sepsis, and infection of the uterine contents may lead not only to local trouble but to septicæmia. The treatment of the various local conditions will be described elsewhere, as will the treatment of septicæmia (*vide* p. 557). The infected uterine contents should be gently removed, and the best means of effecting this is by the introduction of the gloved finger into the uterus. Great care should be taken not to interfere with the lymphatic barrier that shuts off the infected material. For this reason a sharp instrument should not be used, nor should the uterus be curetted. It is also well to bear in mind the fact that it is not difficult to pass a metal instrument through the uterine wall, which is often unusually soft in these cases. After removal of the contents the cavity should be douched out gently with some antiseptic solution.

CHAPTER XVI

MOLAR PREGNANCY

CARNEOUS MOLE

A CARNEOUS mole is a dead ovum which has been destroyed in the early months of pregnancy, as a rule before the formation of the placenta. The destruction is brought about either by a slight progressive hæmorrhage or by repeated small ones. The exact cause of the bleeding is not known, but it takes place into the decidua and chorio-decidual space, and the blood is maternal in origin. If it is sufficiently sudden or extensive, abortion will take place, but if

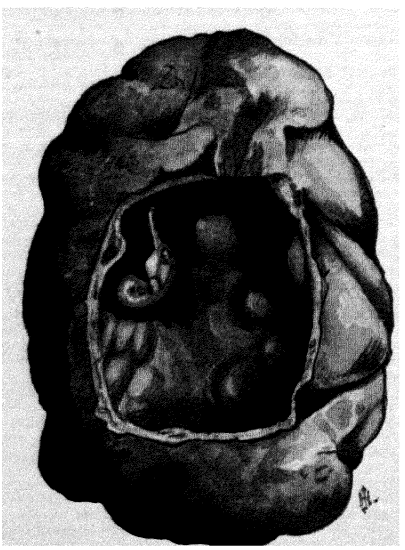


FIG. 42.

not the effused blood eventually surrounds the ovum and the chorionic membrane and villi are more or less destroyed. The blood is, as a rule, unequally distributed, and bulges forward the amnion in irregular projections, the appearance thus produced suggesting the term "tuberous mole". This extravasated blood cuts off the developing ovum from its supplies, and it perishes.

The amnion, a resistant membrane, is usually found being intact in the midst of the blood clot. On rare occasions hæmorrhage takes place in its cavity. The fœtus perishes—hence the old term "blighted

ovum"—and is either completely absorbed or found disorganized in the liquor amnii.

There is often a marked disproportion between the state of the development of the fœtus and the size of the amniotic cavity, and it has been suggested that this is due to an excessive amount of liquor amnii being present.

The destroyed ovum may be retained for many weeks in the uterus, during which time the fluid constituents of the blood surrounding the ovum will be absorbed and the wall will become "fleshy," hence the term "fleshy mole" is applied to this condition. The wall on section shows at times a laminated appearance, and microscopic examination of a portion shows degenerated chorionic villi in the blood clot.

Symptoms

As the pregnancy is clinically normal until the ovum is destroyed, it will be at first accompanied by the early symptoms of pregnancy, which vary markedly in prominence in different individuals. Subsequently the ovum is destroyed, with the result that the mammary activity and the morning sickness disappear.

There may be a slight continuous vaginal hæmorrhage, and the case is clinically indistinguishable from a threatened abortion. The uterine contents, however, are not discharged, and the process settles down for a time. As the uterus is not emptied, menstruation is not re-established.

On bimanual examination, the uterus is harder and less elastic than usual, and contractions cannot be detected in it. It will at first be larger than normal, but instead of increasing gradually in size it becomes smaller as the fluid is absorbed, so that it does not correspond in size to the supposed duration of the pregnancy. Eventually, after a period of time varying from a few weeks to three or four months or even longer, the mole is expelled.

Diagnosis

This condition can be diagnosed with certainty only by an examination of the contents of the uterus after they have been expelled. It has to be differentiated from a case of pregnancy in which the ovum is still living. In the latter the uterus will be soft and elastic, contractions will be detected, and the uterus will increase progressively in size as the pregnancy advances.

Again, the physical signs in some respects are like those of a fibroid, but with the latter the history is different, as regular and profuse menstruation will probably be present.

For the diagnosis of hydatidiform mole, see p. 178.

Treatment

A mole sooner or later acts as a foreign body and is expelled. It may be necessary, however, to remove the mole on account of the persistent bleeding, offensive discharge, pain, or rise of temperature, or the woman may demand its removal owing to her patience being exhausted and the uncertainty of her condition.

In cases of threatened abortion, it is always advisable to watch the development of the uterus in case the ovum has died and a carneous mole has been formed. The administration of ergot, or better of pituitary extract, may be used in an attempt to incite the uterus to expel its contents.

In the rare cases in which it is necessary to remove a carneous mole, it will be found a difficult matter to dilate the cervix. This is an occasion in which the laminaria tent is of great service. The tent may excite the uterus sufficiently to make it empty itself. If it does not do so it will make the further dilation of the cervix safer and easier.

HYDATIDIFORM OR VESICULAR MOLE

A hydatidiform mole consists of a collection of vesicles of varying size resulting from the degeneration of the chorionic villi. The vesicles are arranged on a number of stalks which spring from the surface of the chorion, each representing an original villus. These original villi branch, and the branches show the same vesicular formation, so that they come to resemble strings of beads (Fig. 43). It is one of the rarer complications of gestation. It has been met with in extra-uterine pregnancy and also accompanying a normal twin, and in a portion of the placenta of a healthy fœtus.

Cause

This condition is found throughout the child-bearing period, most frequently in multiparæ and especially towards the end of the child-bearing age. It has been known to recur several times in the same patient, and has therefore been thought to be due to some general condition of the mother, such as Bright's disease or anæmia, but the fact that only a portion of the chorionic tissue (or only one of twin placentæ) may be affected renders such an hypothesis improbable.

Morbid Anatomy

The change in the chorionic villi begins during the first two months of pregnancy, when the whole chorion is covered with villi. The amniotic sac is usually indistinguishable, and an embryo cannot be found. This is because the embryo dies very early and disintegrates (Fig. 43). The change in the chorion is not always universal; occasionally a placenta at term has been seen with a small area of hydatidiform degeneration, the fœtus being alive and normal. But infrequently in a twin pregnancy, one chorion has completely undergone hydatidiform degeneration and the embryo has perished, while the placenta and embryo of the other ovum are normal.

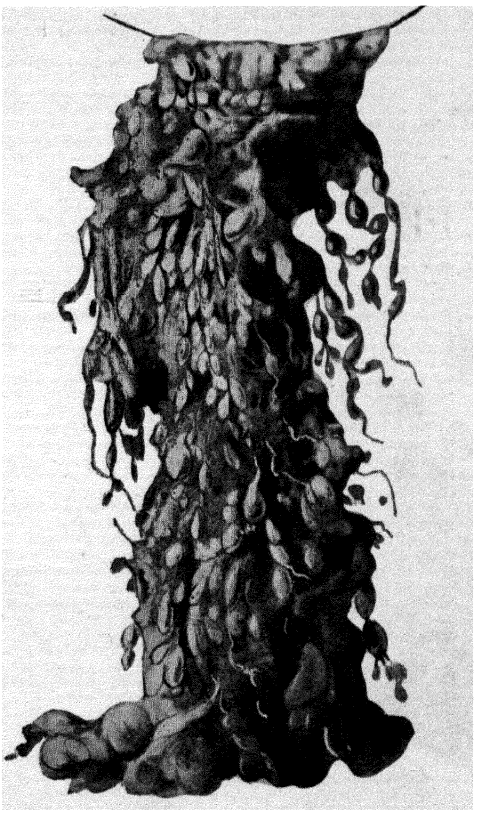


Fig. 43.—Universal Hydatidiform Degeneration of the Ovum.

Owing to the enlargement of the villi, the chorion takes up as much room as the whole ovum of a normal pregnancy. In many cases the size of the uterus is greater than that of a normal pregnant uterus corresponding to the same period of amenorrhœa. This increase in size is chiefly found in cases in which concealed hæmorrhage has occurred into the uterus owing to the separation of the chorion. This undue increase in size often occurs in a short time, and leads to distension of the uterus, accompanied by pain.

Vesicles vary in size from the microscopic to about three centimetres in the longest diameter. The largest vesicles are usually elliptical, only the smaller ones having a spherical outline.

Microscopically, the vesicles are seen to consist of the usual structure of a chorionic villus, but show an excessive proliferation of the trophoblastic covering (chorionic epithelium), accompanied by an œdematous or dropsical degeneration of the connective tissue. There are therefore, at the same time, proliferation and degeneration taking place in the villus. In the smaller vesicles the connective

tissue of the villus can still be recognized, but its cellular elements are degenerate and are widely separated from one another by fluid accumulations. In the larger vesicles the connective tissue and the blood-vessels have quite disappeared, nothing remaining but the cyst wall composed of chorionic epithelium containing clear fluid. This fluid was formerly described as the result of mucoid or myxomatous degeneration of the connective tissue of the villus. It has been shown recently, however, that the fluid does not contain any mucin; it is therefore looked upon as a primary œdematous change with secondary necrosis of the connective tissue.

Both the components of the chorionic epithelium undergo proliferation, the syncytium forming a massive plasmodial covering to large aggregations of actively proliferating Langhans' cells. These buds may be large enough to be detected with the naked eye. Such masses of chorionic epithelium attached to the vesicles are practically indistinguishable from the cell masses which characterize the malignant growth known as a chorion-epithelioma.

This active proliferation of the chorionic epithelium is the essential feature in the pathology of a hydatidiform mole, and must be looked upon as the first manifestation of some unexplained primary disease of the ovum itself. The relatively enormous increase in the two layers of the trophoblastic covering gives to the mole a much increased power of eating into, or eroding, the uterine wall. Clinically important results take place in consequence, and in some cases the villi penetrate completely through the decidua and perforate the uterine muscle. Even the peritoneum may be reached and broken through, so that hæmorrhage occurs into the abdominal cavity. This power of deep penetration is the distinguishing feature of the so-called malignant hydatidiform mole, presumably the frequent precursor of a chorion-epithelioma. Thus every gradation from a simple hydatidiform degeneration of the chorion up to the malignant penetrating mole can be found. Microscopically the tissues from all these varieties are alike, and there is no means of deciding from its histology which mole must be regarded as malignant.

It is common to find a cystic condition in one or both ovaries associated with these cases. The ovary may be enlarged up to the size of a fist, showing on the surface a large number of cysts of varying sizes up to that of a pigeon's egg. The naked-eye section strongly resembles that of a cystic kidney. The cysts have very thin walls, are sometimes transparent, and contain a thin watery fluid. Under the microscope there is a great increase of the number of lutein cells, which are not arranged in the wall of the cysts as in a corpus luteum, but are scattered throughout the stroma. If the mole is expelled

or removed and the patient recovers, the ovary gradually resumes its normal size.

It is generally accepted that there is some connection between the corpus luteum and the embedding of the fertilized ovum. When this condition of the ovaries was first noticed, it was suggested that the increased amount of lutein tissue was responsible for the luxuriant proliferation of the trophoblast. But the more modern view is that the hydatidiform mole is a primary disease of the ovum, and the ovarian changes described are secondary. Our knowledge on this point, however, is incomplete.

Symptoms

The chief symptom is bleeding. This has been seen as early as six weeks after the last normal period, but usually occurs in the third or fourth month of gestation. Sometimes the abnormally large size of the uterus and the absence of fœtal movements may attract attention.

Signs

The uterus is generally larger than in a normal pregnancy of the same duration, but not always so (Fig. 44); indeed, some cases have been recorded in which it was actually smaller. The consistence of the uterus is usually tense, but may be that of normal pregnancy. External ballottement cannot be obtained nor fœtal heart-sounds heard, except in the very rare cases of twin pregnancy in which one ovum only is affected.

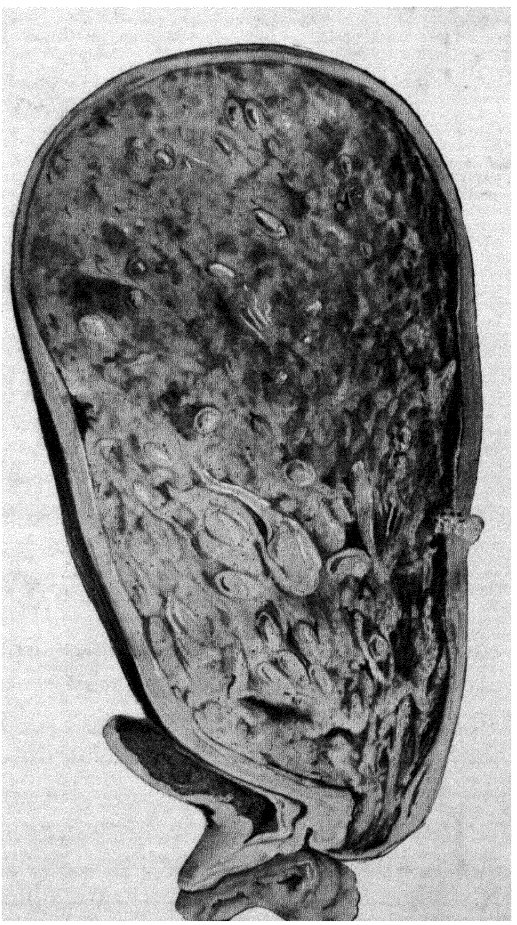


Fig. 44.—Hydatidiform Degeneration, showing Thinning of the Uterine Wall and Enlargement of the Uterus.

On vaginal examination no fœtus can be felt, but there may be the usual signs of threatened abortion, namely, slight dilatation of the cervix and hæmorrhage. Later, when the cervix is sufficiently

dilated to admit the finger, the mole can be felt and the diagnosis is obvious.

In cases in which the mole is unusually large there is often albuminuria and œdema, and occasionally severe vomiting.

Diagnosis

Hydatidiform mole has to be differentiated from threatened miscarriage in an otherwise normal pregnancy. The main points are the size of the uterus, the absence of signs of the fœtus, and the presence of the vesicles. Hydramnios with a threatened miscarriage is to be inferred from ballottement and the presence of fœtal heart-sounds. Concealed accidental hæmorrhage gives very similar physical signs, and can only be differentiated by the history and sudden onset, while in many cases the two conditions are associated.

In those cases associated with albuminuria, œdema, and vomiting, the absence of signs of the fœtus should suggest that the condition is one of hydatidiform mole, and not one of ordinary pregnancy with toxæmia.

Lastly, unless the menstrual history can be very carefully obtained there is a distinct risk of mistaking a hydatidiform mole for a degenerate fibroid or an ovarian cyst.

Prognosis

Danger to life may arise from **hæmorrhage.**

During the expulsion and still more during digital removal of the mole there may be serious hæmorrhage, and as small pieces are adherent to the uterine wall, the uterus may not retract well, and so postpartum hæmorrhage of some severity may ensue and may be fatal to the already exsanguine patient.

Sepsis.—This is a frequent complication owing to the fact that the uterus rarely empties itself completely, and the introduction of the fingers is required to separate adherent portions.

Erosion of the Uterine Wall.—When the villi penetrate deeply, the wall of the uterus may be so thin that hæmorrhage may occur under the peritoneum, or even rupture of the uterus take place.

Chorion-epithelioma.—Statistics show that this extremely fatal growth is found more frequently after hydatidiform moles than

after any other type of pregnancy, and therefore the possible occurrence of chorion-epithelioma must be taken into account when estimating the risks of hydatidiform mole.

Treatment

The treatment is to get the uterus emptied, contracted, and retracted. Digital removal may give rise to profuse hæmorrhage, and therefore every opportunity should be given to the uterus itself to expel the mole. If there is no dilatation of the os when the diagnosis is made, a tent should be inserted. If the tent provokes good uterine contractions, the mole is generally spontaneously expelled. If the uterine action is sluggish, pituitary extract may be used to stimulate it.

If the patient is bleeding severely when first seen and the os is sufficiently dilated, evacuation of the uterus should be encouraged by manual compression and the administration of pituitary extract. So far as possible, the mole is to be squeezed out from above rather than pulled out from below. A hot intra-uterine douche is a valuable aid to expulsion.

The vagina should be tightly packed (see page 727) under anæsthesia, and an abdominal binder applied.

After the evacuation of the main mass the interior of the uterus should be explored with the finger, and then wiped out with a piece of sterile gauze soaked in tincture of iodine. Neither ovum forceps nor the curette should in any case be used.

Ergot is given during the puerperium. If the lochia continue coloured with blood at the end of four weeks, the uterus should be curetted and the scrapings submitted to an expert pathologist. If any hæmorrhage subsequently occurs, the interior of the uterus should again be explored owing to the possibility of chorion-epithelioma.

Chorion-epithelioma secondary to hydatidiform mole does not, however, always lead to persistence of red lochia. They do not necessarily persist when the growth lies within the wall of the uterus rather than projecting into its cavity.

CHAPTER XVII

EXTRA-UTERINE PREGNANCY

A FULLER description of extra-uterine pregnancy will be found in the companion volume on Diseases of Women, but it is necessary to give a short account of some of its features in a volume on Midwifery. The subject comes into Obstetrics as apart from Gynæcology in several ways, *e.g.* in the diagnosis of early extra-uterine pregnancy from abortion and from retroversion of the pregnant uterus, in the diagnosis of cases in which there is severe pain during pregnancy, and also, rarely, in the diagnosis between advanced extra-uterine pregnancy and normal pregnancy.

SYMPTOMS

Extra-uterine pregnancy is not an uncommon condition, especially among the classes from which the bulk of hospital patients is drawn. The usual history is that one monthly period is missed, although in many cases there is no interval of amenorrhœa, then the patient is seized with more or less violent pain and has uterine hæmorrhage, usually only slight in amount. In many cases—probably all in which the hæmorrhage is slight in amount—the blood is dark in colour, resembling the discharge which comes from a uterus which contains a carneous mole. In a fair proportion of cases a *decidual cast* of the uterus is passed, whole or in pieces, but it is often unnoticed by the patient. In some cases there may be two, three, or more months of amenorrhœa—the ovum in these cases growing in the tube wall without disturbance by hæmorrhage. As long as extra-uterine pregnancy is not accompanied by internal hæmorrhage there is not, as a rule, much, if any, pain. The common terminations of tubal pregnancy, three in number, *viz. mole formation, abortion,* and *rupture,* are all due to hæmorrhage into the cavity which contains the ovum, or into the wall of the cavity. It is a very rare thing for extra-uterine pregnancy to continue to term. The reasons why the majority of cases of tubal pregnancy come to grief are to be found in the anatomical structure of the Fallopian tube. An ovum which

becomes embedded in the uterus finds there a thick, vascular membrane, the endometrium, which undergoes decidual changes, increases in thickness to a considerable extent, and provides a large number of capillaries and small arteries and veins. The placenta can be formed in the decidua without any great amount of hæmorrhage taking place, the bleeding that occurs when the small vessels are attacked by the trophoblast, during the formation of the placenta, being small in amount and not a source of danger to the ovum. In the Fallopian tube, on the other hand, except in the folds of mucous membrane which are not large enough to contain the growing ovum, there is very little, if any, connective tissue between the surface epithelium and the muscle, and no thick decidua is provided in which the ovum can grow. There are decidual changes in the Fallopian tube, but no thick decidual membrane is formed, because there is no thick layer of connective tissue out of which it could be formed, consequently the trophoblast, the active layer of burrowing cells on the external surface of the ovum, burrows into the muscle of the Fallopian tube. The cavity containing the ovum is thus made up, on the outer side of muscle and peritoneum, on the inner side by a certain amount of muscle and the tubal mucous membrane. Some of the vessels which are attacked by the trophoblast are large, and when these are opened up the pressure of the blood-stream is often able to break down the resistance offered by the fœtal cell-mass, with the result that hæmorrhage into the ovum is a common occurrence in tubal pregnancy. The formation of a blood-mole, which in the uterus is a comparatively rare occurrence, is an exceedingly common one in tubal pregnancy. When the ovum has been destroyed by hæmorrhage—being converted into a *tubal mole*—the hæmorrhage may cease, in which case there are no acute symptoms, and the mole may gradually undergo absorption, but it must be remembered that the burrowing action of the trophoblast may have weakened the wall of the Fallopian tube so much that it cannot withstand any increase of tension without giving way. The inner wall of the cavity which contains the ovum may give way so that hæmorrhage occurs into the interior of the Fallopian tube. This might be spoken of as *internal rupture*. The further course of events will depend on whether the abdominal ostium is open or closed. If it is open, blood will run out, sometimes in a mere trickle, sometimes in a large stream, into the peritoneal cavity. When this occurs the condition is spoken of as being one of *tubal abortion*. Students often think that in a tubal abortion the mole is passed into the uterus and comes out through the vagina. It is impossible to say that this never occurs in cases of interstitial pregnancy, but it is so rare that it may be

neglected altogether. Sometimes a mole is completely loosened from its attachments, and is extruded from the abdominal ostium of the Fallopian tube into the peritoneal cavity with a greater or less amount of hæmorrhage. This is called *complete tubal abortion.* If, in spite of the fact that bleeding has occurred through the abdominal ostium, the mole still remains *in situ,* the condition is called *missed tubal abortion*, or tubal mole. It is possible that bleeding may occur into the interior of the Fallopian tube without the formation of a mole, but it must be a rare occurrence. Tubal rupture, on the other hand, occurs frequently without there having been destruction of the ovum by hæmorrhage. By tubal rupture is meant a breach in continuity in the outer wall of the Fallopian tube. It is not always such a violent process as the word "rupture" would seem to convey; "erosion" in such a case being a better term. In examination of specimens removed by operation weak spots are often found where the trophoblast, in the process of forming the placenta, has perforated the wall of the Fallopian tube until the peritoneal coat has been reached, and sometimes the peritoneum as well has been destroyed. Sometimes a perforation is found which has been sealed by a small patch of fibrin. This is spoken of as a "*concealed rupture*". It must be remembered, however, that there is an intervillous space filled with blood which has been poured out of maternal vessels the walls of which have been destroyed by the trophoblast. If this intervillous space communicates with the perforation of the wall of the Fallopian tube, blood will escape into the peritoneal cavity. Another form of rupture is seen in cases in which the wall of a large blood-vessel has been destroyed by the trophoblast. In this case there is a rush of blood which may break through one of the weak spots which have been described as "concealed ruptures," so that the artery bleeds straight into the peritoneal cavity. It is not very uncommon when operating to find that blood is spurting out of a hole in the tube wall. In other cases the rupture seems to be due to increase of pressure in the cavity containing the ovum, caused by hæmorrhage into this cavity. The hæmorrhage may be due to erosion of a large vessel in the process of formation of the placenta, or may be caused by a bimanual examination or by a straining effort on the part of the patient. The fact that the ovum has been converted into a blood-mole does not make the patient safe from the danger of rupture of the Fallopian tube. If the abdominal ostium is closed any increase in tension in the Fallopian tube due to fresh hæmorrhage, however brought about—whether due to erosion by trophoblast, to increase of blood-pressure or actual squeezing of the tube—may be enough to cause the weakened wall of the tube to give way.

Diagnosis between Early Extra-uterine Pregnancy and an Abortion

It is never safe without making an examination to assume that bleeding during early pregnancy is due to a threatened miscarriage. It may be due to various other complications of uterine pregnancy or may be due to extra-uterine pregnancy. A careful consideration of the symptoms and physical signs will, in most cases, enable a diagnosis to be made between intra- and extra-uterine pregnancy. As a working rule severe hæmorrhage, with slight pain, in early pregnancy is due to threatened or inevitable abortion, while slight hæmorrhage, with severe pain, is due to extra-uterine pregnancy. The pain in extra-uterine pregnancy is frequently described by the patient as extending into the vagina and rectum. Faintness, frequency of pulse, and pallor, cannot be explained by the small loss of blood from the uterus. The character of the blood, dark, "coffee-ground" material, from the outset, may suggest that the pregnancy is extra-uterine. The cervix is not so soft, as a rule, in extra-uterine as in intra-uterine pregnancy, though it is by no means a simple matter to say in a given case whether the cervix is or is not as soft as would be expected, especially if examination of the cervix is complicated by the presence of an "erosion". On bimanual examination the body of the uterus is not so much enlarged, and is not so soft or so globular, in extra-uterine as in intra-uterine pregnancy. Hegar's sign cannot be obtained in extra-uterine pregnancy. On careful bimanual examination, unless the patient is stout or tender, a swelling on one side of the uterus or on one side and behind can usually be found in a case of extra-uterine pregnancy. In a case in which bimanual examination is difficult an anæsthetic should be administered. A very difficult case for diagnosis is presented when a stout woman, who has a small ovarian cyst, has also a threatened miscarriage. The comparative absence of pain, the consistence of the uterus, and the character of the bleeding are the most important points in making a diagnosis.

Diagnosis between Retroversion of the Pregnant Uterus at or about Thirteen Weeks and a Retro-uterine Hæmatocele

These conditions may easily be confused unless a careful examination is made. By a retro-uterine hæmatocele is meant a collection of blood which has usually come from a pregnant Fallopian tube—*vide* Diseases of Women—and has become encysted in the pelvis (see

Fig. 45). Its boundaries are: below, the pouch of Douglas; in front, the uterus and broad ligaments; behind, the rectum and sacrum; above, matted coils of intestine, omentum, and, if the collection is a large one, the lower part of the anterior abdominal wall. If large enough a retro-uterine hæmatocele may produce physical signs much resembling those caused by retroversion of the pregnant uterus. In both cases there may be retention of urine; in both cases the cervix is high up and difficult to reach, and in both cases the pouch of Douglas

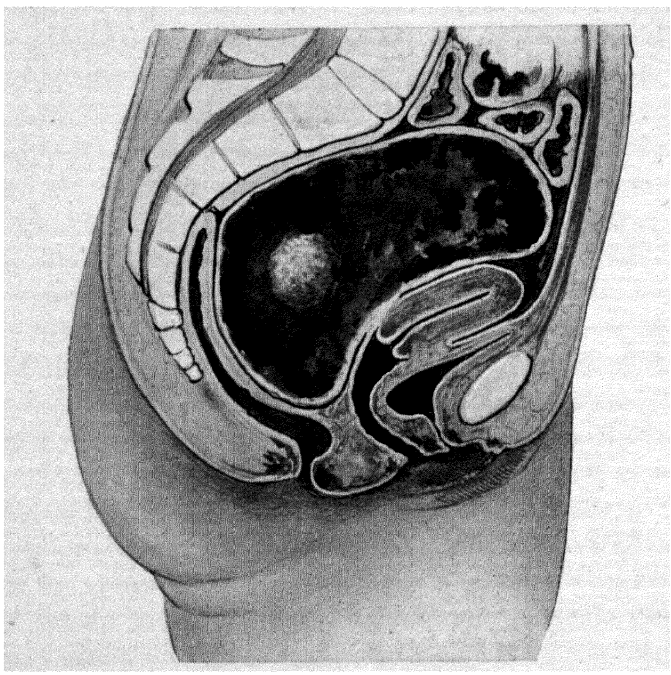


FIG. 45.—LARGE HÆMATOCELE (DIAGRAMMATIC) FILLING THE PELVIS AND REACHING UP INTO THE ABDOMEN. THE UTERUS IS PUSHED UPWARDS AND FORWARDS. THE BLADDER IS DRAWN WRONGLY —ITS CAVITY SHOULD BE ABOVE THE SYMPHYSIS.

is filled by an elastic swelling. The differential diagnosis must be made by a consideration of the history and the physical signs.

HISTORY

In the case of retroversion of the pregnant uterus causing retention of urine there is, as a rule, a history of three months' amenorrhœa, with no irregular hæmorrhage, and no pain unless the distension of the bladder is painful. With a hæmatocele there is usually a history of less than three months' amenorrhœa; there is irregular hæmorrhage; there is or has been pain; there is often an appreciable degree of anæmia, and there may be a slight amount of pyrexia. If with

the former condition there is or has been bleeding from threatened abortion, the history will be of less value in the differential diagnosis. Fortunately such combination is rare.

Signs

After the bladder has been emptied an elastic swelling may be felt in the brim in each case. If the hæmatocele is a large one it will produce a swelling which rises up above the pelvic brim, is tender on palpation, and is found to be resonant on light percussion over part of its surface. On a casual vaginal and bimanual examination the physical signs in the two cases may appear to be identical, but on careful examination, under an anæsthetic if necessary, the body of the uterus will be felt in front of the hæmatocele. The position of the cervix, if the pelvis is completely filled by the swelling, will be no guide to the differential diagnosis. If the retroverted pregnant uterus is not sufficiently large to fill up the pelvis completely, the cervix may be found to be pointing rather forwards, but in cases in which the pelvis is completely filled by either the retroverted pregnant uterus or a hæmatocele the cervix will simply be placed very high up and far forwards, against the top of the symphysis pubis or even above it.

If contractions can be felt in the mass filling Douglas's pouch the mass must be the body of the uterus. A useful point in the differential diagnosis is the condition of the posterior vaginal wall. In the case of a retroverted pregnant uterus the posterior vaginal wall can be made to slide to a slight degree over the surface of the mass in Douglas's pouch, while in the case of a hæmatocele the posterior vaginal wall has a much more fixed feeling.

Full-time Extra-uterine Pregnancy.—Extra-uterine pregnancy very rarely continues to full time. In these cases, as a rule, unless the patient complains of pain, there is no suspicion, until after the expected date of labour is passed, that the pregnancy is abnormal.

Signs

If a careful abdominal examination is made it may be noticed that the child is felt with undue ease. On bimanual examination the firm, solid, comparatively small uterus, enlarged only up to about the size that would correspond with three months' normal pregnancy, may be felt below and to one side of the large sac which contains the ovum. At the time when labour was expected what is

known as "mock labour" comes on. The uterus contracts and the patient feels "the pains". There may be a slight "show," and examination will prove that there is a certain amount of dilatation of the cervix, but no bag of membranes will be found. After these pains have gone on for twenty-four or more hours they cease. After this there is no longer any evidence that the fœtus is alive, fœtal movements and fœtal heart-beats having ceased. The abdominal tumour becomes gradually smaller and firmer on account of absorption of liquor amnii. The subsequent changes that may take place in the extra-uterine sac, *viz.* mummification, lithopædion formation, and suppuration, will be found to be described in the volume on Diseases of Women.

Treatment of Cases of Advanced Extra-uterine Pregnancy

The explanation of the occurrence of advanced extra-uterine pregnancy is to be found in the fact that when the wall of the Fallopian tube gave way living and uninjured chorionic villi were exposed, and became attached to the structures immediately adjacent, *e.g.* omentum, uterine wall, broad ligament, intestine. In some cases the "sac" surrounding the ovum is made up largely of broad ligament, in others it is chiefly "adventitious," *i.e.* the result of adhesions. It is obvious that there may be danger of uncontrollable bleeding if the placenta is separated from such structures as intestine, pelvic peritoneum, etc. Consequently, if extra-uterine pregnancy with a living fœtus is diagnosed in the later months of pregnancy, the best treatment is to keep the patient under close observation until three months after full time and not to operate until then, when the placenta will be thrombosed and may be separated from its attachments without dangerous bleeding.

When there is any doubt as to the diagnosis the uterine cavity should be explored to settle the diagnosis before the abdomen is opened.

CHAPTER XVIII

HYDRAMNIOS

By this term is meant the presence of an excessive quantity of liquor amnii. It is not known exactly what the amount must be in order to merit the term "excessive," because the normal quantity is not certainly known, variations from 10 to 50 ounces being not uncommon in normal conditions. Probably quantities less than 6 pints at full time would not be clinically recognizable as hydramnios.

The amount of liquor amnii may attain enormous proportions; cases of 15 pints and even 30 pints at the fifth and sixth month of pregnancy respectively have been recorded (Fig. 46).

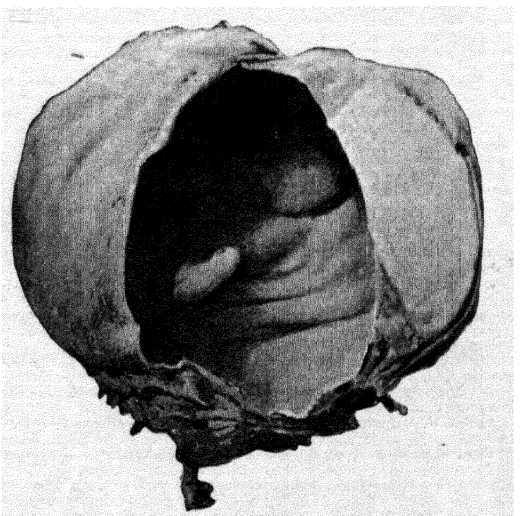


FIG. 46.—HYDRAMNIOS, SHOWING THE DISPROPORTION BETWEEN THE SIZE OF THE FŒTUS AND THE SAC THAT CONTAINED AN EXCESSIVE AMOUNT OF LIQUOR AMNII.

Nature of Fluid.—The fluid itself has the same characters as ordinary liquor amnii as regards both appearance and composition (see p. 31); it may, however, contain a slightly increased amount of urea.

Cause.—The origin of the fluid is disputed. Theoretically it may be due to over-secretion, imperfect absorption, or to a combination of the two conditions. Two opposing theories have been advanced: some authorities regard it as maternal and others as fœtal in origin.

Theory of Maternal Origin.—In considering the physiology of the fœtus it was stated that the amniotic fluid is normally derived

mainly from the mother. An excess is therefore probably derived from the same source, although this by no means necessarily follows.

Maternal diseases which are accompanied by circulatory disturbances, especially cardiac and renal disease and syphilis, may lead to œdema of the placenta and an increased secretion into the amniotic sac.

Experiment supports the maternal theory, for if sodium sulphindigotate is injected into the veins of a pregnant rabbit, blue coloration of the amniotic fluid, but not of the fœtal kidneys, will be produced.

But while this is probably true, yet there are many facts which support the view that an excessive amount beyond the normal is of fœtal origin.

Theory of Fœtal Origin.—In many cases careful examination of the mother does not show any evidence of abnormality which could be supposed to play a part in the production of hydramnios. On the other hand, some lesion of the fœtus is by no means an infrequent accompaniment. It is stated that some fœtal abnormality exists in just less than one-half of all cases of hydramnios.

Among these abnormalities may be mentioned anencephalus and spina bifida. In these conditions it is supposed that the excess of fluid is the result of increased urinary secretion from the stimulation of the exposed cerebral or spinal centres. Other deformities, such as harelip, clubfoot, ectopia vesicæ, may also be found in association with hydramnios.

Lesions which cause obstruction either in the cord or within the fœtus have been found, and it has been shown that an obstruction to the circulation in the umbilical vein is accompanied by an exudation of fluid from the cord and from the fœtal surface of the placenta. Such an obstruction may be produced by the persistence of the so-called vasa propria, which usually become obliterated during the latter half of pregnancy. According to other observers obliterative changes in the coats of the arteries of the chorionic villi may result in similar effects. The obstruction may also be due to stenosis or thrombosis of the umbilical vein, or to torsion of the umbilical cord. The obstruction may lie within the fœtus itself, for cirrhotic changes in the liver were found in a series of cases. These cirrhotic changes are not necessarily syphilitic in nature.

The obstruction is due to cardiac abnormalities in a large proportion of cases; thus occlusion of the right auricle, tricuspid insuf-

ficiency, stenosis of the pulmonary arteries and the aorta, have all been observed.

It is also believed by some that the excess of fluid results from an excessive urinary secretion on the part of the fœtus. That the fœtus can urinate into the amniotic cavity is known. A further fact which is taken to support the fœtal origin of hydramnios is that the condition is found with uniovular twins, anencephaly, and all sorts of fœtal deformities. The histories of 50 cases of hydramnios in multiple pregnancy (46 twins and 4 triplets) have been analysed. Of these 22 of the twins were uniovular in origin. The heart and kidneys of the fœtus in the hydramniotic sac were found larger, both relatively and actually, than those of the normal twin. It is believed by many that the cardiac hypertrophy causes an abnormal activity of the kidneys, and thus produces the hydramnios. The fœtal skin, according to some authors, may play a part in the production of the fluid. A thickened and folded condition of the fœtal skin has been noted in cases of hydramnios.

Finally, the amnion is regarded by some as the source of the fluid, for cases showing inflammatory changes in the amnion leading to an increased exudation have been recorded.

Whatever be the exact nature of the origin of hydramnios, several interesting facts in its etiology should be noted. Thus hydramnios is more common in multiparæ than primigravidæ, and in 75 per cent. of cases the fœtus is a male. Further, the condition has been found in extra-uterine pregnancy, and, as has already been stated, may affect only one ovum in cases of twin pregnancy.

Varieties

Two varieties of hydramnios must be clearly distinguished, chronic and acute.

Chronic Hydramnios.—That most commonly met with is the chronic form. This, as its name implies, is a slowly progressive variety. It is not usually apparent until the fourth or fifth month of pregnancy. As a general rule the chronic variety, unless there is any sudden increase in size, does not give rise to much disturbance. The patient may complain of an undue size of the abdomen, and may notice undue mobility of the fœtus. If the abdomen becomes greatly distended she may complain of flatulence and dyspepsia, and also, owing to the pressure upwards upon the diaphragm, of attacks of palpitation, dyspnœa, and she may be somewhat cyanosed. Varices and œdema of the legs are liable to develop.

It is extraordinary, however, how tolerant the abdomen may be of even a large amount of fluid provided it has been formed slowly.

Acute Hydramnios.—There is, however, a second and rarer form known as acute hydramnios. In this variety the fluid accumulates rapidly, and a much slighter degree of distension may lead to disturbances which are sufficiently serious to endanger the life of the patient. Owing to the rapid formation of the fluid the uterus and abdomen cannot accommodate themselves to the increase of pressure. The patient experiences severe pain, suffers from serious vomiting, and in fatal cases death has been preceded by a rising temperature and pulse-rate. The most common time for acute hydramnios to occur is about the middle of the pregnancy, and it is often associated with uniovular twins.

Physical Signs

In a well-marked case of hydramnios the following signs may be observed. The abdomen is larger than is usual for the period of the pregnancy, and the fundus of the uterus is at a higher level. The abdominal wall may be greatly thinned and the recti widely divaricated. The uterine wall feels tenser than usual. The normal variations in the consistence of the uterus may be absent. It is not easy to map out the fœtus distinctly owing to the distension of the uterine wall, but the fœtus is unduly mobile and external ballottement is extremely well marked. Owing to the undue mobility of the fœtus a malposition frequently occurs. Fluctuation and a fluid thrill are obtained with unusual ease. The fœtal heart-sounds are difficult to hear, being muffled by the presence of an excessive amount of fluid between the uterine wall and the fœtus.

Differential Diagnosis

Chronic Hydramnios.—The facts already enumerated will serve to differentiate this condition from an ordinary pregnancy. There are, however, several other causes of an undue enlargement of the uterus during pregnancy besides hydramnios.

Multiple Pregnancy.—Sometimes the differential diagnosis from this condition is almost impossible, especially as twin pregnancy is often accompanied by hydramnios. In this case the hydramnios is usually detected, and the multiple pregnancy is not diagnosed. When, however, the multiple pregnancy is not complicated by hydramnios,

a diagnosis can be made more easily because the uterus is firmer to the touch, and palpation reveals more than one fœtal head and an unusual number of small parts. Further, more than one fœtal heart may be heard in different places and beating at different rates.

Ovarian Cysts.—If pregnancy does not co-exist with an ovarian cyst the condition may be diagnosed by the absence of the symptoms of pregnancy, by the mobility of the mass, by the fact that it does not harden on manipulation and on auscultation it is dumb. Bimanual examination will show that the uterus is not enlarged, and is separate from the tumour.

When pregnancy does co-exist with an ovarian cyst the diagnosis from hydramnios is more difficult. It depends upon the identification of two tumours, only one of which shows the characteristic signs of the pregnant uterus, including intermittent contractions. In doubtful cases in which some interference is necessary owing to the abdominal distension, it is better to open the abdomen. The cyst if present can then be removed, and the risk of premature termination of the pregnancy is not great.

Hydatidiform Mole may cause an undue enlargement of the uterus. But no fœtus can be palpated and no fœtal heart heard. There may also be a history of a blood-stained discharge, and very rarely, of the passage of vesicles.

The uterus will also appear unduly large if the patient has made a mistake as to the time of her last regular period. A small loss of blood may occur at the end of the first month of pregnancy and be mistaken for a period. It is necessary to know the duration and amount of this loss. Finally, the uterus is enlarged in the rare condition of concealed accidental hæmorrhage, but here the patient is collapsed and shows signs of internal hæmorrhage, and the uterus is tense and tender.

Acute Hydramnios.—In acute hydramnios the diagnosis is often difficult on account of œdema of the abdominal walls. Care must be taken to exclude intestinal obstruction because of the accompanying vomiting and distension.

Effects on Pregnancy and Labour.—Owing to the undue mobility of the fœtus a malpresentation is not uncommon, and this, if not corrected, may result in obstructed labour. There is a liability to premature labour, which is stated to occur in 50 per cent. of cases. The labour is usually protracted owing to the weak uterine contractions, due to the over-distension of the uterine muscle. The

membranes are prone to rupture prematurely. After delivery ther is a liability to postpartum hæmorrhage, from atony of the uterus.

Treatment

There is no known method of controlling the production c absorption of the amniotic fluid, except in some syphilitic case when antisyphilitic treatment may be successful. In the chroni variety the minor grades of hydramnios rarely require treatmen If, however, the pressure symptoms from the accumulated flui are so great as to cause dyspnœa or palpitation, then the pregnanc must be terminated no matter what period it may have reache This may be accomplished by perforating the membranes through th cervix, pushing the head up, and catheterizing the uterus with a douch nozzle, when the fluid will drain away, and the uterus contract.

In the acute forms the pregnancy must be terminated at onc on account of the unfavourable prognosis to the mother.

DEFICIENCY OF LIQUOR AMNII

This condition, the opposite of hydramnios, is characterize by an unduly small amount of amniotic fluid, which may b represented by only a few cubic centimetres. Its cause is no known; many of these cases are probably due to early ruptur of the membranes. It has been observed, however, in cases i which the fœtus showed an imperforate urethra, and also in case associated with complete absence of both kidneys. It has bee concluded, therefore, that the lack of fluid was due to the non formation of urine.

In other cases the fœtal skin is markedly thickened, and is dr and crumpled in appearance.

The results of a deficient amount of liquor amnii may be serious Adhesions may be formed between the fœtus and the amnion; th fœtus may be unduly compressed; malformations of the fœtu are common. Labour in this condition is liable to be compli cated owing to malposition of the fœtus, and to amniotic ad hesions, and in the first stage there may be difficulty owing to th absence of the normal dilating bag of membranes.

CHAPTER XIX

ANOMALIES AND DISEASES OF THE PLACENTA

Anomalies in Size.—At term the average diameter is about 8 inches, and the thickness varies from ¾ of an inch to 1¼ inch, being greatest near the centre. In some cases the thickness is evenly distributed, in others it varies considerably in different portions, but as a rule the thickness is in inverse proportion to the area. Some of the largest placentæ have been found in uniovular twin pregnancies.

Anomalies in Weight.—The average weight of the placenta at term is 1 lb. to 1¼ lb. Occasionally, however, this is much increased, for weights of 2 to 2½ lbs. have been observed. The weight will vary slightly according to whether the umbilical cord has been ligatured late or early, thus imprisoning little or much of the fœtal blood.

On an average the weight is about one-sixth of that of the child. In many conditions of disease, an increase in weight occurs. This is found to be so in syphilis, when the placental weight may be as much as a quarter or even half that of the fœtus. An increase has also been found in cases of albuminuria in the mother, and in general anasarca of the fœtus.

Anomalies in Shape.—The variations in shape are many. The placenta may be rounded, ovoid, reniform, or lobulated. The lobulation may be regular or irregular in shape, and occasionally a lobe may be attached to the main mass by only a narrow isthmus of placental substance. In some cases the lobes are quite separate and distinct, giving rise to a *multiple placenta* with a single pregnancy. More frequently the organ is divided into two lobes more or less completely. When the division is incomplete and the vessels extend over both lobes before uniting to form the umbilical cord, the placenta is called a *placenta bipartita* (see Fig. 20).

There may be three lobes (*placenta tripartita*) (see Fig. 21), or more than three (*placenta multilobulata*).

Placenta Succenturiata.—There is a further variety of divided placenta which is of considerable clinical importance. This is the *placenta succenturiata* (see Fig. 22).

This anomaly is not infrequent. One or more accessory lobules of placental substance are found on the chorion at a distance from the edge of the main placenta. They are united to the placenta by vascular connections, both arterial and venous.

The placenta succenturiata is of clinical importance because it is liable to be retained in the uterus after the placenta proper has been expelled.

The results which may follow are: postpartum hæmorrhage, owing to the inability of the uterus to retract and contract because it is not empty; severe after-pains; and, if septic organisms reach this accessory placenta, there is also the risk of septic infection and intoxication.

It is always necessary, therefore, to bear in mind the possibility of a placenta succenturiata, and when examining the placenta and membranes after delivery the evidences of this abnormality must be searched for, *viz.* small rounded defects in the chorion at a short distance from the edge of the placenta; the extension of the vessels over the edge of the placenta on to the chorion; and the abrupt ending of these vessels at the margin of the defect in the chorion.

It is probable that all these divisions into lobes and the presence of lobules result from some abnormality of the decidua. The decidua basalis is the most highly vascularized part of the decidua. Here the chorionic villi grow markedly and produce the chorion frondosum. If, however, this vascularization of the decidua is not limited to one area, but is marked also in other places, then there will result a corresponding overgrowth of the chroionic villi at these places with the production of placental islands.

Another view is that lobes have been produced by the formation of infarcted areas within the placental tissue, but the objection to this view is that the membranes between the lobes do not show any abnormality.

Placenta Fenestrata.—This is a rare variety, in which the placenta is oblong in shape and has an aperture in its substance near the centre.

Placenta Diffusa or Membranacea.—In this form the chorionic villi remain functional around the whole ovum, probably owing to an abundant vascularization of the decidua. The placenta

therefore is not limited to the decidua basalis, but covers the whole ovum. This is a rare variety. In all those instances in which this abnormality has been found there has been no interference with the nutrition of the fœtus, but the patient is liable to premature termination of the pregnancy, and to antepartum hæmorrhage. Complications have also occurred during the third stage of labour, for the thinned-out placenta is friable and is not readily separated. Thus postpartum hæmorrhage may occur, and there is an increased risk of infection. After removal, this form of placenta may be found

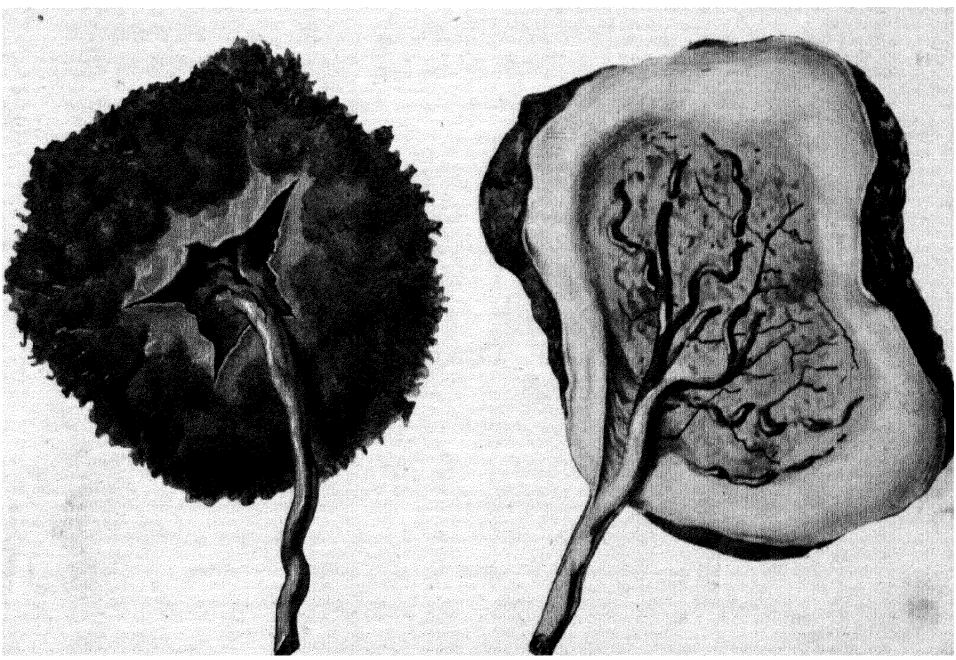


FIG. 47.—PLACENTA MEMBRANACEA.

The placenta covers the whole ovum and is not limited, as it should be, to the decidua basalis.

FIG. 48.—PLACENTA CIRCUMVALLATA.

to be firm in places owing to extravasation of blood in its substance (Fig. 47).

Placenta Circumvallata.—This is due to a proliferation of the chorionic villi, which takes place around the margin of the placenta after the amnion has become definitely attached to it. The appearance thus produced is that the fœtal surface may present a central depressed area which is surrounded by an elevated portion. The amnion is attached to the edges of the central depressed portion. This variety is apt to be followed by a tearing of the chorion at the elevated edge of the placenta (Fig. 48).

Cysts of the Placenta.—Cystic structures in the placenta are not infrequently observed.

There are two varieties: surface placental cysts, and those found within the placental substance itself.

Surface Cysts.—This is the more common variety. The cysts vary in size from that of a cherry to that of a hen's egg (see Fig. 49). They are derived from the chorion, for the amniotic membrane can be stripped off from them.

The contents are, as a rule, clear and watery in nature, but may be blood-stained.

The cyst wall is lined by a whitish membrane, and may contain infarcted areas.

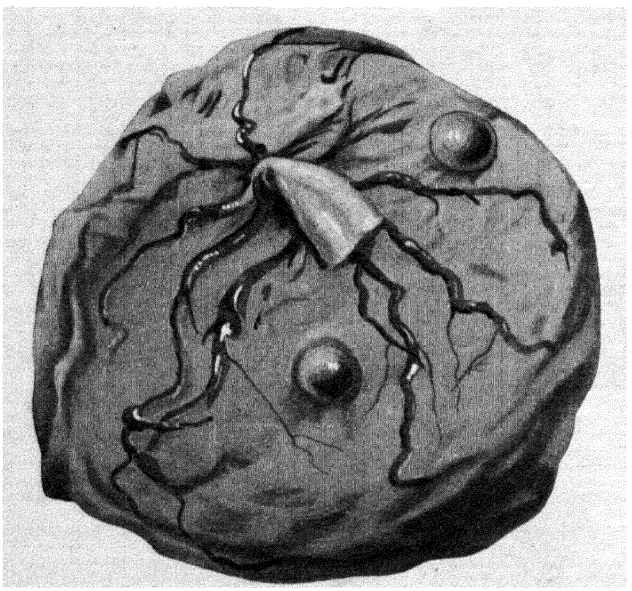


FIG. 49.—SURFACE CYSTS OF THE PLACENTA.

Microscopic section shows one or more layers of large cells, the nuclei of which are round and vesicular and may show evidence of degeneration. In the infarcted regions the tissue is composed of fibrin, and the cells are absent. These cells correspond with those of Langhans' layer, and the cysts are due to degeneration of the trophoblast.

Deep Cysts.—This is the rarer variety. In size the cysts are smaller than those found on the surface, and are seldom larger than a cherry.

The contents are usually clear, but may be caseous in appearance. These deep cysts are not infrequently found within the substance of an infarcted area. The cyst wall is made up of fibrin. They are

probably produced either from a breaking down of an infarct or from a degeneration of the trophoblast cells. In this case the walls may be lined with cells similar to Langhans' cells.

Cystic masses, whether they are on the surface or of the deep variety, do not appear to affect the course of a pregnancy or labour.

Inflammation of the Placenta.—The evidence of a true inflammation of the placenta is meagre, although much has been written describing the condition. Many of the changes described are now believed to be the result of infarction, and the so-called abscesses are probably not abscesses, but cysts containing grumous material mistaken for pus. An acute inflammation may occur. It results from an extension of an inflammatory process from the decidua, and is therefore not to be regarded as a primary condition. The inflammation which may thus occur has been observed in cases of gonorrhœa and syphilis, and in some cases of general pyæmia.

Tuberculosis of the Placenta.—Tubercle in the fœtal portion of the placenta is a very rare phenomenon. Local lesions have, however, been found in the decidua and in the chorion. In cases in which the mother has a generalized tuberculosis no changes may be discovered in the placenta, although tubercle bacilli have been demonstrated in the fœtus. But tubercle bacilli have been found in the placenta; thus one investigator found them in 9 out of 20 women who died from tuberculosis. It is evident, therefore, that the incidence of congenital tuberculosis may have been underestimated, although in the vast majority of cases the disease is not transmitted to the fœtus. The possibility of seminal infection must also be taken into account. Experiments upon rabbits and guinea-pigs have shown that tubercle bacilli may reach the ovum by means of the spermatozoa.

Syphilis of the Placenta.—Inflammatory changes and gummatous formations have been described in the placenta. An endarteritis may occur, and thickening is not infrequent in the coats of the vessels in the chorionic villi.

It is believed that some infarcts may be of this nature.

Thrombosis in the intervillous spaces has also been observed; these thrombi later become organized and form fibrous masses enclosing and pressing upon the villi. The placenta was formerly described in syphilis as being unduly large, œdematous, and friable. There is stated to be a proliferation of the connective tissue stroma and a hyperplasia of the decidua.

It must be remembered that these views are not admitted by some observers, who claim that there may be no apparent abnormality in the placenta of syphilitic patients. This is undoubtedly true in many cases, but even from these the spirochæta pallida has been obtained.

Calcification of the Placenta.—Fatty and calcareous degeneration are often met with in the placenta, especially towards the termination of pregnancy. The small calcareous nodules are frequently observed upon the maternal surface of the placenta, and are best demonstrated by rubbing the fingers over this surface, when it is felt to be gritty. Sometimes the calcareous area is in the form of a flat plaque; usually it consists of a number of scattered minute points. These calcareous masses are near the surface, and can often be seen by the naked eye.

They have been mistaken for tuberculosis of the placenta. The formations are caused by a deposit of calcium salts in the necrotic tissue around the "fastening villi," and also in the decidua basalis.

No abnormality in the pregnancy results from them so far as is known.

Tumours.—Solid tumours of the placenta are rare, although a large number have been described in the literature of the subject, and it is probable that in many cases the tumour was in reality a placental infarct. Such tumours vary in size from that of a pea to a man's head.

The most frequent variety is the myxoma fibrosum. This is composed of fibrous tissue containing myxomatous areas scattered within it. Several other varieties of tumours have been described, including fibroma, angioma, and sarcoma. Many of these, however, by more recent work, have been shown to be really of one type, and to consist of masses of chorionic villi with hypertrophy of the blood-vessels. In some cases the tumour is connected with the chorion by a pedicle containing an artery and vein. These vascular tumours have been given the term "chorio-angiomata". As a general rule the remainder of the placenta is unaffected, and they have no clinical significance, unless they are large enough to throw a considerable area of the placenta out of function. It is said that in these cases some abnormality, such as hydramnios or antepartum hæmorrhage, may be associated with the condition.

Infarction.—This is one of the commonest abnormalities of the placenta. Many terms have been used for this condition, such as placentitis, atrophy, scirrhus, and hepatization of the placenta.

The infarcted areas vary in size, shape, and appearance.

They occur as :—

1. Small whitish fibrous structures upon either the maternal or fœtal surface of the placenta. They may be scarcely visible to the naked eye, and are rarely larger than half an inch in diameter.

2. White fibrous structures situated within the placental substance. These areas are irregular in shape, and the remainder of the placenta may show no abnormality (Fig. 50).

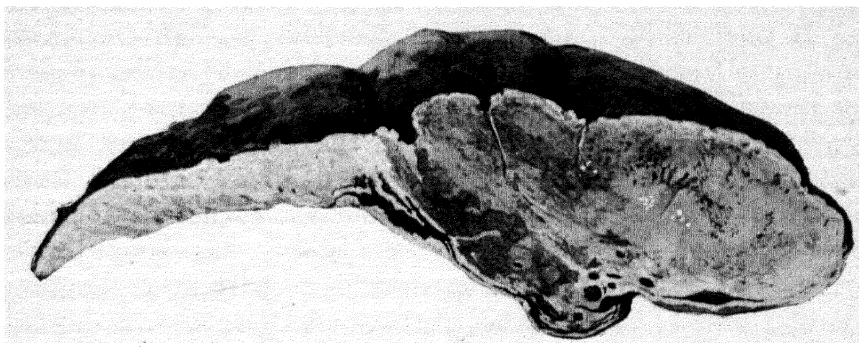


FIG. 50.—INFARCTION OF THE PLACENTA.

The infarct is shown as a white fibrous structure occupying the whole of the thickness of one portion of the placenta, the rest of the placenta being normal.

3. Large areas of placental tissue, sometimes one or more cotyledons, may be fibrous in appearance; in rare cases one-half, or almost the whole organ, may be involved.

4. A broad whitish ring may partially or completely encircle the placenta. The band is placed at the margin of the fœtal surface; it is beneath the amnion, and is rarely more than a quarter of an inch in thickness. The appearance is known as placenta marginata.

5. Pinkish masses of irregular size, which are usually most marked on the maternal surface. They may extend through the entire thickness of the placenta. These are known as red infarcts.

CAUSATION

The changes have been attributed to inflammatory lesions of the decidua. This view, however, is probably not the correct one, for the cells showing these changes are those of the "decidual septa," which are now regarded as of fœtal rather than maternal origin, while the decidua is a maternal structure.

The more modern view is that the infarcts result from obliterating endarteritis in the vessels of the chorionic villi. The endarteritis causes an interference with the circulation through the arteries of the

villi, and necrotic changes therefore follow at their extremities. The syncytium, being the outer layer of the sheath of the villus, can still obtain nourishment from the maternal blood which bathes it, and so is not affected. The deeper layer, *i.e.* Langhans' cells and the connective tissue stroma, cannot obtain nourishment and is affected and shows necrotic changes. These necrotic areas gradually become converted into fibrin. Later, similar changes occur in the syncytium, with the result that the maternal blood coming in contact with it also clots in the intervillous spaces, and then undergoes fibrin formation. If these changes occur simultaneously in neighbouring villi, eventually a number of them become welded together by fibrin. They gradually undergo more degenerative changes until eventually they can scarcely be detected within the fibrinous mass, and an infarcted area is produced (Fig. 50). Red infarcts are not formed in this way, and their method of production cannot be explained. It has been stated, however, that there is some association between them and albuminuria, and imperfect development of the fœtus. They may possibly be due to hæmorrhage into the placental substance from rupture of vessels in the decidua.

Results

Minute infarcts may be discovered in every placenta on careful examination. The larger infarcts are said to occur in 63 per cent. of cases. Abnormal results do not follow if the infarcts are small and are not present in excessive numbers. But when they are of large size, or many are present, they may disorganize so much of the placenta as to interfere with the nutrition of the fœtus, and occasionally may cause its death. Red infarcts are not observed so frequently as the white. They are associated with maternal albuminuria in from 33 to 67 per cent. of cases, according to various observers. They are not associated with eclampsia, however, but with the albuminuria due to old kidney disease. The fœtus is frequently imperfectly developed and may die as a result of these red infarcts.

CHAPTER XX

DISEASES ASSOCIATED WITH PREGNANCY

SYPHILIS

SYPHILIS is said to be one of the most important causes of the premature interruption of pregnancy. It must always be suspected in cases of premature labour or intra-uterine death, even if there is no other evidence of the disease, in the presence of a positive Wassermann reaction in either parent. An examination of the fœtal tissues for the presence of the parasite may be the only means of determining the diagnosis. If infection of the mother occurs during pregnancy the primary sore may not be so characteristic as usual, and the secondary manifestations are often but slightly marked. It is partly for this reason that it is regarded as possible by some observers for a healthy woman to give birth to a syphilitic child (Colles's law), it being supposed in these cases that the ovum has been directly infected by the spermatozoon of the father. This view is open to doubt, and it is probable that the virus may be in an attenuated form, for if an apparently healthy woman, who gives birth to a syphilitic child, nurses her baby, she does not become obviously infected, which suggests that she is really already infected to a mild degree. Further, the Wassermann reaction can be obtained from the maternal blood in cases in which there is evidence of fœtal syphilis and no evidence of the disease in the mother. The modern view is that the woman who has given birth to a syphilitic child is herself syphilitic.

The effect of syphilis upon pregnancy varies according to the time when infection has taken place. When inoculation of the mother occurs before conception, abortion or premature labour frequently results. If the labour is premature, the child is often dead; rarely it is born alive with definite manifestations of the disease. If the child is born at full time, as a rule it does not at birth show any sign of the disease, which, however, makes its appearance later. If the infection has occurred some considerable time before the pregnancy, especially if the patient has been

energetically treated, the child will probably be healthy and never manifest any signs of the disease.

When inoculation of the mother occurs at the time of conception or during the pregnancy, the child is almost invariably syphilitic, but the risk varies with the period of pregnancy at which syphilis is contracted; if within the first few months, the fœtus always shows evidence of the disease, while if it occurs later, the child may escape.

It must be remembered that a syphilitic child born alive at full time rarely shows any evidence of syphilis until some weeks after birth; in the rare cases in which there is evidence of this disease at birth it nearly always takes the form of syphilitic pemphigus (see p. 632).

Treatment

Antisyphilitic treatment of both parents is required, even if the mother appears healthy. Salvarsan should be injected intravenously, and should be followed by treatment with mercury. The salts of arsenic, mercury, and iodide of potassium are readily transmitted through the placenta, so that the fœtus is also protected by the drugs. Many cases have been recorded showing the beneficial results to the child from the antisyphilitic treatment of the mother. According to Colles's law, the syphilitic child may be suckled with impunity by its own mother, but if she cannot suckle it, a wet nurse must on no account be employed.

For the treatment of the child, see p. 632.

GONORRHŒA

If the disease is contracted during pregnancy, an acute vulvo-vaginitis with marked redness and œdema of the vulva is likely to follow.

A patient with a chronic gonorrhœal infection may become pregnant if the infection has not involved the lining membrane of the Fallopian tubes. Many cases of gonorrhœa in pregnancy are those in which infection and conception occur at the same time.

The disease has little effect upon the pregnancy unless the uterine cavity is also involved, which may happen during the first three months, when abortion is likely to occur. On the other hand, there is a grave risk during the puerperium that the disease may spread to the Fallopian tubes, pelvic peritoneum, or the blood-stream. During labour the child's eyes are in danger of being infected.

Treatment

Treatment of the Mother. In Pregnancy.—The patient should first be anæsthetized, and after the vagina and vulva have been thoroughly swabbed free of discharge, a solution of nitrate of silver, 5 per cent., should be well applied to the mucous surfaces. The patient should afterwards be kept in bed, and the vagina douched every four hours with 2 quarts of boric acid solution, and once daily nitrate of silver should be applied to the vaginal walls, till the discharge has practically ceased, when once a week will be sufficient.

In Labour.—If the disease is not cured, or is seen for the first time during labour, the vagina should be swabbed dry and then painted with tincture of iodine. If there is a long second stage, a douche containing a drachm of tincture of iodine to the pint should be administered.

In the Puerperium.—The patient should assume the sitting position as soon as possible. The danger of vaginal douches during the puerperium is that organisms may be carried up into the uterus. It is true that water kills the gonococcus, but the puerperal vagina is soon secondarily infected with other organisms, and herein lies the danger.

Treatment of the Child.—The precautions detailed on p. 629 should be taken directly the child's head is born and after. The child must be examined carefully every day for signs of commencing gonorrhœal ophthalmia. This disease is the commonest cause of blindness in children.

TUBERCULOSIS

The effect of pregnancy on a tuberculous woman is always harmful, and the symptoms become accentuated during the puerperium and lactation. There is no predisposition to the premature interruption of pregnancy.

Prognosis

Many tuberculous women give birth to perfectly healthy children at full time. Sometimes tuberculosis is transmitted from mother to child, and the bacilli have been found within the fœtal blood. The infection probably occurs through the placenta by the blood, for the fœtal lesions are most marked in the liver. In the vast majority of cases, however, the disease is not directly transmitted

from mother to fœtus, and when it develops later in the child it may be due to its being in the same surroundings as the tuberculous mother, and also to the fact that its powers of resisting the invasion of the tubercle bacillus are less than in those of a child of healthy parents.

Treatment

When the pregnancy is advanced induction of premature labour is never advisable, as it is as damaging to the patient as labour at full time. The pregnancy, therefore, should be allowed to continue. If it appears certain that the patient will die before term, then, in the interests of the child, the induction of premature labour might be morally justifiable.

The mother should not be allowed to suckle her infant, and be warned of conveying infection by kissing.

Abortion is not to be advocated lightly in tuberculous women. The cases in which abortion is justifiable are those in which a patient has had early phthisis which has recently become quiescent, and as the result of the strain of pregnancy signs of recrudescence have appeared.

MEASLES

Few cases of measles affecting the pregnant woman are recorded. Abortion or premature labour is likely to follow. Intra-uterine transmission of the disease to the fœtus has been observed, and the child may be born with the characteristic rash or develop it during the puerperium. It is especially dangerous to a young infant on account of the pulmonary catarrh.

TYPHOID

Typhoid fever is a serious complication of pregnancy in that abortion or premature labour occurs in a very large proportion of the cases, but the pregnancy does not affect the disease itself. The bacilli have been demonstrated within the organs of the fœtus, and ulceration of Peyer's patches may also be found in the fœtal intestine.

SMALL-POX

The prognosis of small-pox during pregnancy is more serious than in the non-pregnant condition, the confluent and hæmorrhagic varieties being commoner. The effect upon the pregnancy very

commonly is to induce abortion or premature labour. Children have been born with the eruption developed; in the case of binovular twins one only may be affected. The possibility of transmission from mother to fœtus of the protective influence of vaccination is disputed, but, when necessary, pregnant women may be vaccinated without any risk of inducing abortion or premature labour.

CHICKEN POX

Varicella runs a similar course in the pregnant and non-pregnant woman. There is no increased liability to a termination of the pregnancy. The child may be born covered with the rash.

SCARLET FEVER

It is usually stated that scarlet fever is more common during the puerperium than during pregnancy. Care must be taken not to confuse the rash which occurs in cases of puerperal sepsis with that of scarlet fever. If the fever occurs during pregnancy the disease is more serious, especially if it arises towards the end of pregnancy. Abortion is likely to follow during the early months. There is no satisfactory evidence that the fœtus may be born with the disease.

CHOREA

Cause

The combination of chorea and pregnancy generally occurs in a young primigravida who has had rheumatic fever. That pregnancy predisposes to an attack of chorea seems likely from the fact that, apart from childhood, the disease is most common in the pregnant woman. There is often evidence of some nervous strain, but the most modern view would be to class it with the toxæmias.

Symptoms and Signs

In the majority of cases, chorea appears during the first four months of pregnancy. It differs from an average attack of the disease in the non-pregnant woman in being more severe, so that the movements are more violent, the wasting is greater, and the tendency to mania is increased.

Prognosis

The prognosis is not nearly so serious as was formerly supposed. In the large majority of cases the course of the pregnancy and labour is unaffected. Miscarriage and premature labour are probably slightly more frequent. Soon after the termination of pregnancy the disease generally disappears.

Treatment

Absolute rest in bed and a liberal diet are necessary. The patient may need controlling owing to the severity of her movements. Apart from acetyl-salicylic acid and the salicylates, drugs have been found of little use. The patient must be made to sleep, if necessary, with the aid of chloral and bromide. It is extremely important that the patient should be isolated and be reassured in every way. If there is any suspicion that the chorea has been induced by worry, an endeavour should be made to ascertain the cause of this, and if possible to remove it. The management and discipline exercised by a tactful nurse are a most important factor in the treatment.

The question as to the advisability of terminating the pregnancy has to be considered only when the life of the patient is in danger, and this fortunately is very rare if the patient is treated properly. The mortality in these cases is high, and published statistics show that considerably better results attend the spontaneous than the operative termination of the pregnancy.

There is not the slightest doubt that in many cases induction of labour has caused the patient's death.

APPENDICITIS

The combination of appendicitis and pregnancy is not so infrequent as the published cases would lead one to suppose. An acute attack may arise *de novo*, or it may be secondary to a chronic attack, the enlarging uterus having broken down adhesions in the neighbourhood of the appendix.

Diagnosis

Abdominal pains on the right side may be due to pyelitis, extra-uterine gestation, biliary or renal colic, or appendicitis, while in addition pain not so localized may be associated with the uterine

contractions due to labour or miscarriage. The most frequent error is to confuse pyelitis with appendicitis, and in any doubtful case, therefore, the urine should be carefully examined.

Although the vomiting associated with appendicitis has been mistaken for pernicious vomiting, its sudden onset and the condition of the pulse, temperature, and urine should make the diagnosis clear.

Appendicitis during the early days of the puerperium has on occasions been confused with puerperal sepsis.

Prognosis

The danger of appendicitis during pregnancy and the puerperium is enhanced because it is more difficult to diagnose early, to drain the pelvis efficiently after operation, and the danger of the inflammation spreading is greater with a growing uterus. Miscarriage is also likely to occur.

Treatment

The pregnancy should be ignored. If an operation is advisable apart from pregnancy, it should be performed. In a woman who has already had an attack, and is likely to become pregnant, appendicectomy as a prophylactic treatment is indicated.

HERPES GESTATIONIS

Cause

This skin disease, which is peculiar to pregnancy, is now attributed to toxic neuritis. It has been known to occur in the same patient in successive pregnancies.

Symptoms

The patient complains of itching and burning which at times become unbearable.

Signs

The rash appears first on the buttocks and legs, and may eventually affect the other parts of the body. It assumes a multiform character, and is grouped after the manner of herpes, erythematous patches, papules, vesicles, pustules, and bullæ appearing indiscriminately.

Prognosis

Herpes gestationis has no effect on the pregnancy, but the sleeplessness arising from the irritation may cause the woman to become exhausted.

Treatment

A mixture containing hypophosphites, arsenic, and iron should be given internally, and locally bismuth and starch powder or lotions of carbolic acid or mercury should be applied.

CHAPTER XXI

DISEASES ASSOCIATED WITH PREGNANCY (*cont.*)

CHRONIC NEPHRITIS

THE association of a chronic nephritis with pregnancy may be a most serious complication.

During pregnancy the kidneys are required to excrete not only the products of the altered maternal metabolism but the fœtal waste-products as well. If the patient has chronic nephritis, the kidneys, which before the pregnancy were just able to deal with the ordinary daily metabolism, are liable to break down in function owing to the extra work thrown upon them.

SYMPTOMS

In many cases chronic nephritis may give rise to no symptoms of any serious moment, symptoms, however, may occur at any period of the pregnancy. Commonly the patient seeks advice about the fifth month of pregnancy on account of headache, œdema of the legs, and vomiting. On examination the face is pale and the eyelids are puffy, especially on waking. There is œdema of the legs and ankles, and there may be œdema of the vulva. The heart shows signs of hypertrophy, the radial arteries feel thickened, and the blood-pressure is raised; readings of over 200 mm. Hg (systolic pressure) are not infrequent. The urine contains albumin and epithelial casts. Investigation of the past history often reveals that the patient has been the subject of scarlet fever or of diphtheria, following upon which she has at times complained of œdema of the face or legs, and the passage of urine in small amount which contained albumin. Between these attacks she passed large amounts of urine, of low specific gravity, containing a trace of albumen.

Effects of the Pregnancy upon the Chronic Nephritis.

Pregnancy usually causes further damage to the already diseased kidneys, and this damage is permanent. This may be (1) because the kidneys cannot excrete both the maternal and fœtal

waste products, or (2) because they may be damaged in process of excreting the poisons, if symptoms of pregnancy-toxæmia supervene.

(1) In this group the patients appear to be in their usual health during the early months of pregnancy until the kidney-function shows evidences of impairment. This takes place about the fifth month, when the patient complains of headache, vomiting, and œdema. If the symptoms are allowed to progress the œdema becomes more marked, and may involve also the abdominal walls; there may be signs of pleural effusion or œdema of the lungs; the urine becomes scanty and the amount of albumin increases; epithelial, hyaline, and granular casts are abundant, and blood may be present. Albuminuric retinitis with flame-shaped hæmorrhages is commonly found.

A patient with these symptoms may gradually, sometimes suddenly, pass into a drowsy condition, which deepens into coma often accompanied by the muscular twitchings or convulsions of uræmia.

(2) In this group the symptoms of the toxæmia of pregnancy are superadded to those of the chronic nephritis. They may appear at any period of the pregnancy, and have been observed as early as the second month; usually they occur in the later months. It is in this form of disease that the symptoms, which may be chronic, are frequently extremely sudden in onset. The patient may feel well except for lassitude and some slight œdema and headache. Suddenly the headache becomes more severe, she complains of vomiting, and may rapidly pass into a condition of coma. The urine becomes scanty and contains much albumin. These cases are frequently fatal; post-mortem examination of the kidneys reveals evidence of old-standing nephritis, for they are contracted, granular, and contain much fibrous tissue, and in addition there is evidence of an acute toxæmia, for the epithelium is in a state of acute degeneration.

Effects of Chronic Nephritis on the Pregnancy.

Chronic nephritis does not prevent conception, but if the patient becomes pregnant she is liable to miscarriage or to premature labour. In a series of cases investigated one-third ended in spontaneous miscarriage. Accidental hæmorrhage is a common complication.

The death of the child before birth is often observed. This is probably due partly to the loss of placental function owing to the presence of extensive placental lesions, and partly to a superadded toxæmia.

Diagnosis

It is often a matter of great difficulty to differentiate pregnancy complicated by chronic nephritis from pregnancy-toxæmia without previous nephritis. The two conditions have for long been confused. Their symptoms of headache, vomiting, œdema, and albuminuria have points of striking similarity, and the difficulty is frequently accentuated by the possibility that the state of pregnancy-toxæmia may be superimposed upon an already existing condition of chronic nephritis.

The points of difference between the two conditions have been more fully dealt with when considering the subject of the toxic albuminuria of pregnancy and eclampsia. It will suffice now to recall that in the case of chronic nephritis a history of scarlet fever or diphtheria followed by some evidence of kidney disease is frequently to be obtained. The urine in the past has been excessive in amount, of low specific gravity, and has contained a trace of albumin. At the time of the attack during the pregnancy the urine contains a marked number of casts, while the total nitrogen, the urea, and the ammonia-coefficient are almost unaltered. Albuminuric retinitis is more common. The blood urea is raised, the urea concentration in the urine is lowered. The ratio of urinary proteins is that of 6 of albumin to 1 of globulin. In a consideration of all these points it will be remembered that the opposite is the case in the toxæmia of pregnancy (see p. 120).

The differential diagnosis is still more difficult if the patient is not seen until after the onset of convulsions or coma: during the puerperium, however, the symptoms do not rapidly improve as they do after eclampsia, the blood-pressure falls very slowly, and the urine continues to contain albumin and casts, and may do so for many months.

Prognosis

The prognosis with regard to the child is bad. Premature labour occurs in a large proportion of the cases, and the child is often dead, or may die *in utero* before labour. With regard to the mother, the effect of pregnancy is to damage the kidneys still further, and the lesions so produced are permanent. Provided that no convulsions or coma supervene the immediate prognosis for the mother's life is good. It is found that if the fœtus dies, or if the fœtus is expelled, the symptoms show a marked improvement as a general rule. This is, however, by no means always the case. If the patient

survives, the symptoms of kidney disease persist in an aggravated degree, and if she becomes pregnant again the symptoms are more severe and earlier in their onset. This has often led to the advice that patients with chronic nephritis should not marry. Such advice is not within the province of the physician. It is his duty to inform such patients of the risks, but the decision as to marriage is for them. Such advice has occasionally been ignored by patients, and cases have been recorded in which women the subject of chronic nephritis have successfully gone through several pregnancies and survived. A recorded case is of interest: "The patient had had all the signs of chronic tubal nephritis for thirteen years, and had been married for eight years; she had borne five children, and bore a sixth alive in the hospital. This was not a case of recurrent acute nephritis, but of persistence of both albuminuria and tube casts; it is more remarkable in that even without the additional strain of pregnancy, it is unusual for a patient with such a condition to survive for so long." The following case has been described: "A woman consulted her doctor, before marriage, on account of swelling of the legs, and was advised not to marry because she had Bright's disease. She disregarded the advice, and shortly after marriage became pregnant; labour was induced in the 36th week because of great œdema, breathlessness, and persistent headache. A living child was born, and after delivery the symptoms rapidly improved, but three months later the urine still contained a heavy cloud of albumin with granular and epithelial casts. She was warned of the risks of another pregnancy, but conceived again within six months of leaving hospital. She has subsequently borne two other children."

Treatment

The treatment is the same as for the toxic albuminuria of pregnancy (see p. 114), but because of the more permanent nature of the damage to the kidneys there should be less compunction in terminating the pregnancy. The onset of albuminuric retinitis should be regarded as an indication for the immediate induction of abortion or premature labour, as any delay increases the risk of permanent impairment of vision.

PYELITIS AND PYELONEPHRITIS DURING PREGNANCY

Definition.—During recent years a great deal of attention has been given to patients who pass pus from the kidneys in the urine

during pregnancy. Until recently the condition was regarded as due to the pregnancy, because it was found that the symptoms improved if the pregnancy was terminated, and the name pyelitis *of* pregnancy was used to denote the condition. Similar symptoms, however, occur apart from pregnancy; they have been observed in men, and the disease is quite common in young children.

Further, the term "pyelitis" must be used in a comprehensive sense, for the kidney lesions are not always confined to the pelvis of the kidney; the kidney-substance, the ureters, and also the bladder, may be involved in the inflammatory processes. As the infective organism is so frequently a member of the bacillus coli group, the term "bacillus coli infection of the urinary tract during pregnancy" is used by some writers, but the use of this term is open to the objection that it excludes infection by other organisms, which does as a fact occur sometimes. Pyelitis, or pyelonephritis, during pregnancy, is so convenient a term that it is proposed to use it here.

It is necessary to define clearly what is meant by this term. It is applied only to cases in which the kidneys have been healthy previous to the pregnancy, and have presented no evidence of disease, so that conditions associated with pyuria, such as tuberculous disease or renal calculi, are not included within the definition. The disease is far more common than was at one time supposed, probably because it is only within the last twenty-five years that it has come to be recognized. It occurs usually between the ages of twenty and thirty, and is far more frequent during a first pregnancy. The symptoms appear, as a rule, during the fifth and sixth months of pregnancy, but they may arise at any time, and sometimes in the puerperium.

Relapses during the same pregnancy take place, it is stated, in from 15 to 20 per cent. of cases; and attacks in subsequent pregnancies have been noted in about 10 per cent.

Morbid Anatomy

Few patients suffering from pyelitis die. The post-mortem lesions of the milder cases, therefore, are not known. The following description refers only to the severe cases.

The Kidneys.—It is usually the right kidney which is affected. From the recorded cases 55 per cent. are on the right side, 35 per cent. the left, and 10 per cent. on both sides.

The kidney is of a pale colour and softer than the normal. It may be enlarged owing to the distension of the pelvis which is

nearly always present. The cut surface shows some dilatation of the pelvis, which is injected, thickened, and roughened. Within the kidney-cortex small abscess-cavities are frequently discovered, which, like the pelvis of the kidney, contain pus, and from which the causative organism can be directly obtained. Microscopic section shows little change in the substance of the kidney except in the region of the abscess-cavities, where there is evidence of small-celled infiltration.

The Ureters.—The right ureter below the brim of the true pelvis is usually normal, above the brim it is dilated. The lining membrane is thickened and injected. The amount of dilatation is usually not more than that of a goose quill, but cases have been observed in which the dilatation was so great that the ureter resembled a piece of intestine. It may be convoluted or kinked in places, and adhesions may be present between it and neighbouring structures.

This sudden dilatation of the right ureter above the level of the brim of the pelvis, although usually described, is not always present. Occasionally the dilatation may exist from the level of the bladder, and a case has been recorded in which the left ureter was dilated in its whole length.

The Bladder may show no abnormality. In a certain proportion of cases, however, there are signs of cystitis. This may have preceded the attack of pyelitis, or may be the direct result of the pyelitis.

A case has been recorded in which a pregnant woman died with pyelitis before the expulsion of the child. Cultures taken from the liquor amnii, the placenta, and the fœtus failed to show the organism which was responsible for the pyelitis.

Pathology

It will be observed that some dilatation of the ureters and the pelvis of the kidney usually exists in these cases. In this dilated portion the urine tends to accumulate, and infection is therefore liable to follow. It is not always necessary, however, that there should be some obstruction to the outflow of urine for infection to take place.

When we seek for the cause of the dilatation usually present, it is necessary to remember that post-mortem examination of women

who have died from various causes during the later months of pregnancy reveals, as a rule, some such dilatation, and it has been

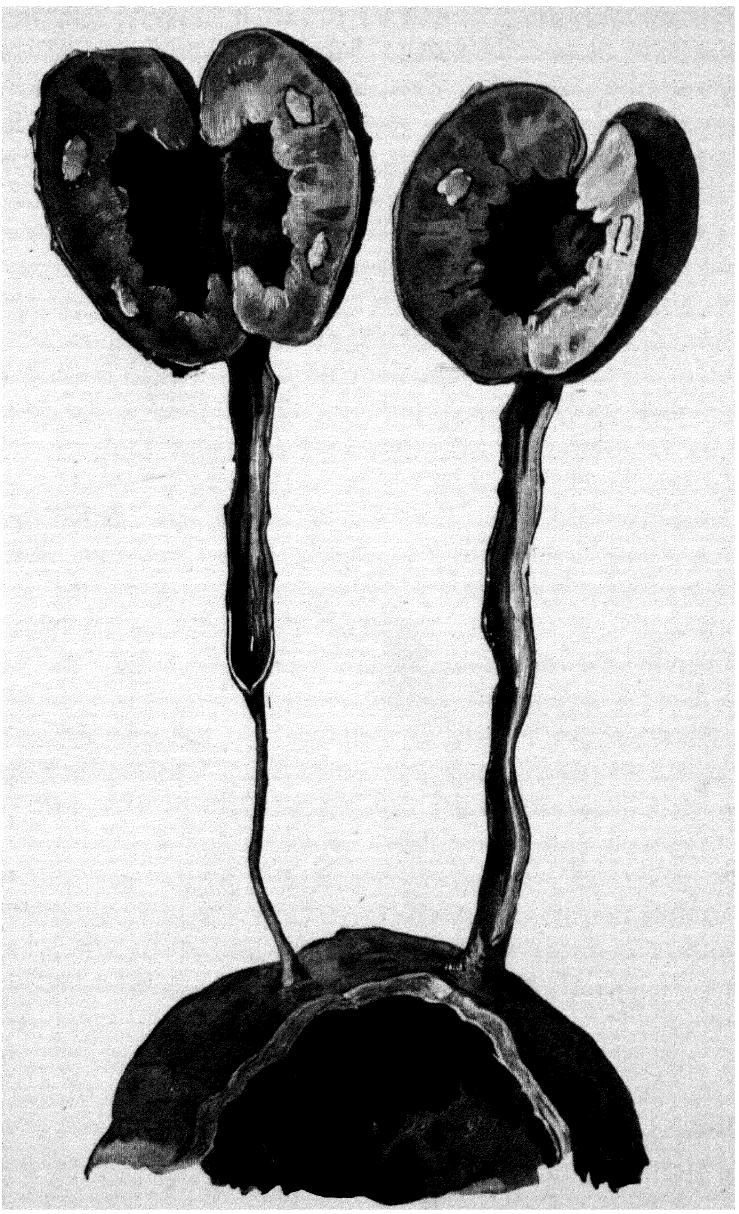


FIG. 51.—PART OF THE RIGHT URETER AND THE WHOLE OF THE LEFT URETER ARE SEEN TO BE DILATED. THE KIDNEYS ARE ENLARGED AND A SECTION OF THE CORTEX IS SEEN TO BE THICKENED.

found that the dilatation, while sometimes bilateral, is more commonly unilateral, on the right side, or is more marked on the right side. The explanation for these facts is probably that the

dilatation is the result of mechanical pressure by the pregnant uterus itself. The symptoms are most marked about the time when the uterus fills the pelvic cavity; were the fœtal head the cause, the symptoms would be more marked towards the end of pregnancy when the head is most capable of exerting pressure. It will be remembered that the ureter lies upon soft structures both above and below the brim of the true pelvis, and that it is just as it passes over the brim that it is most exposed to the effect of the pressure. Experiments upon dogs have shown that very little pressure is required to cause obstruction; a weight of 5 grams compressing the ureter over a space of 8 millimetres prevented the flow of 400 grams of urine.

It is probable, further, that the right ureter is the more commonly involved on account of the tendency of the uterus to incline towards the right side, and to twist upon its vertical axis so that the left side lies more to the front, with the result that the ureter on the right side may be both kinked and pressed upon.

The right ureter, it should be noted, also lies further from the middle line than the left, and is therefore less protected by the projection of the sacral promontory.

The Infecting Organism.—An organism of the bacillus coli group is nearly always the cause of the condition. The organism has been obtained not only from the bladder by means of the catheter, but directly from the kidney by ureteral catheterization, contamination from the bladder being thus excluded.

The organism can be obtained as a rule in pure culture; sometimes it gives the biochemical reactions of the classical bacillus coli, but this is not invariably the case.

Organisms of other nature have been known to occur, such as the bacillus paratyphosus, streptococcus, staphylococcus, and gonococcus.

The Path of Infection.—There are three possible paths of infection by which the organism reaches the kidney:—

1. By the blood-stream (descending infection).
2. By the urinary tract (ascending infection).
3. By the intestinal lymphatics (direct infection).

1. *By the Blood-Stream.*—This method of infection is considered to be the most likely. Even during health the body may contain a few wandering organisms which have entered the blood-stream, possibly through the tonsils or from the intestinal tract. In health

they are excreted by the kidneys. Should the kidneys, however, be damaged, then there is the liability that these organisms may settle down in the damaged tissue. Such damage may exist in the urinary system during pregnancy, as shown by the dilatation of the ureters and renal pelves, owing to the extra work demanded of the kidneys, which are required to excrete not only the waste products of the mother, but also those of the fœtus.

This view is based upon experimental proof. The ureters of rabbits have been tied, and bacillus coli and streptococci have been injected into the veins of the ear. In every case pyelonephritis has followed, and the causative organism has been recovered. Similar results were obtained after ligature of the urethra.

Additional support is given to this view by the observations that the urine of pregnant women in about 20 per cent. of cases contains coliform bacilli, although there is no evidence of urinary infection. It is argued that these organisms are in process of excretion by the kidneys.

On the other hand, it is not often that the organism can be discovered and grown from the blood, even if the blood is examined when the symptoms are acute. In a few instances, however, the organism has been obtained in this way.

2. *By the Urinary Tract.*—This view supposes that the organisms ascend to the kidney along the course of the bladder and ureters. Those who accept this view point out that in a large number of patients the attacks are preceded by some severe gastro-intestinal disturbance, and that the female urethra, on account of its anatomical relations, is peculiarly liable to contamination from the rectum. That such contamination occurs is not very probable, but it is a fact that cystitis does precede the pyelitis in a considerable number of cases. It has been conclusively demonstrated that even in the absence of any clinical evidence of cystitis the bladder may contain the bacillus coli.

It may be regarded as established that the organisms are frequently present in the bladder. The question that next arises is, Can they ascend to the kidney? There is sufficient evidence to prove that they can do so, notwithstanding the natural valvular action of the ureteral orifice. It has been shown that the organisms travel up within the mucous membrane of the ureter. If one ureter of a rabbit is ligatured, and coliform bacilli are injected into the bladder, the rabbit will develop a pyelonephritis on the same side, and the bacilli can be seen within the lymphatics of the ureter.

3. *By the Intestinal Lymphatics.*—It is possible that the organism may pass directly from the intestinal tract to the kidney. The

kidneys are in close anatomical relationship to the ascending and descending colon, and if a lymphatic connection exists between the renal pelvis and these portions of the intestine, it is possible that organisms may reach the kidney in this manner. The frequency of a preceding attack of constipation or diarrhœa has already been referred to. But if this was the usual path of infection it is difficult to understand why the streptococcus fæcalis, which is so commonly present in the intestine at this level, is not more often noted to be the causative organism.

The subject is an obscure one, and it is not possible at present to decide which is the path of infection. It is probable that infection may occur by means of any of the three paths which have been discussed.

Symptoms

The symptoms manifest themselves in two forms, the acute and the chronic.

(*a*) *Acute Form.*—The patient, usually a primigravida and at about the sixth month of pregnancy, is suddenly seized with an acute attack of abdominal pain, which is felt in the lumbar or iliac region of one or both sides, generally the right. The temperature rises suddenly to about 103°-104°, and may be accompanied by a rigor; the pulse-rate is rapid and often remains about 120 per minute for several days. The patient frequently appears profoundly ill, and complains of obstinate constipation or severe vomiting and diarrhœa. It is a characteristic of the disease, however, that the patient improves rapidly in appearance after the rigor is over. The abdomen may be distended and is tender, especially over the region of the affected kidney, and the rectus muscle is held rigid. On vaginal examination some tenderness may be elicited in the lower portion of the ureter.

(*b*) *Chronic Form.*—In this form the symptoms are not so characteristic, and the mode of onset is subject to variations. The symptoms may manifest themselves by a gradual onset with malaise and increasing lumbar pain, by cystitis and pain in the kidney region, by gastro-intestinal disturbances, or by symptoms suggesting pleurisy and pneumonia. The temperature is slightly raised and irregular; on palpation the kidney is tender and may feel enlarged. The kidney tenderness often subsides after the free passage of pus in the urine, and there is a tendency for the pain to subside in one lumbar region and later to develop upon the opposite side. The attack in some cases is extremely mild; there may be pain and

no other symptom, or the patient may have rigors without any apparent cause.

The Urine.—In a certain number of cases there has been evidence of a preceding cystitis, and this complication is liable to follow. At first the urine is diminished in amount and of high specific gravity. Later the amount is much increased, probably owing to the large amount of fluid given in the course of treatment. On examination of a specimen drawn off by catheter, or obtained directly from the kidney by ureteral catheterization, the urine is turbid, contains pus and flocculent débris; the reaction is almost invariably acid. It is seldom offensive. On culture a pure coliform bacillus is obtained. The débris contains large quantities of these organisms, pus corpuscles, epithelial cells, some red blood-corpuscles, and some albumin.

The Blood.—The white cell count is raised beyond that which is ordinary during pregnancy; in many cases there is a leucocytosis of from 20,000 to 30,000 per c.cm., affecting chiefly the polymorphonuclear cells.

The organism is rarely to be obtained on cultivation of the blood, but it has been recovered from the blood in a small proportion of the most severe cases. Agglutinins and bactericidal substances are present in the blood sometimes, and the patient's serum frequently has the power of causing clumping of the organisms.

Course and Complications

In the majority of cases, under suitable treatment an improvement takes place within a few days, the pain subsides, the temperature falls, and the urine contains less pus. It must be remembered, however, that even after all the symptoms have completely subsided, the urine frequently contains micro-organisms, and they may continue to be present for several months or years. This explains the liability which patients show to a relapse.

In a certain number of cases the course is not so favourable. A pyonephrosis may develop, and cases have been reported of its rupture with the formation of a perinephritic abscess or a generalized infection of the peritoneal cavity. The formation of a pleural effusion has occurred in several instances, and the bacillus coli has been recovered from the pleural fluid. Malignant endocarditis has followed in a few of the recorded cases.

Prognosis

The maternal mortality is low. Improvement nearly always follows medical treatment as opposed to surgical measures, and it is very seldom necessary to terminate the pregnancy in order to relieve the pressure upon the ureter. A case has been described in which even after this was done the patient died, owing to an inflammatory kinking of the ureter. The presence of much pus in the urine is not necessarily a bad sign, for it may be an indication that the pus can drain away freely. When death takes place it may be due to toxæmia, or to septicæmia. The prognosis for the child is by no means so good, since abortion or premature labour may occur in the more severe cases. The child is not infected by the organism.

Diagnosis

The diagnosis is based upon the occurrence of a raised temperature, pyuria, and the presence of abdominal pain and tenderness in the situation of the kidney. It should always be thought of when there is kidney tenderness during pregnancy. Care must be taken, when examining the kidney, that the affected side is uppermost, the patient being on her side, so that the uterus does not obscure the palpation of the kidney. It is made certain by a catheter examination of the urine when the presence of coliform bacilli is proved, and this can be rendered more accurate by means of ureteral catheterization, when the organism can be obtained direct from the kidney. This method of diagnosis is not entirely free from the risk of damage to the affected kidney or ureter, and should not be employed if there is evidence of an accompanying acute cystitis. It is necessary to remember also that certain other conditions must be carefully eliminated, as the symptoms are sometimes obscure. Thus the patient must be examined in order to exclude an acute lesion of the gastro-intestinal tract, especially appendicitis. The presence of other disease of the kidney, such as a renal calculus, should be eliminated by an X-ray picture, and tubercle bacilli should be looked for in the urine. When abdominal pain exists it is necessary to make sure that the symptoms are not the result of pleurisy or pneumonia.

Treatment

The patient must be placed in bed in order to obtain rest to the inflamed structures and for the relief of pain. If the right kidney

is the one affected, she will obtain more relief if she lies mainly upon the unaffected side, with the knees flexed to relax the abdominal muscles. Hot fomentations or a belladonna plaster may be placed over the tender region with benefit. If both kidneys are involved, the foot of the bed should be raised. The diet must consist mainly of milk. Milk-puddings, bread and milk, and custard may be allowed, but a diet rich in proteid should not be given, in order to avoid extra work for the damaged kidney.

An essential part of the treatment is the administration of large amounts (such as 6 pints) of fluid—water, barley water, Contrexeville or Vichy water. The fluid is necessary to flush out the kidneys and to carry away in the urine any infected material within the renal pelvis. As the bacillus coli does not flourish in an alkaline medium, the urine should be made alkaline by large doses of citrate of potash. The following prescription is suggested :—

℞ Potass. Citratis . . . gr. xxx.
Tinct. Hyoscyami . . ℥ xx.
Sp. Chloroformi . . ℥ x.
Infus. Buchu. recentis ad ℥ i.

This dose should be given every four hours until the reaction of the urine has become alkaline, and then three times a day usually for some weeks.

It is generally found that as soon as the reaction of the urine becomes alkaline, the patient loses her pain, and the temperature becomes normal, although the bacillus may still be found in the urine.

Serum and Vaccine.—The administration of a bacillus coli serum has been recommended and tried, but the results have so far proved disappointing, possibly because the bacillus coli is unable to produce an anti-toxin, and the members of the bacillus coli group of organisms show considerable variations in their characteristics.

With regard to the question of vaccine treatment, it is difficult to dogmatize. Many cases undoubtedly do show a sudden and marked improvement after their use, but it must be remembered that such improvement may occur in cases in which no vaccines have been employed. They should certainly be tried in any case in which the symptoms show a tendency to become chronic, and there can be no doubt that relief of pain frequently follows their administration, although the organisms may still be present in the urine. The initial dose should be small in acute cases—not more than

5 million bacilli; in the milder and more chronic forms a larger initial dose, such as 10 millions, should be given. The vaccine is to be repeated at intervals of five days in increasing doses until a dose of 100 millions is being used. The vaccine must be autogenous.

Surgical.—As a rule these medical measures suffice, and the patient shows an improvement within ten days to a fortnight or even less. When, however, there is no improvement, the temperature remains high and the pulse-rate frequent, or when there is evidence that the pus cannot drain away from the kidney, other measures may have to be adopted. It is necessary to make it quite clear that these further measures are seldom required and must be reserved for exceptional cases.

The simplest and most effectual method of allowing the pus free exit from the kidney is to remove the pressure exerted by the pregnant uterus upon the ureter. This is done by terminating the pregnancy by means of a bougie inserted between the membranes and the uterine wall, or by the introduction of a small-sized rubber bag. The results are usually favourable, nor does the pyelitis appear to increase the risk of infection of the uterus during the puerperium. It may be advisable, when the symptoms develop late in the pregnancy, to delay the induction of labour for as long as possible so that a living child may be obtained. The artificial termination of pregnancy is not always to be advised, especially if the patient is an elderly primigravida and a future pregnancy is unlikely, nor is this treatment always successful.

Other measures are recommended if the urgency of the symptoms suggests that there is an infection of the kidney substance, or if the case becomes chronic and shows no tendency to clear up. It has been advised that the renal pelvis should be irrigated by an antiseptic solution, but such a method is liable to cause grave danger from injury to the ureter and pelvis, which may even be ruptured from the increased pressure caused by the fluid.

If a pyonephrosis develops, nephrotomy and the formation of an urinary fistula is the best practice. Nephrectomy is not advised, for the remaining kidney may be already involved in the infection, or may later become the site of disease. Nephrectomy should be reserved for those cases in which the kidney is completely disorganized and functionless, or a fistula persists.

Pyelitis during the Puerperium.—Attention has been called recently to the occurrence of pyelitis during the puerperium. The

symptoms are late in their onset as a rule, and are frequently accompanied by rigors. It is by no means uncommon to mistake such cases for puerperal septicæmia or appendicitis; therefore, to avoid this error, care should be taken to examine the region of the kidneys for tenderness, and the urine for the presence of the coliform bacilli.

CHAPTER XXII

DISEASES ASSOCIATED WITH PREGNANCY (*cont.*)

HEART DISEASE AND PREGNANCY

BEFORE a consideration of this subject can be undertaken it is necessary to investigate what effect, if any, pregnancy exerts upon the normal heart.

The result of recent research has been to show that little, if any, hypertrophy of the heart muscle occurs during pregnancy. On the other hand, a derangement of the cardiac function may take place. Thus it has been pointed out that there may be changes in the rate and rhythm of the heart, dilatation of the right side of the heart, and pulsation in the veins of the neck. These are abnormal conditions, and they are liable to become more marked if the pregnant woman is suffering from a valvular lesion.

Acute Endocarditis.—An acute endocarditis may occur as an accidental complication of pregnancy. Serious at any time, the condition is more so during pregnancy, for the causative organism has been known to pass to the fœtus and cause its death *in utero*.

Chronic Valvular Disease.—Pregnancy not infrequently occurs in patients in whom heart-lesions are present. In a series of 96 collected cases the mitral valve was the most commonly affected, mitral insufficiency either alone or combined with stenosis being much more common than simple stenosis. The actual figures were :—

Mitral insufficiency	37 cases.
Mitral stenosis	5 ,,
Combined mitral lesions	34 ,,
Aortic insufficiency	3 ,,
Aortic and mitral lesions	10 ,,
Uncertain lesions	5 ,,
Myocarditis	2 ,,

Of these only one-seventh showed cardiac manifestations.

Effects of Pregnancy upon the Heart Disease

As long as compensation is retained the outlook is good, but there is a liability for the compensation to fail, especially in the later months of pregnancy. It is usually stated that the most serious cases are those in which mitral stenosis is present, either alone or in combination with other lesions; and some authors consider that the risk of pregnancy is so great in these cases that marriage should be forbidden, or, if married, patients should be advised to avoid the occurrence of pregnancy. But it should be remembered that it is not the duty of the doctor to forbid marriage. He must explain the facts and the risks to the patient, and, if she wishes it, to her relatives and her future husband. With this explanation his responsibility should cease; it is for them to decide. Nor do the facts warrant the view that these lesions are especially serious to pregnancy. A series of 300 women treated at Guy's Hospital has been analyzed. It was found that 135 of the patients went through 608 labours without failure of compensation, one woman passing successfully through 17 pregnancies. Failure of compensation occurred in only 8 per cent. of these cases in their first pregnancy, and was present in only 15 per cent. of those who passed through 5 pregnancies.

Should compensation fail and appropriate treatment not bring about an improvement in the condition, the patient is in serious danger. Compensation may fail early in the pregnancy, but it is more liable to occur in the later months of pregnancy, or during or shortly after labour.

In such cases the patient may die suddenly. Two distinct clinical conditions are associated with this event.

(*a*) The heart may fail owing to an elevation of the arterial pressure with great dilatation of the right side. This is more likely to occur during the later months of pregnancy or during labour, owing to the rise of blood-pressure incident to the uterine contractions; or

(*b*) The heart may fail immediately after the birth of the child as a result of the previous strain and the fall in the arterial pressure.

Even if the patient does not die, her condition is serious on account of the increased damage to the heart.

Effect of the Heart Disease on the Pregnancy

Irregular hæmorrhages during the early months are not uncommon. There is a tendency to the occurrence of abortion and premature

labour. These results may be brought about from associated changes in the placenta. In some cases there is postpartum hæmorrhage.

Treatment

A patient who is the subject of chronic valvular disease must be kept under close observation and avoid cardiac strain, and so long as no evidences of failure of compensation arise the pregnancy may be allowed to continue.

Signs of slight failure of compensation, such as œdema, albuminuria, cardiac dilatation, and irregularities of the pulse, must be treated by keeping the patient in bed. Rest is the essential point of the treatment, and it should be helped by cardiac tonics such as digitalis or strophanthus in small doses, aperient drugs, and careful dieting to avoid gastro-intestinal distension. Usually with such measures the symptoms disappear and compensation is improved.

If, however, the failure of compensation is more serious, as is shown by increasing dilatation of the heart and irregularity of the pulse, together with dyspnœa, cyanosis, pulmonary œdema, hæmoptysis, or hæmatemesis, then the pregnancy must be terminated in such a manner as to throw as little strain on the cardiac muscle as possible.

It cannot be too strongly borne in mind, however, that an artificial termination is rarely necessary. If the patient is seen when near full time, do not interfere, as more damage may result from interference than by leaving the pregnancy to continue. An attempt should always be made to improve the patient's condition, and if an improvement follows there is no valid reason for induction. The pregnancy should be terminated only in those cases in which marked failure of compensation occurs early in the pregnancy.

During the first stage of labour the patient should not walk about, but should rest in a reclining position; in some cases, when the uterus is greatly distended and undue pressure is exerted upon the diaphragm, relief may be obtained by artificial rupture of the membranes. The second stage should be conducted in a reclining position, the patient lying on her back with the shoulders raised, and not in the left lateral position. The aim must be to make the second stage as short as possible to avoid the strain upon the cardiac muscle which accompanies the forcible muscular contractions, and bearing-down efforts must be avoided at all hazards. In order to achieve this the patient is anæsthetized and the child extracted by the forceps; it is better to avoid the administration of chloroform on account of the depressing action upon the cardiac muscle, and to substitute ether.

After the labour, care must be taken to avoid postpartum collapse; a sandbag or tight binder may be placed on the abdomen, and saline solution given *per rectum* if necessary.

Several cases have now been recorded in which patients with serious failure of compensation have been successfully treated by means of Cæsarean section, in some instances performed under spinal anæsthesia.

As a matter of experience, it is found that cases of heart disease, if kept in bed during the last few weeks of pregnancy, can stand the strain of labour much better than would be expected.

THE DUCTLESS GLANDS AND PREGNANCY

The Thyroid and Exophthalmic Goitre.—The thyroid usually undergoes a slight, sometimes a considerable, enlargement during pregnancy, and returns to its usual size when the pregnancy is completed.

When the thyroid has been previously enlarged by the presence of a goitre, the pregnancy in some instances appears to cause a rapid increase in the size of the tumour, and cases have been recorded in which a goitre, which was growing slowly prior to the pregnancy, enlarged so rapidly and to such an extent that tracheotomy became necessary.

There can be no doubt that conception has a marked influence upon exophthalmic goitre. By some it is regarded as a factor in its production. Whether this is so is doubtful; but it is a certainty that when the condition already exists the symptoms are aggravated, and show a tendency to subside after the end of the pregnancy. Its influence is, however, variable; some cases are improved. Thyroid insufficiency has been regarded as a factor in the causation of eclampsia, and the enlargement which occurs in pregnancy may be protective.

That the disease may be hereditary is now definitely established. A case has been reported in which it was present in a child at birth, who had an enlarged thyroid, prominent eyeballs, and the heart-beats were uncountable. The child died within a few days. Other cases have been observed in which the symptoms were present in the child, but in a much slighter degree; in these the symptoms entirely passed off in the course of ten days. Breast-feeding in such patients does not appear to be contra-indicated.

The Pituitary Body.—Cases have been described in which pregnant women have developed evidence of pituitary enlargement.

Acromegaly has been observed during pregnancy, and the presence of glycosuria, which is often associated with an enlarged pituitary body, is discussed in the section upon diabetes (see p. 229).

The Suprarenal Body.—Suprarenal extracts have been used with benefit as a cure for osteomalacia, a condition in which the bones are softened during pregnancy.

DIABETES AND PREGNANCY

The significance of sugar in the urine of pregnant women depends not only upon the quantity of the sugar, but also upon its variety. This complication is not uncommon, and has not the serious significance that was attributed to it in the past. Cases of true diabetes mellitus are rare in pregnancy. In most cases the variety of sugar is lactose, has no clinical importance, and is only of temporary duration.

Tests for Sugar.—Fehling's test is not very reliable. Thus, if the two solutions A and B have been mixed together and kept for some time the solution may reduce itself on boiling, and, in addition, the test is also positive to other substances, *i.e.* creatinine, uric acid, and glycuronic acid. This test must therefore be confirmed by other tests. Benedict's test is the simplest of these and is far more delicate and reliable; 5 cm., or 90 minims of Benedict's solution and 10 drops of urine are boiled together. If sugar is present in a concentration of over 0·5 grams per 100 c.c. of blood, there will be a brick-red precipitate in about 30 seconds after the onset of boiling, but to make certain, the mixture should be boiled for 2 minutes. If the solution remains blue sugar is present in a concentration of less than 0·1 gram; if the colour turns green there is more than 0·1 gram per 100 c.c. of blood present.

A positive Benedict's test does not necessarily, however, imply that the sugar present is in the form of dextrose, for it is also positive in the presence of lactose, lævulose, pentose, and homogentesic acid. Each of these will be considered in more detail.

Lactose.—A trace of lactose may often be found in the urine during the later months of pregnancy, and simply indicates, in all probability, a premature mammary activity. Lactosuria is a frequent occurrence during the puerperium, and is especially marked about the third or fourth day when the breasts may be engorged. When the breasts are not distended the lactose disappears, but may reappear

if the breasts again become engorged or if the lactation is for some reason abruptly checked.

This form of sugar is produced within the breasts, for in the case of a pregnant bitch in which the breasts were amputated no lactose was found in the urine, but dextrose in considerable quantity. It would appear, therefore, that the breast is able to convert glucose into lactose.

Lactose is not fermented by yeast; there is difficulty in obtaining the osazone crystals on heating with phenyl hydrazine and potassium acetate, and the crystals, even when so obtained, differ from those of glucosazone.

The presence of lactose has no pathological significance, it disappears when lactation ends and requires no treatment.

Lævulose.—According to Cammidge this form of sugar is present in the urine in 25 per cent. of pregnant women. It may occur in conditions which have no known clinical importance, but it is also present if the liver is seriously damaged, as in acute yellow atrophy. The presence, therefore, of lævulose during pregnancy demands a careful examination of the patient to exclude serious damage to the liver, but if no evidence of this is obtained the sugar may be disregarded.

Lævulose reduces Fehling's and Benedict's solutions, it is fermented by yeast, and produces osazone crystals identical with dextrosazone. It can be distinguished by the fact that it rotates the plane of polarized light to the left.

Dextrose.—This form of sugar is present not only in true diabetes mellitus but in certain other conditions, such as renal glycosuria, and temporary diminution of sugar tolerance. It is also present in cases of pregnancy complicated by exophthalmic goitre and pituitary disease, as is evidenced by acromegaly.

Renal Glycosuria

Under normal conditions the blood-sugar content is from 0·09 to 0·17 gram per 100 c.c. of blood. When the blood containing this amount of sugar reaches the kidney, the renal epithelium does not normally let the sugar pass through. In renal glycosuria the kidney threshold is lower than the normal, and the sugar will pass through without there being any increase in the amount of sugar in the blood and without any diminution in the sugar tolerance. Thus the sugar may be said in renal glycosuria to leak through the kidney as if through a sieve.

The condition is stated to occur in from 0·1 to 1 per cent. of the population, is usually discovered accidentally, is not accompanied by any of the symptoms of diabetes mellitus, and is believed to be congenital in origin.

Many records are now available which show that patients who have had this form of glycosuria for years may bear children without harmful results; often their children have the same form of glycosuria.

There is evidence to show that the kidney threshold is lowered during pregnancy, and that renal glycosuria may originate during the pregnancy.

The condition requires no treatment. The patient should be allowed her ordinary diet. It is inadvisable to restrict carbohydrates in such patients since, their threshold being low, this treatment may deplete the sugar of the blood to a dangerous degree. If the blood-sugar be made to fall as low as 0·04 gram per 100 c.c. of blood coma may follow.

Temporary Diminution of Sugar Tolerance

This form of glycosuria is described by some authors as alimentary. The patient has a lower sugar tolerance.

A healthy person has a very high toleration for carbohydrates, and in the normal individual the sugar in the blood cannot be raised by the ingestion of sugar to such a level that it will overflow into the urine. It is now established that during pregnancy the maternal metabolism is profoundly changed, one manifestation of this change being that the same amount of carbohydrate cannot be assimilated as in the non-pregnant condition.

The amount of sugar excreted in such patients is not large, it is usually from 10 to 50 g. in the day.

The diagnosis from renal glycosuria is made by feeding the patient with 25 to 50 g. of dextrose and afterwards estimating the blood-sugar. The degree in the rise of blood-sugar will show the degree of diminution of sugar tolerance.

Temporary diminution of sugar tolerance probably represents one of the commonest forms of glycosuria during pregnancy. As a general rule the condition is not unfavourable, and when the pregnancy has ended the sugar tolerance also falls to the normal, to rise again in the event of a subsequent pregnancy. A case has, however, been placed on record in which this favourable course did not occur, but in which, with the subsequent pregnancy, the diminution of the sugar tolerance was to a greater extent, and the patient developed true diabetes mellitus. It is possible, therefore, that temporary diminution of sugar tolerance is an antecedent to diabetes, and that

these patients have diabetes in a mild degree. Such patients, although the outlook is favourable, require careful supervision; the total output of sugar should be estimated and the carbohydrates intake restricted in proportion, but these must not be too rigidly excluded. If the blood-sugar remains normal under treatment, the amount of carbohydrate may be cautiously increased.

Under insulin treatment, *i.e.* 5 to 10 units of insulin, these patients may be allowed greater latitude and may eat moderate amounts of bread, and when the urine contains no sugar the treatment may be relaxed provided an occasional blood-sugar estimation is made.

The cause of the temporary diminution of sugar tolerance is obscure. It is known to occur in conditions other than pregnancy, such as worry and undue strain. The adrenal, pituitary, and thyroid glands are stimulated by the sympathetic, and their secretions lower sugar tolerance. The pancreas is inhibited by the sympathetic, and its secretion raises carbohydrate tolerance. Glycosuria may, therefore, result from disease of these glands or from disturbance of the sympathetic nervous system controlling them.

But such views as to the true explanation of lowered sugar tolerance must, in the light of our present knowledge, be regarded as only speculative.

True Diabetes Mellitus

While in patients who have glycosuria in the forms previously described the condition is only accidentally discovered, is of temporary duration, and is unaccompanied by symptoms, the reverse is the case in patients suffering from true diabetes mellitus. In these the condition is permanent, the patient suffers from thirst, hunger, and weakness, the sugar content of the blood is greatly above the normal and acidosis is present. Such patients must be placed upon the full routine treatment for true diabetes mellitus with periods of starvation to keep the urine free from sugar and the level of the blood-sugar at the normal. Under insulin treatment these measures may be considerably modified and the starvation may be unnecessary. As regards the obstetrical management of the patient our views, provided the patient responds to insulin treatment, have been profoundly modified. Formerly it was believed that true diabetes associated with pregnancy was a grave complication. The prognosis in the severe cases was distinctly bad. The patient was liable to miscarry or the fœtus to die *in utero*. The fœtus is often of excessive size and there may be an excessive amount of the liquor amnii. Formerly the maternal mortality was high; 27 per cent. died within

24 hours of delivery, and 23 per cent. within two years. When treated by modern methods, however, women may pass through pregnancy and labour in safety.

The best treatment to prescribe is a difficult matter to determine. If under suitable dietetic and drug treatment the symptoms subside, and the blood-sugar can be kept within range of the normal the tendency should be to discourage the termination of the pregnancy. The severity of the symptoms and the response to treatment must decide the measures to be taken. If the symptoms persist and the condition of the patient becomes worse the pregnancy should be terminated, but even so the nearer it is to term the more reluctant should be this decision.

The second stage of labour should be shortened with due regard to the safety of the mother in order to obviate muscular effort and to diminish the risk of cyanosis and acidosis. Cyanosis may induce hyperglycæmia as may also chloroform and ether. It is stated that ether has an inhibitory action on insulin. Cyanosis must, therefore, be avoided, and gas and oxygen or spinal anæsthesia be employed. Morphia is not contra-indicated. In order to diminish acidosis and the liability to coma, it is advisable to give the patient normal saline intravenously with the addition of bicarbonate of soda (ʒi ad. O i), both during labour and immediately after delivery.

CHAPTER XXIII

DISEASES ASSOCIATED WITH PREGNANCY
(*continued*)

INSANITY AND CHILDBIRTH

WOMEN may become insane during pregnancy, labour, the puerperium, or the period of suckling, and the tendency of modern teaching is not to lay stress on the divisions formerly made into varieties of insanity according to the period of onset. The insanity of childbirth may be a first attack or may be a recurrence of the disease. The influence of childbearing should be regarded as that of one of the many strains which are recognized as being capable of inducing mental illness.

Any variety of insanity, other than those of congenital origin or of senile decay, may appear in connection with childbirth. The prognosis depends upon the kind of insanity from which the patient is suffering.

Varieties of Insanity.—The varieties most likely to be met with are: (1) Confusional Insanity, (2) Alternating Insanity, (3) Dementia Precox. The differential diagnosis of these three varieties is often very difficult and will need the help of an expert alienist.

Dementia Precox may be held to include all those insanities ending in a "terminal dementia" from which there is no hope of complete recovery. Alternating Insanity implies a constitutional and lifelong tendency to attacks of excitement, depression, or stupor. These attacks are often precipitated by the strain incidental to childbearing. Confusional Insanity includes those cases in which the underlying cause is exhaustion or septic intoxication. In such cases complete recovery may be hoped for.

DIAGNOSIS AND PROGNOSIS

The common symptoms which forebode the onset of insanity are refusal of food, sleeplessness and dislike of the child.

Time of Onset.

(*a*) Onset during pregnancy is the least favourable event. Such

cases are generally examples of Dementia Precox, less often of Alternating Insanity.

(*b*) During parturition and the puerperium the precipitating cause is likely to be either nervous exhaustion or septic intoxication or both. Such nervous exhaustion may be due to pregnancy in an unmarried woman. Owing to the nature of the cause the most frequent form is Confusional Insanity, but Alternating Insanity is quite common. The immediate prognosis is generally good. The ultimate prognosis is favourable only in the case of a family history of insanity, in the absence of a history of previous attacks, and in the case of Confusional Insanity.

(*c*) Very similar considerations apply to insanity arising during lactation. Exhaustion is very likely to be the precipitating cause, and, in the absence of other determining factors, a diagnosis of Confusional Insanity, and consequently a favourable prognosis, is extremely probable.

History of Previous Attacks.

A history of previous attacks, or a family history of insanity, demands careful investigation. If such a history is obtained, the case is probably not one of Confusional Insanity, though even then this type cannot be excluded absolutely.

The Predominant Kind of Mental Symptom.

This is exceedingly important, but any exact determination of this question is really a matter for an expert alienist. There are five main types, *viz.* delusions, stupor, depression, excitement, and delirium.

Delusions are an unfavourable symptom, as also is stupor unless it arises in the course of delirium or exhaustion.

It should be remembered that the most prominent symptom of Confusional Insanity is confusion, from a clouding of consciousness at one end of the scale to actual delirium at the other, together with hallucinations which are usually those of sight and hearing only.

Treatment

In by far the greater number of all cases of insanity it is much better to remove the patient from her relatives and usual surroundings. Further, when the patient is treated at home, it may be found that when she recovers she has such an intense dislike of the surroundings associated with her illness that they may have to be changed permanently. In addition to this, really efficient treatment at home is very costly.

If the patient is treated at home, the medical practitioner must caution the relatives against infringing section 315 of the Lunacy

Act of 1890, whereby it is made illegal for any one to take charge of any person of unsound mind for payment, unless such person is certified under the Act. Taking into consideration the foregoing, it may be justifiable to treat a patient at home during her pregnancy to save the child from the stigma of being born in an asylum, and in any case the physician must be prepared so to treat her if the relatives refuse to allow her to be removed. After labour the child must be removed at once from the mother, and no young children must be allowed in any circumstances to come near her, since, however mild the case may seem to be, suicidal or homicidal tendencies may appear suddenly at any time. Moreover, sudden dislike of the husband or attendants and definite erotism and obscenity are particularly characteristic of puerperal insanity.

The patient should be given a suitable room or rooms on the ground floor, with three attendants who have been trained in mental nursing, one for night duty and two for day duty, and the nurse on night duty must be able to obtain help promptly if required. If the rooms cannot be on the ground floor, means must be taken to prevent the patient from being able to throw herself out of a window. Any possibility of suicide must be prevented, whether in the water-closet, bathroom, or from scissors, knives, fire, light, or any other means, but the only adequate arrangement is the very strictest and most constant supervision, and this must be impressed forcibly on all those in charge.

The most important points in active treatment are the giving of adequate nourishment, rest in bed during the acute stages, a due amount of sleep, preferably in the open air, and free action of the skin and bowels. Plain food should be given in abundance, supplemented by plenty of milk. If food is refused and persuasion is useless, the patient must be fed nasally.

For sleeplessness, open air by day and night in a verandah is well worth trying, as also is keeping the patient in a bath kept at 100° F. for half an hour or longer at a time. Both these methods of treatment are most easily managed in a well-equipped asylum. Hypnotic drugs should be avoided as far as possible, though it is often necessary to use them. The most useful are paraldehyde in doses of 1 to 3 drachms once or twice a day, to which 30 to 60 grains of bromide may be added, and 20 minims of liquid extract of liquorice to disguise the taste; chloral in 15 to 30 grain doses twice or thrice in the twenty-four hours, with or without bromides, if not contra-indicated by the condition of the heart or circulation (chloral should not be continued for many days); barbitone, which may be given in a single dose of 10 or perhaps 15 grains; sulphonal, grains 15 to 30, twice a

day for a day or two, together with some laxative; or trional, grains 10 to 20. In very acute excitement morphia grain $\frac{1}{6}$ with hyoscine grain $\frac{1}{100}$, cautiously increased up to grain $\frac{1}{4}$ and grain $\frac{1}{75}$ respectively, is often invaluable, and the hyoscine in particular may be especially useful if given just before the prolonged warm bath. When the acute symptoms have subsided, graduated exercise should be begun and the supervision very cautiously relaxed. The risk of suicide is greatest just before or just after the climax of depression. During convalescence strychnine and phosphoric acid may be given with iron and aloes for amenorrhœa if necessary. If convalescence flags, thyroid extract may or may not work wonders.

Generally speaking it is not right to end a pregnancy on account of a woman's insanity, since in most cases the ending of the pregnancy has no effect on the symptoms in consequence of the type of insanity which develops at this time. Possible exceptions to this rule are (1) when the insanity appears to be due to the conviction of the woman that she will die in labour, or that her child will be a monster or otherwise abnormal; (2) when the patient has had two or more previous pregnancies and has become insane during the puerperium each time.

Closely connected with this question is the desirability or otherwise of preventing pregnancies. Operative measures for this purpose may perhaps be undertaken in similar exceptional cases. If this is done, consultation with an expert alienist should be insisted upon, the purpose of the operation must be fully explained to the patient and her husband at a time when there is clear evidence that the patient is not in a condition of certifiable insanity, and a letter of indemnity should be given to the surgeon. The plea that a patient should be sterilized on eugenic grounds should not be entertained in the present state of our knowledge.

The majority of cases which arise after delivery develop during the first fortnight of the puerperium. In treating these the same principles should be borne in mind. Special points are that belladonna plaster, which is often used when lactation is interrupted, is dangerous in these cases since it could be used for suicidal purposes, and that, when there is pyrexia, any possible source of toxæmia or sepsis must be eliminated or treated. Sponging may be used for hyperpyrexia, but in other cases the prolonged warm bath does great good. If there are multiple abscesses, or if the case is evidently toxic in origin, polyvalent serum has sometimes been of the greatest value. Incontinence of urine or fæces will call for the most careful nursing to prevent bedsores. When the insanity arises during the later periods of suckling, it is usually due to exhaustion,

and for this reason is commoner among the poorer classes. The patient should be removed from home and given abundant food, ample rest, and general tonic treatment in the hope that when the strength of the body is regained the mental condition also will be cured.

SUDDEN DEATH IN PREGNANCY

Sudden death during pregnancy may be due to conditions quite independent of the gestation, such as morbus cordis, cerebral hæmorrhage, or embolism. It may also be due to hæmorrhage depending directly on the gestation, either internal, as in ectopic gestation or in concealed accidental hæmorrhage, or external, as in unavoidable hæmorrhage or external accidental hæmorrhage.

Very rarely a uterus may rupture during pregnancy, generally through the scar of an old laceration or Cæsarean section incision, and this may in exceptional cases lead to sudden death, though more usually it does not do so.

CHAPTER XXIV

TUMOURS COMPLICATING PREGNANCY

TUMOURS OF THE OVARY AND PREGNANCY

THE frequency with which ovarian tumours complicate pregnancy has been found in different sets of statistics to be from about 1-1500 to 1-890 cases.

Thus an ovarian tumour is a comparatively rare complication of pregnancy, and since ovarian tumours in themselves are comparatively common the probability is that they predispose to sterility. It has been found in a fairly large series of cases that of the different kinds of ovarian tumour the simple and multilocular cysts occur in 68 per cent. of the cases, dermoid cysts in 23 per cent., innocent solid tumours in 2 per cent., and malignant tumours in 5 per cent.

There is considerable difference of opinion as to whether their growth is accelerated as the result of gestation. Some authorities definitely state that there is no acceleration of growth, which, if true, is a very remarkable fact in view of the great increase in size of the ovarian vessels which is known to take place during pregnancy.

SIGNS AND SYMPTOMS

The existence of these tumours is often unknown to the patient. Hence the possibility of the presence of such a complication forms one important reason why every pregnant woman should be examined carefully by a medical man before the time for her confinement arrives. Occasionally the woman has some pain or unusual disturbance of micturition, especially if the tumour lies in the pouch of Douglas. In some cases the presence of the tumour seems to be associated with excessive sickness.

Similarly, when the tumour lies in the pelvis, it may interfere with the growth of the uterus to such an extent as to cause abortion. Abortion may also result if the tumour is very large, when it is apt to embarrass the breathing and the circulation.

Apart from the effects of pressure, however, symptoms may arise

from accidents to the tumour. Torsion of the pedicle may occur as the uterus grows, and is found to take place in about 12 per cent. of cases in which pregnancy is complicated by the presence of an ovarian tumour, whereas in the absence of pregnancy the pedicle becomes twisted in only about 8 per cent. of all cases. Other accidents that may happen are intracystic hæmorrhage, rupture, suppuration, or necrosis. The frequency of rupture is from 2 to 5 per cent.

Diagnosis

The possibility that a swelling rising from the pelvis into the abdomen may be a full bladder must always be eliminated by catheterization.

In the early months of pregnancy the uterus is in most cases easily differentiated by bimanual examination from the rounded and probably movable pedunculated ovarian tumour lying behind and to one side of it, but occasionally there is considerable difficulty. A valuable sign when it can be obtained is the periodical contraction and relaxation of the pregnant uterus, which helps to differentiate the two swellings from each other in cases of doubt.

The chief conditions which will have to be distinguished from an intra-pelvic ovarian tumour, associated with early pregnancy, will be ectopic gestation and retroflexion of the gravid uterus. The main points of distinction between the latter condition and an ovarian tumour are that the ovarian tumour is usually asymmetrical and hard and tense, wholly or partly, whereas the retroflexed gravid uterus is usually symmetrical and soft all over.

In most cases the uterus is found to be lying above the ovarian tumour and often to one side of it, and can be made to move independently of the tumour. When there is retroflexion of the gravid uterus, the fornices of the vagina may be drawn up high, occasionally even above the symphysis pubis.

Any failure to distinguish an ovarian tumour complicating pregnancy from an ectopic gestation will be less serious since laparotomy will be the correct treatment in either case. The combination of a twisted and inflamed ovarian cyst lying in the pouch of Douglas with a threatened abortion may be very difficult to distinguish from a tubal abortion.

In all cases of doubtful diagnosis, in which there is any question as to the correct treatment to pursue, a careful examination should be made under anæsthesia.

In the later months of pregnancy, when the tumour lies in the pelvic cavity, it is easy to distinguish, but care should be taken both

then and in the earlier months to exclude tumours of the pelvic colon, if necessary, by the use of the sigmoidoscope.

When the tumour lies above the brim of the pelvis and is of fair size, it is as a rule easy to detect, but it may lie under the liver or spleen or even behind the uterus and beside the spinal column, and so be impossible of palpation.

It is again important to remember that periodical contractions and relaxations in the wall of any tumour are very strong evidence that such a swelling is the pregnant uterus.

If the tumour is adherent to the uterus, it may simulate twins, myoma, bicornute uterus, or even hydramnios, and here again it may be necessary to make a careful examination under anæsthesia.

Treatment

Generally speaking, the best treatment is to remove the tumour as soon as it is diagnosed. Abortion is said to follow the operation in about 19·5 per cent. of the cases operated on, but on the other hand abortion occurs in 17 per cent. of the cases in which no operation is done, and in addition to this the mother is in constant risk of torsion of the pedicle or of one of the other accidents to which the tumour is liable. This applies especially to the first half of gestation. In addition to this there is always the possibility that the tumour may be malignant.

An exception to this rule occurs when the child is just short of viability at the time that the tumour is discovered. In such a case it may be well to delay operation until the child is likely to survive if labour is brought on prematurely by the operation. Some authorities also would wait to operate until labour sets in when the tumour is discovered during the last month of gestation, in order to avoid subjecting a recent scar to the strain of labour. Other possible exceptions to the rule that operation should be undertaken as soon as the tumour is diagnosed are :—

1. When the tumour is small, freely movable, and lies high in the abdomen, and for these reasons it is unlikely to come to any harm before the onset of labour, provided that the patient can be kept under observation and treatment adopted at once in the event of urgent symptoms arising.

2. When the mother is a primigravida and within a few years of the menopause, since in such a case the probability of a second pregnancy is not great, and the present child may be lost by miscarriage as the result of the operation with rather greater probability than if the pregnancy is allowed to continue without operation until at any rate the child is viable.

3. When there are two ovarian tumours, the removal of which would prevent the occurrence of another pregnancy. In all such cases ovariotomy should be done at the time of labour, or failing that as soon afterwards as possible before any untoward effects, which may result from any accident to the tumour consequent on the labour, have time to do irreparable harm to the mother.

There is one kind of ovarian tumour which may be associated with pregnancy which should not be operated upon unless some complication arises, and that is the tumour consisting of multiple lutein cysts which often accompanies a hydatidiform mole. Several tumours of this nature have been known to disappear gradually after the expulsion of the mole (see p. 176).

Pressing indications for operation during pregnancy are torsion, infection, or incarceration of the tumour, over-distension of the abdomen, or the fact that the tumour is growing in the broad ligament.

At the time of operation the uterus should be disturbed as little as possible, and morphia should be given both before operation and for a few days afterwards to lessen the chance of subsequent miscarriage. In some cases it may disturb the uterus less if an assistant with a finger in the vagina pushes up the tumour from below rather than if the operator drags it up from above, especially if it should be necessary to turn the uterus out of the abdomen in order to get at the tumour.

A plan which has been adopted with success in cases in which the tumour seems to be tightly wedged in the pelvis, is to insinuate a rubber tube down by the side of the tumour to the bottom of the pouch of Douglas so that air enters the pelvis below as the tumour is withdrawn. Sometimes, however, it will be necessary to turn the uterus out of the abdomen or even to remove the child by Cæsarean section before the tumour can be removed.

Prognosis

This is good, generally speaking, if the case is correctly treated. Statistics show that the maternal mortality is about 3·3 per cent. when ovariotomy is done during pregnancy.

FIBROIDS OF THE UTERUS AND PREGNANCY

The frequency with which myomata (fibromyomata, fibroids) complicate pregnancy is given as 0·6 per cent. and as 0·1 per cent. in different series of cases. They undoubtedly predispose to

sterility, a fact which accounts for the comparative infrequency of the co-existence of the two conditions. The effect of each condition on the other may be considered separately.

Effects of Pregnancy on Fibroids.—Generally speaking, fibroids become larger, softer, and flatter during pregnancy. In most cases the enlargement is due mainly to œdema, though also in a lesser degree to hypertrophy, in which the uterine wall takes part, but it may be the result of some form of degeneration. This softening

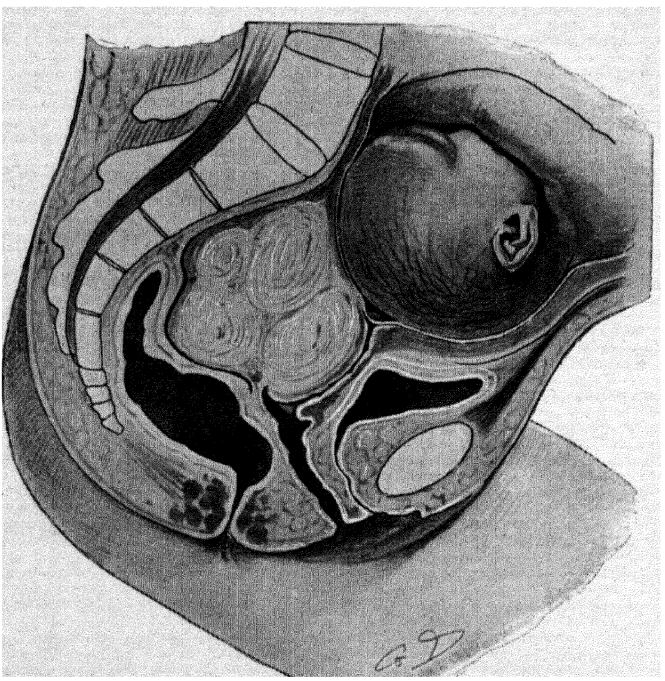


FIG. 52.—FIBROID TUMOUR OF THE CERVIX WHICH PROVED AN INSUPERABLE BAR TO DELIVERY BY THE NATURAL PASSAGES.

and flattening may cause a tumour which was comparatively prominent early in gestation to become scarcely distinguishable by palpation in the later months. The flattening may displace downwards into the pelvic cavity part of a growth which was originally altogether above the pelvic brim. On the other hand, there is a marked tendency for fibroids in the cervix or lower uterine segment to rise somewhat during the later months quite apart from any similar process which may go on during labour. In other cases, when the tumour lies in the pelvis, enlargement produces incarceration and consequent pressure symptoms.

Interstitial tumours tend to become more superficial during

pregnancy, and if their progress is towards the uterine cavity, they may even become polypoid and be extruded during the puerperium.

Subperitoneal pedunculated tumours may fall into the pouch of Douglas, or may undergo torsion of the pedicle and necrosis, though this last event is rare.

Cystic degeneration or any of the other degenerations to which myomata are liable may complicate pregnancy. Rarely suppuration or more rarely still gangrene may occur. In all these degenerations peritoneal adhesions are apt to be formed. The so-called red degeneration or necrobiosis in one of its forms seems particularly to be associated with pregnancy. In this, and indeed in other forms of degeneration, there is usually considerable pain, which may be accompanied by pyrexia and vomiting. These symptoms in many cases gradually disappear with rest in bed and symptomatic treatment.

Effects of Fibroids on Pregnancy.—As already stated, the presence of fibroids tends to cause sterility, especially when they are submucous or interstitial. If pregnancy occurs, however, they may produce abortion. On the whole, interference with gestation by myomata is surprisingly infrequent (Fig. 52).

Pressure symptoms may arise, more especially when the tumour is impacted in the pelvis either as the result of retro-displacement of the uterus or from the original position of the tumour. As a result the urethra or bladder is most commonly pressed upon, less commonly the veins or the bowel.

Sacculation of the uterus is said to occur occasionally when myomata are present in the walls of the pregnant uterus.

It has been stated also that the placenta is frequently implanted over a fibroid tumour.

Malpresentation of the fœtus may be produced when the cavity of the uterus is much distorted by fibroids.

Diagnosis

The coexistence of fibroids of the uterus with gestation sometimes interferes seriously with the typical signs and symptoms of either condition, so that mistakes are by no means unknown.

Supposing the existence of pregnancy is obvious but the pre-existence of uterine fibroids is unknown, the latter may be very difficult to detect when they have become much softened and flattened. If, on the other hand, they are projecting and nodular their detection and diagnosis are as a rule easy. Fortunately, in the

former case the tumours are unlikely to interfere seriously with either pregnancy or labour.

In the early months of pregnancy when a threatened abortion is associated with an œdematous and degenerating subperitoneal myoma the diagnosis from ectopic gestation may be extremely difficult or even impossible. The pain, however, in the former case is not, as a rule, so sudden in onset nor so severe, and if the symptoms are not very urgent, time will clear up the diagnosis. If a woman who is known to have a myomatous uterus becomes pregnant, the recognition of the latter condition will depend on the superposition of the usual signs and symptoms of gestation on those of the myomata. These signs and symptoms are, however, sometimes considerably masked. For instance, there may be intermittent hæmorrhages due to threatened abortion, and the tumours themselves may prevent the recognition of the fœtal parts by palpation, or may make the swelling palpated utterly unlike the normal pregnant uterus either in shape or consistence.

In such a case in which there may be none of the ordinary signs to prove or indicate the presence of gestation, the presence of intermittent contractions felt in the swelling on palpation point strongly to the existence of pregnancy. In the later months X-rays can be used to show the fœtal bones.

Rectal examination should never be omitted, since by this means ballottement of the fœtus may sometimes be obtained behind a myoma which lies anteriorly. In all cases in which there is doubt it is well, if there are no urgent symptoms, to watch the case and to make repeated examinations at intervals. In this way the true state of affairs will often become evident.

There are certain conditions which may simulate fibroids associated with pregnancy. These are the so-called "phantom fibroids," which are generally local contractions of the uterine wall sometimes accompanied by pain, or in other cases the result of parts of the uterus only being gripped between the fingers in bimanual examination. In such cases the physical signs are found to have altered at a second examination.

A similar mistake may be made when there is an angular gestation; that is to say, when the ovum has become implanted close to the junction of the tube and uterus, or when there is a double uterus one half of which contains the ovum.

The differential diagnosis between a large symmetrical interstitial fibroid and the pregnant uterus is occasionally very difficult, especially when there is amenorrhœa due to the onset of the menopause or other intercurrent condition. Here again the presence or

absence of the usual signs and symptoms of pregnancy is the first thing to look for. Especially suggestive of pregnancy are contractions and relaxations in the tumour as already mentioned.

A positive diagnosis can generally be made after repeated examinations of the case at intervals; in the later months the X-rays may be of use.

If it should happen that the abdomen has been opened, the diagnosis may still be difficult even after the tumour has been turned out of the peritoneal cavity and lies in the hands of the surgeon. The general points of distinction, in such circumstances, are that the pregnant uterus is darker and more congested, the Fallopian tubes and ligaments are thickened, ballottement may be obtained and contractions excited by manipulation of the tumour.

Treatment

The great majority of women with fibroids of the uterus go to full time and pass through labour without serious difficulty. It is remarkable how these tumours, even though they appear to be likely to obstruct labour, will become displaced from the pelvis with the help perhaps of the fingers of the obstetrician so that the labour ends naturally.

It is best to operate during pregnancy only when there is some distinct and pressing indication; that is to say, when the patient's life or health is endangered by such conditions as severe pressure or serious degeneration or necrosis of the tumour, or by unbearable pain, rapid increase in size, or over-distension of the abdomen.

Apart from these indications, it should be remembered that the need for operative treatment may be doubtful until after the patient has been in labour for some hours, hence operation should be performed during pregnancy only in the presence of some such indication as has been mentioned already. Even then operation should be delayed if possible till the later weeks of pregnancy for the sake of the child.

If the tumour is impacted in the pelvis, it can in some cases be dislodged by digital pressure with the patient in the genupectoral or in Sims' position. In other cases it will have to be removed either by division of its pedicle when it is a pedunculated subperitoneal myoma, by enucleation if it is embedded in the wall of the uterus, or by hysterectomy. Enucleation per abdomen (abdominal myomectomy) during pregnancy is generally an easy though rather a bloody operation, and is followed by abortion in from 17 to 50 per cent. of the cases according to different statistics. Even the decidua has

been exposed without abortion resulting. Very careful stitching of the bed of the tumour is necessary in order that it may stand the strain of a subsequent labour or abortion. It is probably best to stitch with catgut in several shallow layers.

The hæmorrhage from enucleation may be so profuse that hysterectomy becomes necessary, while the position or the number of the tumours may be such that hysterectomy is the only possible course.

Abortion or premature labour should not be induced solely on account of myomata of the uterus, since the child will be sacrificed and the tumour remain.

CARCINOMA OF THE UTERUS AND PREGNANCY

Pregnancy is unknown with carcinoma of the body of the uterus, but it has been known to occur in association with sarcoma of the uterine body. Chorionepithelioma may invade the walls of the uterus during pregnancy.

Carcinoma of the cervix is the most common form of malignant disease to be associated with pregnancy. It is found almost exclusively in parous women, and is a very dangerous complication, the immediate mortality being about 43 per cent. for the mother and 60 per cent. for the child. The vaginal discharge, which accompanies the disease in its later stages, doubtless tends to prevent conception, but in the early stages there is probably but little influence of this kind, the comparative rarity of the complication being due to the fact that the disease usually occurs in the later years of menstrual life when pregnancy is less likely to occur.

The Effect of Pregnancy on Carcinoma of the Cervix and the Effects of Carcinoma of the Cervix on Pregnancy.—Most authorities agree that the effect of pregnancy on the tumour is to make it grow rapidly, and to cause rapid invasion of the glands and lymphatics. Abortion is frequent, and occurs in from 30 to 40 per cent. of the cases. Placenta prævia is a not uncommon complication. Intra-uterine death of the fœtus is frequent.

Diagnosis

Whenever a woman who is pregnant has irregular hæmorrhage or a purulent or fetid vaginal discharge, she should always be examined *per vaginam*, since the cause may be carcinoma of the cervix.

The diagnosis is made by the usual criteria of this disease, but as a general rule the growth, at any rate in those cases in which it can be felt on the outside of the cervix, is more easily differentiated than at other times, since the normal tissues of the cervix become softened as usual, but the growth remains firmer in texture.

For this reason close attention should always be paid to any hard tissue in the cervix of a woman advanced in pregnancy lest an early case of carcinoma of the cervix should be missed. When there is any doubt as to the diagnosis, a small piece of the hard tissue should always be removed for examination under the microscope. If this has to be done, abortion does not necessarily follow.

When the growth starts in the walls of the cervical canal the diagnosis in early cases is not so easy, since intermittent hæmorrhages will be the only clue to the condition.

It is found that there is a higher percentage of operable cases during pregnancy than at other times. The reasons for this probably are, that when the growth is advanced pregnancy very rarely occurs, and that when hæmorrhages appear during pregnancy the woman is more apt to seek advice early than at other times.

Treatment

This differs according to whether the growth is in an operable or an inoperable condition.

When it appears likely that the growth can be exterminated by a radical operation the great majority of gynæcological surgeons unhesitatingly advise this course and disregard the pregnancy. Some few, having regard to the fact that recurrence is more likely to take place after operation in these than in other cases, would merely lay the facts before the parents and leave them to decide. A radical cure following operation may be hoped for in 25 per cent. of the cases operated on.

The uterus should not be emptied before operation, because there is great risk of septic infection from the growth invading the uterus and surrounding structures if this is done.

If, when the case is first seen, the child is nearly but not quite viable, it may be justifiable to wait a week or two before operating. If, however, the child is viable, operation should be performed at once. The radical method of hysterectomy, preceded by Cæsarean section, when the child is viable, should be the operation chosen. This method is more easily carried out during pregnancy than at other times, owing to the greater ease with which the pelvic tissues can be dissected.

In cases in which the growth has gone so far that radical operation is not possible the pregnancy should be allowed to continue till near full time, and then Cæsarean section, followed by supravaginal hysterectomy, should be performed. Most operators sew the peritoneum over the stump of the cervix; some few treat the cervical stump extra-peritoneally, as in Porro's operation, in order to prevent possible contamination of the peritoneal cavity from the growth in the cervix, which is practically always septic.

In rare cases, in order to prevent symptoms caused by septic absorption and fetid discharge, it may be necessary to scrape and cauterize the growth during gestation. This does not by any means necessarily bring on abortion.

The dangers of allowing natural labour to take place, even when it seems that this may be possible, are severe hæmorrhage, rupture of the uterus, and puerperal sepsis.

It is well to examine these inoperable cases about a fortnight after delivery, because occasionally when some involution has taken place the growth has been found to have become operable. In such a case the use of radium before operation might be advisable, since by this means the extent of the growth might perhaps be still further diminished.

SECTION II—LABOUR

(*A*) *NORMAL LABOUR*

CHAPTER XXV

ANATOMY OF THE PELVIS

THE following account is concerned with the pelvis from an obstetrical point of view, and only those anatomical points which have relation thereto will be dealt with.

BONES OF THE PELVIS

The pelvis consists of four bones, the two ossa innominata, the sacrum, and the coccyx.

The Os Innominatum.—This bone is formed of three parts, the ilium, the ischium, and the pubes, which up to twenty years of age are separated from each other by a triradiate piece of cartilage, whose centre is at the acetabulum.

The Ilium.—The anterior superior extremity of the ilium is named the anterior superior spine ; the posterior superior extremity, the posterior superior spine. The ridge of bone stretching between these two points is known as the crest of the ilium. There are certain measurements of obstetrical importance which are taken between the two anterior superior spines, between the crests, and between the two posterior superior spines. On the inner surface of the ilium, where it joins the ischial and pubic bones, is a prominence known as the ilio-pectineal eminence. The ilia help to form the sides of the false pelvis.

The Ischium.—The ischium forms part of the true pelvis, and terminates in an expanded process of bone known as the tuberosity. Stretching between the ilio-pectineal eminence and the ischial spine is a ridge of bone dividing the ischium into two planes,

the anterior inclined bony plane and the posterior inclined bony plane. If the head during its passage through the pelvis fits the pelvis tightly, these planes take an active part in its internal rotation.

The Pubes.—The pubes, together with its fellow on the opposite side, forms the front portion of the true pelvis. It is joined above and below respectively, to the ilium and ischium of its own side, by two rami, the space between them being known as the obturator foramen.

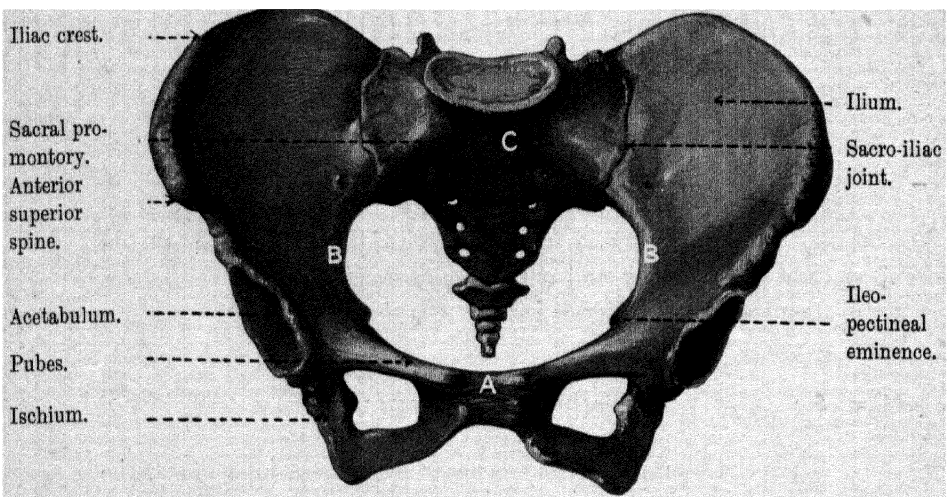


FIG. 53.—FEMALE PELVIS SEEN FROM IN FRONT.

A, B, C, indicate the pelvic brim formed by
A, the upper margins of the pubic lines.
B, the ilio-pectineal lines.
C, the anterior and upper margin of the sacrum.

The Sacrum.—The sacrum is a roughly triangular bone formed by the fusion of the five sacral vertebræ. It forms, together with the coccyx, the posterior portion of the true pelvis. The anterior border of the superior surface of the sacrum, which articulates with the fifth lumbar vertebra, forms the promontory of the sacrum, which is of great importance in the measurement of the true and diagonal conjugate diameters of the pelvis. On the anterior surface of the sacrum are a number of foramina through which issue the nerves which form the sacrosciatic plexus. Pressure on these nerves by the fœtal head, during its passage through the pelvis, is the cause of the cramp in the legs which many women complain of at this time.

The Coccyx.—The coccyx forms the lowest part of the posterior portion of the true pelvis.

THE JOINTS OF THE PELVIS

The Sacro-iliac Joints are situated between the auricular surfaces of the sacrum and ilium, one on each side.

During pregnancy these joints become softened and are capable of a certain amount of movement. By such movements the sacrum is able to swing backwards or forwards through a transverse axis at the centre of the joint, with the result that the size of the inlet

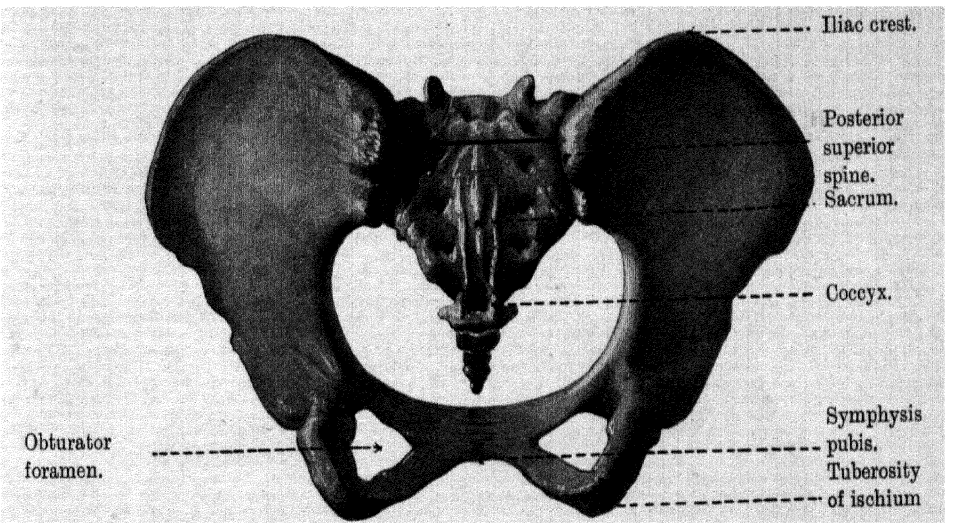


FIG. 54.—FEMALE PELVIS SEEN FROM BELOW.
Black line shows the posterior interspinous, diameter 4 inches (10 centimetres).

During the first stage of labour a woman usually walks about, with the result that by the swinging back of the promontory, the size of the inlet of the pelvis is somewhat increased. During the second stage she naturally lies down and flexes her thighs, which reverses the swing of the sacrum and so increases the size of the pelvic outlet. This excursion of the sacrum is more marked at its lower than its upper extremity. If a woman is placed during labour in the "Walcher" position (see p. 664), the rotation backwards of the upper part of the sacrum is obtained to its extreme limit, and the knowledge of this fact is of use in the treatment of the minor degrees of pelvic contraction.

The Pubic Joint.—The symphysis pubis lies between the upper and anterior portions of the pubic bones. The softening of this joint facilitates the passage of the fœtal head and the division of the symphysis pubis in the operation of symphysiotomy (see p. 720).

The Sacro-coccygeal Joint.—This joint is situated between the

sacrum and coccyx, and becoming softened during pregnancy allows the coccyx to be pushed backwards by the fœtal head during its escape from the pelvis, thus enlarging the antero-posterior diameter of the outlet, and so facilitating the escape of the fœtal head at the end of the second stage of labour.

The Pelvis as a Whole

For obstetrical purposes the pelvis is divided by a heart-shaped rim, which is known as the brim of the pelvis, into two parts, the false and true pelvis.

The False Pelvis is that portion above the brim. It takes no part in the mechanism of labour, and is only here of interest from the fact that between certain of its parts measurements are taken which will enable a judgment to be formed of the size of

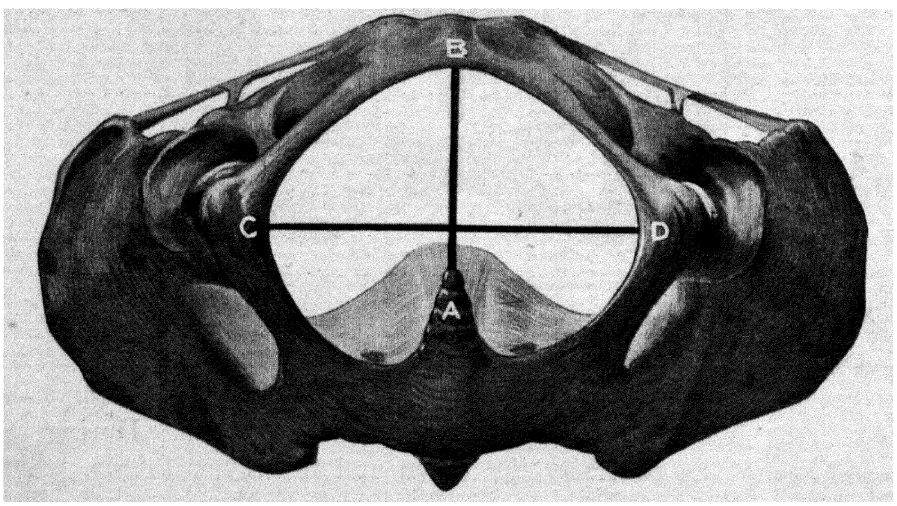


Fig. 55.—The Pelvic Outlet.

A, B, antero-posterior diameter of the outlet, 5¼ inches (13·1 centimetres). This measurement, in a dried pelvis with a fixed coccyx, is half an inch less. C, D, transverse diameter of the outlet, 4¼ inches (10·6 centimetres).

the true pelvis, and, if this is smaller than normal, of the nature of its contraction.

The True Pelvis, which includes the brim and that portion of the pelvis below it, is divided into the brim, the cavity, and the outlet.

The Brim.—The brim is formed in front by the upper margins of the pubic bones, at the sides by the ilio-pectineal lines, and behind by the anterior and upper margin of the sacrum (see Fig. 53).

The Cavity.—The cavity of the pelvis is irregular in shape, and is formed by the pubic bones in front, the anterior surface of the sacrum and coccyx behind, and the inner surfaces of the ischial bones at the sides (Fig. 56).

The Outlet.—The outlet, which is more or less diamond-shaped, is formed in front by the inferior rami of the ischial and pubic bones, behind by the tip of the coccyx and the sacro-sciatic ligaments, and at the sides by the tubera ischii (Fig. 55).

THE PLANES OF THE PELVIS

The planes of the pelvis consist of imaginary planes, bony planes, and a soft plane.

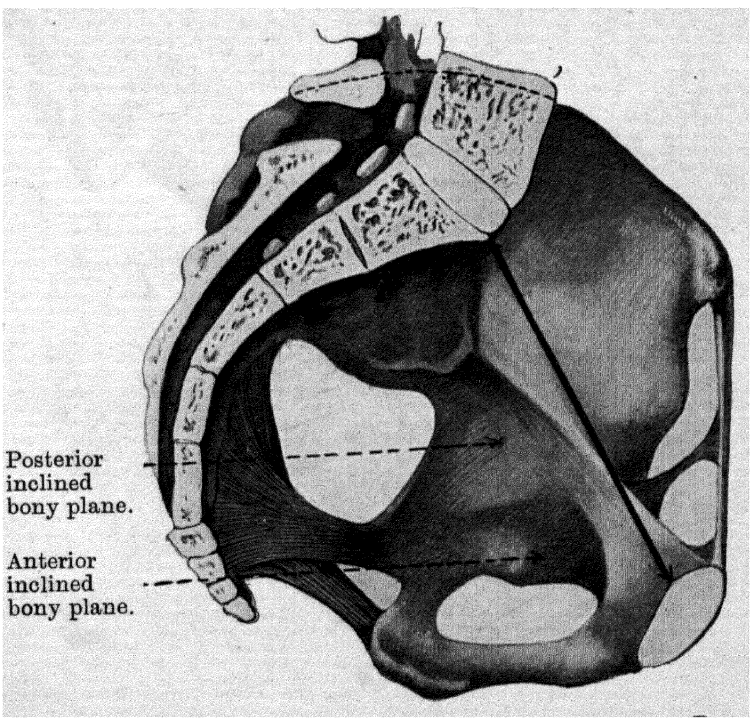


FIG. 56.—ANTERO-POSTERIOR SECTION OF THE PELVIS.

Showing the inclined planes of the ischium, and the inclination of the pelvic brim, which in the erect position is an angle of 55°. Black line indicates the true conjugate measured from the centre of the promontory of the sacrum to the nearest point on the posterior surface of the symphysis pubis, 4¼ inches (10·6 centimetres).

Imaginary Planes.—The true pelvis may be divided into any number of imaginary planes. For practical purposes three only are taken, the plane of the brim, the mid-plane of the cavity, and the plane of the outlet.

The plane of the brim is bounded by the relations of the inlet of the pelvis.

The plane of the cavity is limited in front by the middle of the symphysis pubis, behind by the junction of the second and third sacral vertebræ, and at the sides by a line joining these two.

The plane of the outlet is bounded by the relations of the outlet of the pelvis.

The Bony Planes.—The position of the anterior and posterior inclined bony planes has already been indicated, situated as they

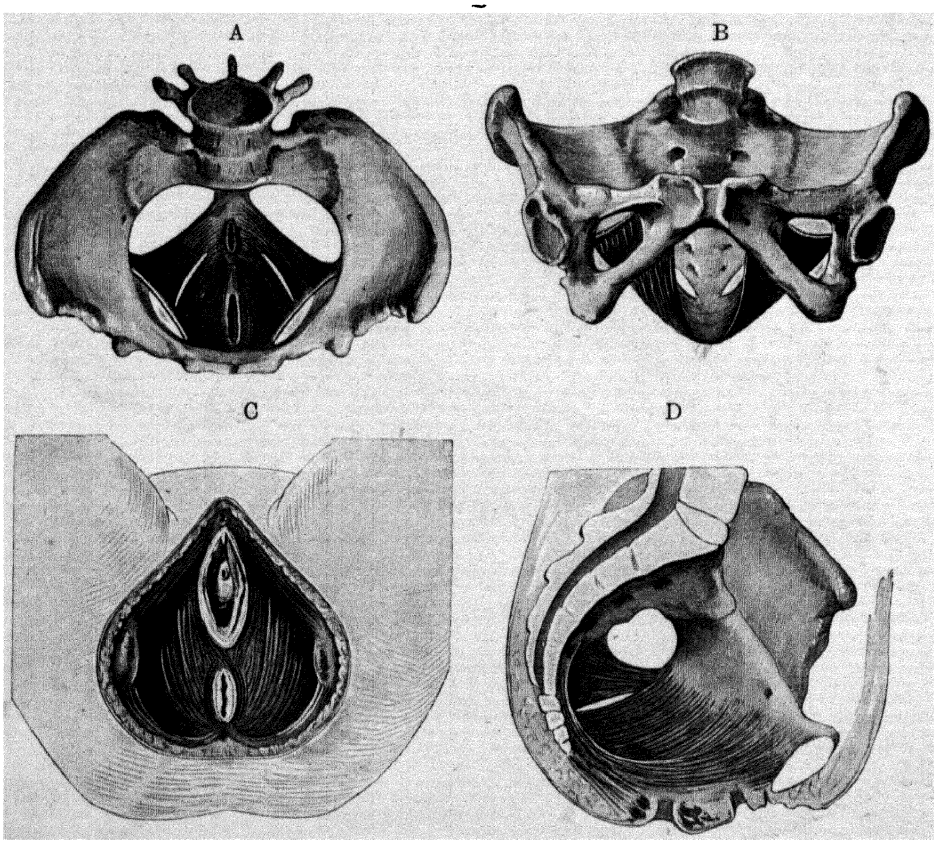


FIG. 57.

A, showing the pelvic floor muscles from above.

B, showing the gutter-like shape of the levatores ani.

C, showing the pelvic floor from below, perforated by the vagina in front and the rectum behind.

D, showing the pelvic floor in sagittal section as seen from the side, with the perineal body between the lower ends of the vagina and rectum.

are on the ischial bones in front and behind, respectively, of a ridge lying between the ilio-pectineal eminence and the spine of the ischium (Fig. 56).

The Soft Plane.—The soft inclined plane of the pelvis is formed by the soft parts comprising the floor of the pelvis (see Fig. 57). It is this soft plane which is concerned in the movement of internal rotation of the fœtal head during normal labour, and also of its flexion or extension during birth.

THE AXIS OF THE PELVIS

The axis of the pelvis consists of an imaginary line which would show the position of the centre of the fœtal head in its passage through the pelvis. Such a line is obtained by taking any number of antero-posterior diameters of the true pelvis, between the plane

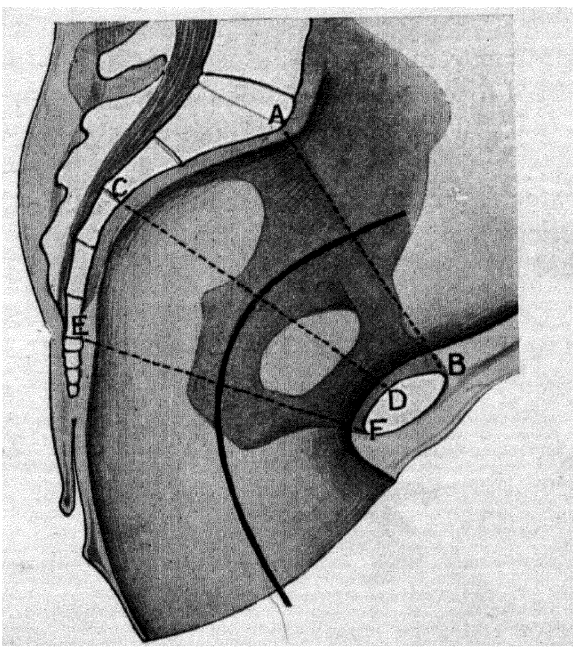


FIG. 58.—THE AXIS OF THE PELVIS.

A, B, plane of the brim. C, D, mid-plane of the cavity. E, F, plane of the outlet. Black line shows the position of the centre of the fœtal head during its passage through the pelvis. This imaginary line is termed the axis of the pelvis.

of the brim and that of the outlet, when a line joining the centres of these diameters will indicate the axis of the pelvis.

THE INCLINATION OF THE PELVIS

By the inclination of the pelvis is meant the relation of the plane of the pelvic brim to the horizon. In the erect position the inclination of the pelvic brim approaches the vertical, and forms an angle of 55° with the horizon.

THE SIZE OF THE PELVIS

Alterations in the size of the pelvis may affect the mechanism of labour to a serious degree. It has been usual in text-books to direct such attention to the measurements of the pelvis that the student is in danger of getting an exaggerated idea of their importance when they depart from the normal. It may be mentioned here that the problems concerned with the management of labour, or its induction in cases of contracted pelvis, are much more concerned with the relative sizes of the head of the child and the pelvis than with the size of the pelvis *per se*. The pelvis may be measured externally and internally.

External Measurements.—The value of the external measurements is referred to on page 417; the following are of importance in this connection. They should be taken with callipers:—

The Anterior Interspinous Diameter.—The distance between the anterior superior spines of the ilia is 10 inches (25 centimetres) (Figs. 166A and B).

The Intercristal Diameter.—The distance between the farthest points on the two iliac crests is 11 inches (27·5 centimetres) (Figs. 165A and B).

The External Conjugate Diameter.—This diameter is measured between the tip of the spine of the last lumbar vertebra and the upper border of the symphysis pubis. It measures 7½ inches (19 centimetres) (Figs. 167A and B).

The Intertrochanteric Diameter.—The distance between the outer surfaces of the great trochanters is 12½ inches (31 centimetres).

The Posterior Interspinous Diameter.—The distance between the posterior superior spines averages 4 inches (10 centimetres) (Fig. 168B).

The normal difference in length between the anterior interspinous diameter and the intercristal diameter is 1 inch (2·5 centimetres). If the difference is less than this, the pelvis is flattened. If the difference is normal but their respective measurements less than normal, the pelvis is generally contracted. When the difference between the two as well as their respective measurements are less than normal, the pelvis is contracted and flattened.

The fact that the external conjugate diameter is a little more or less than normal is of no import, owing to the difficulty which at times is experienced in measuring it, on account of the soft parts covering the spine of the last lumbar vertebra.

If the spine of the last lumbar vertebra cannot be felt satisfactorily its position may be imagined by marking the posterior superior spines, which can always be felt, joining these marks with a horizontal line, and taking a point 1½ inches (3·75 centimetres) above its centre. In some women, but by no means in all, in spite of the sculptors, a dimple can be seen over the situation of the posterior superior spines.

Internal Measurements.—It is customary to take the internal measurements of the true pelvis at three planes, that of the inlet or brim, that of the middle of the cavity, and that of the outlet, and to take them in four directions at each plane, antero-posterior, transverse, and right and left oblique. The right oblique diameter is that which starts from the right side of the pelvis behind and ends at the left side in front, and *vice versâ*. The following are average measurements:—

	Antero-posterior.	Obliques.	Transverse.
Inlet	4¼ in. (10·6 cm.)	4¾ in. (11·8 cm.)	5¼ in. (13·1 cm.)
Cavity	4¾ in. (11·8 cm.)	5¼ in. (13·1 cm.)	4¾ in. (11·8 cm.)
Outlet	5¼ in. (13·1 cm.)	4½ in. (11·2 cm.)	4¼ in. (10·6 cm.)

The oblique diameters of the planes of the cavity and outlet, being measured between soft structures, are of no practical importance, and will not be further considered. The remaining measurements are taken between bony points, but as during life the bones are covered by the soft tissues the distances given are not strictly accurate, being probably nearly a quarter of an inch greater than the diameters actually available.

Measurements at the Plane of the Inlet.

Antero-posterior Diameter, sometimes called the True Conjugate. This diameter is measured from the centre of the promontory of the sacrum to the nearest point on the posterior surface of the symphysis pubis. This represents the smallest diameter of the inlet (Fig. 59, A to B).

Oblique Diameter.—The right oblique diameter is measured from the right sacro-iliac joint to the left ilio-pectineal eminence, and the left oblique diameter from the left sacro-iliac joint to the right ilio-pectineal eminence (Fig. 59, C to D).

Transverse Diameter.—This represents the greatest distance between the ilio-pectineal lines (Fig. 59, E to F).

Measurements at the Mid-plane of the Cavity.

Antero-posterior Diameter.—This diameter is measured from the centre of the posterior surface of the symphysis pubis to the middle of the junction of the second and third sacral vertebræ.

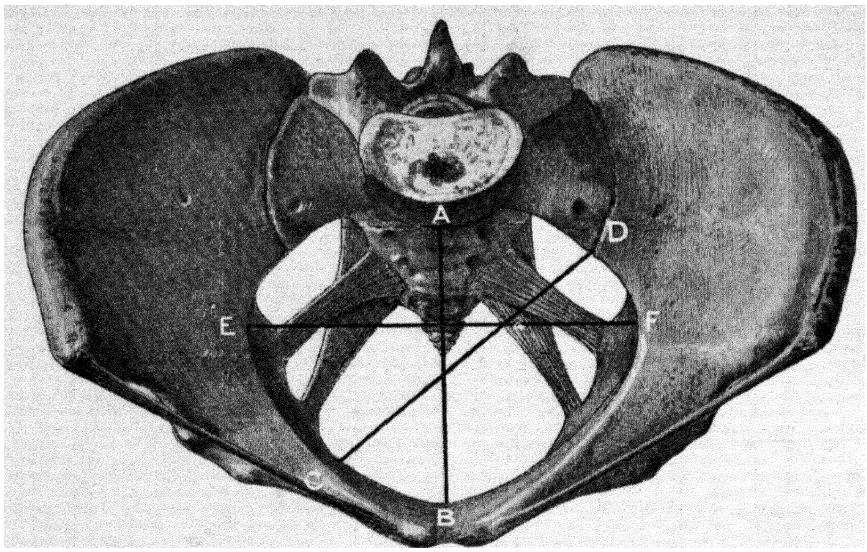


FIG. 59.—VIEW OF THE FEMALE PELVIS IN THE AXIS OF THE BRIM.

A, B, antero-posterior diameter of the brim, 4¼ inches (10·6 centimetres).
C, D, left oblique diameter of the brim, 4¾ inches (11·8 centimetres).
E, F, transverse diameter of the brim, 5¼ inches (13·1 centimetres).

Transverse Diameter.—This diameter is taken between ridges separating the inclined planes on the internal surfaces of the ischial bones.

Measurements at the Plane of the Outlet.

Antero-posterior.—This diameter is taken from the centre of the lower border of the symphysis pubis to the tip of the coccyx, and varies in length according to whether the coccyx is stationary or pushed back by the advancing head. When the coccyx is so moved this diameter measures 5¼ in. (13·1 cm.), otherwise its measurement is 4¾ in. (11·9 cm.) (Fig. 55, A to B).

Transverse.—This measurement is taken between the inner surfaces of the tuberosities of the ischium (see Fig. 55, C to D).

It is impossible to take accurately most of these internal measurements during life. Directly after labour the true conjugate and the transverse at the plane of the inlet may be determined roughly (see p. 423). The antero-posterior and the transverse diameters at the plane of the outlet can be taken with a special instrument (see p. 417).

The length of the most important measurement, however, namely, the true conjugate at the plane of the inlet, can be estimated roughly at any time, either by means of a special instrument (see p. 417), or by a digital examination, by deduction of ¾ inch (1·8 cm.) (see p. 423) from the diagonal conjugate, which should measure 4¾ inches (11·8 cm.).

In the female pelvis as compared with the male—

The bones are slighter and smoother.
The true pelvis is shallower.
The false pelvis is broader.
The pubic arch is wider.
The symphysis pubis is not so deep.
The diameters of the inlet and outlet are larger.
The joints are more movable.

[The terms brim and inlet are usually used synonymously. There is, however, a slight difference between them. The anterior boundary of the brim is the upper margin of the symphysis pubis, while that of the inlet is at a slightly lower level, namely, the point on the back of the symphysis which is nearest the promontory of the sacrum.

There is also some discrepancy as to the precise definition of the limits of the antero-posterior diameter at the outlet. The plane of the outlet is commonly taken through the sacro-coccygeal joint, but the antero-posterior diameter of the outlet is measured to the tip of the coccyx. The diameter is usually measured to the tip of the coccyx as this is a point which can be easily felt and recognized on the living subject.]

CHAPTER XXVI

ANATOMY OF THE FŒTAL SKULL

THE fœtal skull, regarded from an obstetrical point of view, may be divided into the vault, face, and base. Calcification takes place more completely in the bones of the face and base during intra-uterine life, and at birth they are firmly united to each other. The bones comprising the vault of the skull, however, are not so ossified, and when the child is born they are united only by a thin unossified membrane. The result of this difference in development is, that while the bones of the base and face are incompressible, and so prevent damage to the vital centres in the medulla, which they surround, the vault is compressible, and thus allows of the size of the skull being diminished and the shape altered during its passage through the pelvis, by which means its expulsion is made much easier. This diminution in size is due to the fact that by the compression the cerebro-spinal fluid and blood in the fœtal brain are determined to other parts of the body, while the change in shape, or moulding as it is termed, is brought about by the pliability of the bones of the vault and the presence of the membranes uniting them, which allows one bone to overlap the other. During the passage of the head, in a first vertex presentation for instance, the parietal bones overlap the frontal, occipital, and temporal bones, and the right parietal overlaps the left parietal bone. That the shape of the head is thus materially altered may be seen by a reference to the diagrams and descriptions on pages 328, 343.

Vault of the Fœtal Skull.—It will be necessary to describe rather more fully the vault of the fœtal skull, which consists of certain bones, sutures, and fontanelles.

Bones.—The bones of the fœtal skull, which form the vault, are the two parietal and certain portions of the occipital, frontal, and temporal bones. At birth the frontal bone is divided into two equal parts.

Sutures.—The unossified membranes that unite the various bones of the vault are known as sutures. There are six of these sutures.

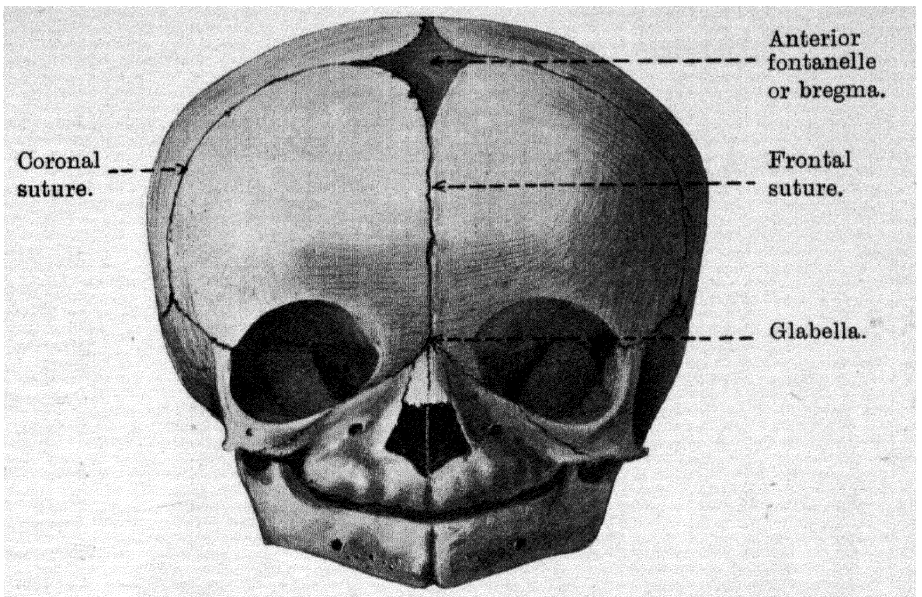


FIG. 60.—THE FŒTAL SKULL.

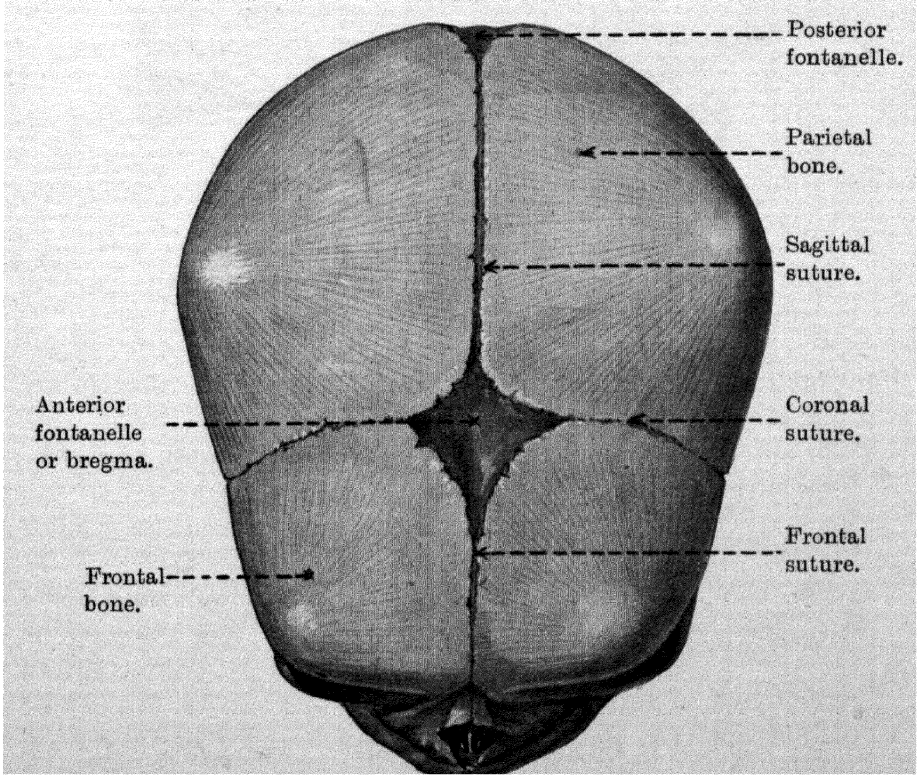


FIG. 61.—THE FŒTAL SKULL.

1. The sagittal suture, uniting the superior borders of the parietal bones.
2. The frontal suture, which is a continuation of the sagittal suture, uniting the two portions of the frontal bone.
3. The lambdoidal suture, uniting the posterior borders of the two parietal bones to the occipital bone.
4. The coronal suture, uniting the anterior borders of the parietal bones to the frontal bones.

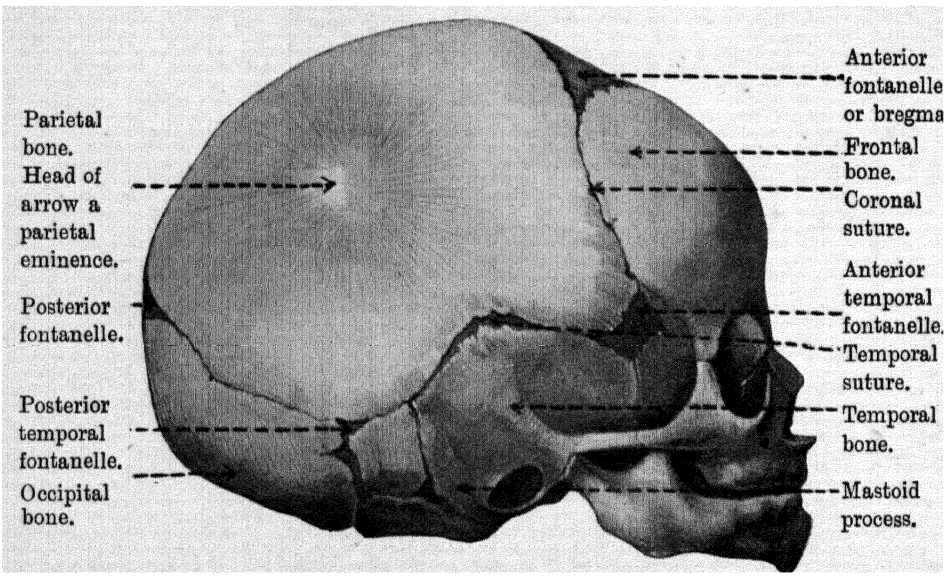


FIG. 62.—THE FŒTAL SKULL.

Lambdoidal suture between posterior fontanelle and posterior temporal fontanelle.

5 and 6. The temporal sutures, uniting the squamous portion of the temporal bones to the inferior borders of the parietal bones.

Fontanelles.—The points of junction of the various sutures are termed fontanelles, and they are six in number.

1. The anterior fontanelle, where the sagittal, frontal, and coronal sutures meet.
2. The posterior fontanelle, where the sagittal and lambdoidal sutures meet.
3 and 4. The anterior temporal fontanelles, at the junction of the temporal and coronal sutures.
5 and 6. The posterior temporal fontanelles, at the junction of the temporal and lambdoidal sutures.

Only the anterior and posterior fontanelles are of obstetrical importance. Their position indicates in which direction the occiput

is pointing, and the amount of flexion or extension the head has undergone.

The anterior fontanelle or bregma can easily be felt unless obscured by a large caput succedaneum. It is much the larger of the two, is roughly lozenge-shaped, has four sutures running into

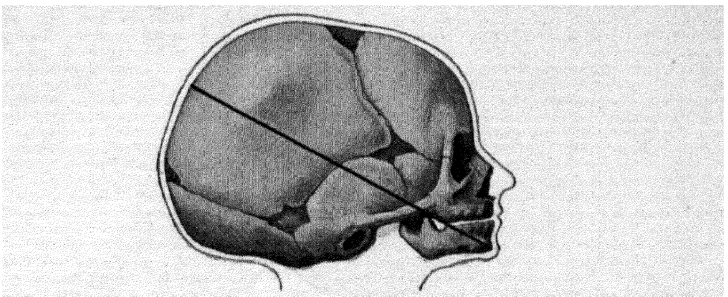


FIG. 63A.

Vertico-mental diameter, 5¼ inches (13·1 centimetres).

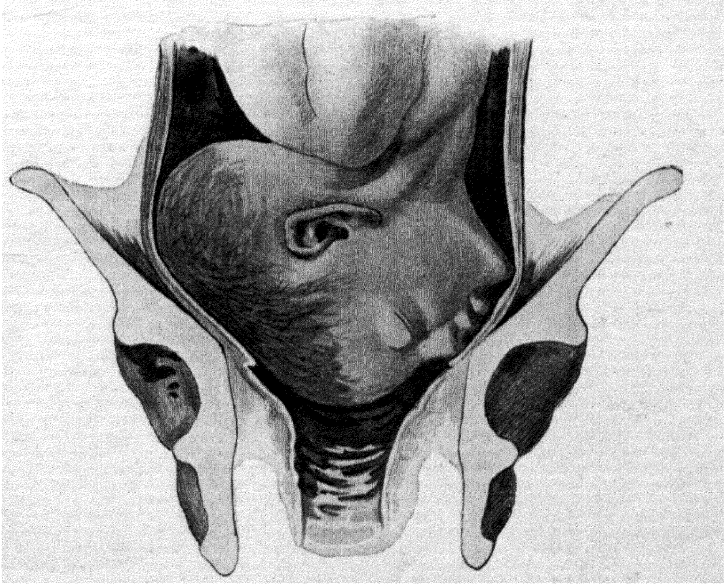


FIG. 63B.

Showing the diameter thrown across the pelvis in a brow presentation.

it, is always patent at birth, and takes about twenty months to close. The posterior fontanelle is triangular in shape, has three sutures running into it, in most cases cannot be felt as a space during birth, and closes soon after. The temporal fontanelles cannot be as a rule felt, and are therefore of but little assistance in diagnosing the position of the head. They are sometimes mistaken for the posterior fontanelle.

DIAMETERS OF THE FŒTAL SKULL

The principal diameters of the skull concerned in the mechanism of labour may be divided into longitudinal, vertical and transverse.

Longitudinal Diameters.

Vertico-mental.—From the point of the chin to the farthest

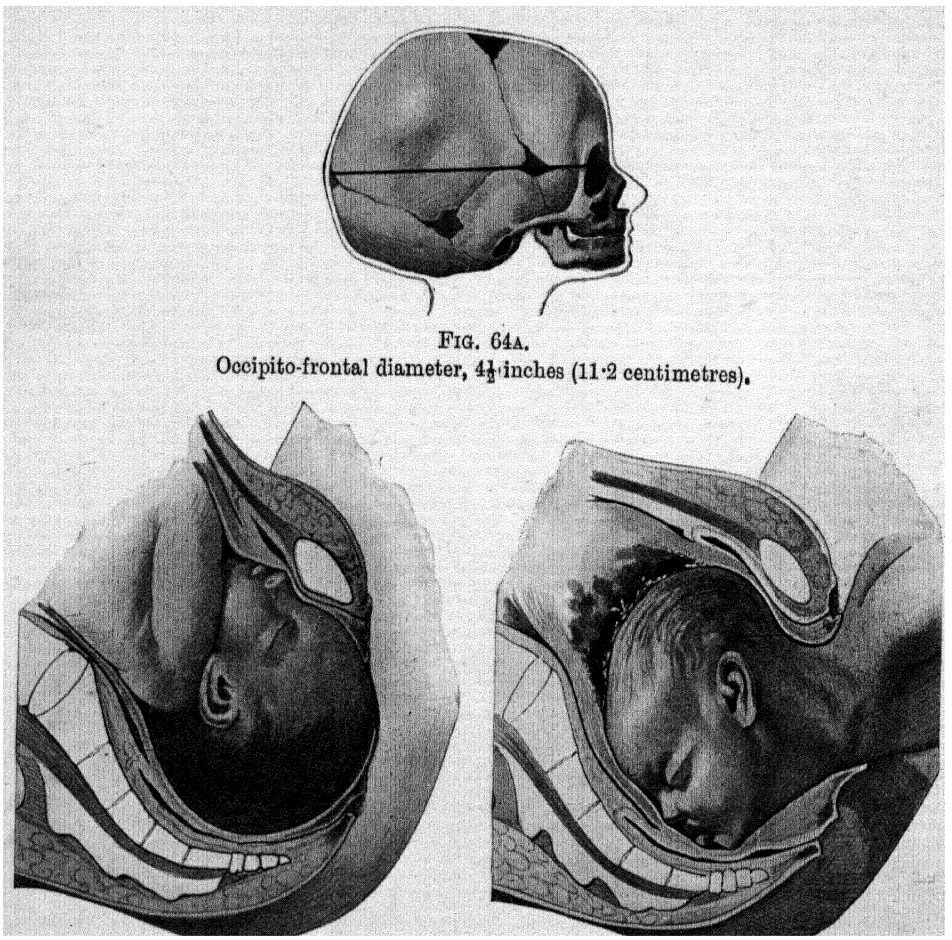


FIG. 64A.
Occipito-frontal diameter, 4½ inches (11·2 centimetres).

FIG. 64B. FIG. 64C.

Showing the diameter thrown across the pelvis in an unreduced occipito-posterior position, and in incomplete flexion of the after-coming head.

point on the vertex, which is nearer the posterior than the anterior fontanelle, 5¼ inches (13·1 cm.) (Fig. 63A). This is the diameter thrown across the pelvis in a brow presentation, the head being midway between flexion and extension (Fig. 63B).

Occipito-mental.—From the point of the chin to the posterior fontanelle, 4¾ inches (11·8 cm.). This is the diameter thrown across the pelvis in complete extension of the after-coming head.

Occipito-frontal.—From the root of the nose to the posterior fontanelle, $4\frac{1}{2}$ inches (11·2 cm.) (Fig. 64A). This is the diameter thrown across the pelvis in an unreduced occipito-posterior position and in incomplete flexion of the after-coming head (Figs. 64B and 64C).

Vertical Diameters.—All the diameters mentioned under this

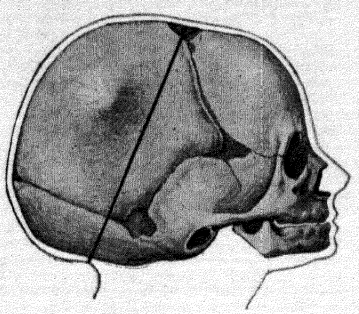


FIG. 65A.

Suboccipito-bregmatic diameter, $3\frac{3}{4}$ inches (9·3 centimetres).

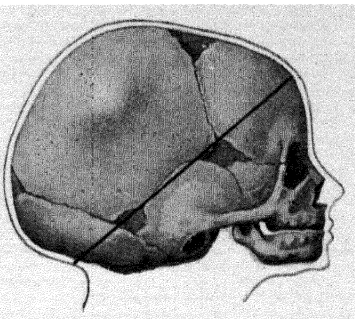


FIG. 65C.

Suboccipito-frontal diameter, 4 inches (10 centimetres).

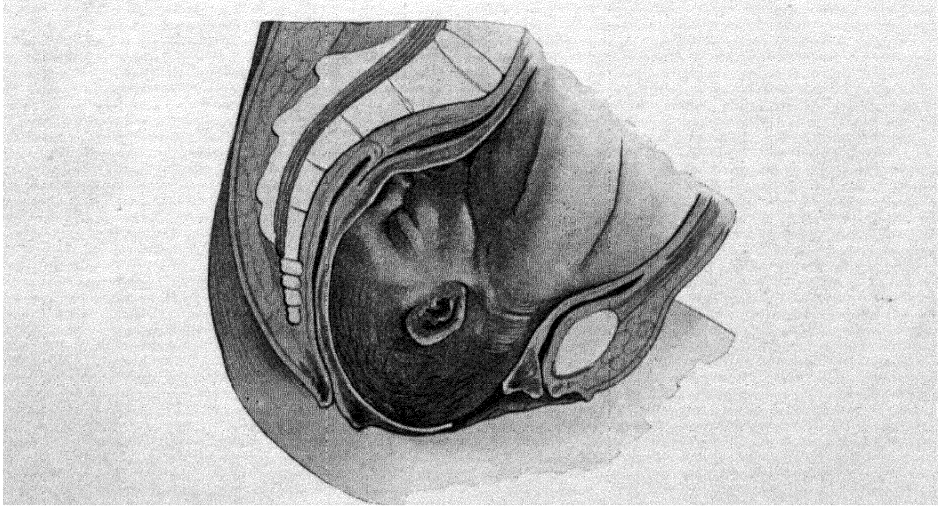


FIG. 65B.

Showing the diameter thrown across the pelvis when the head is completely flexed. When the head is not quite so well flexed the suboccipito-frontal diameter, 4 inches (10 centimetres), is thrown across the pelvis.

heading cannot be described as absolutely vertical, but they are more vertical than longitudinal.

Suboccipito-bregmatic.—From the junction of the head with the neck behind to the centre of the anterior fontanelle, $3\frac{3}{4}$ inches (9·3 cm.) (Fig. 65A). This is the diameter thrown across the pelvis when the head is completely flexed (Fig. 65B).

Suboccipito-frontal.—From the junction of the head with the neck behind to the prominence of the forehead, 4 inches (10 cm.).

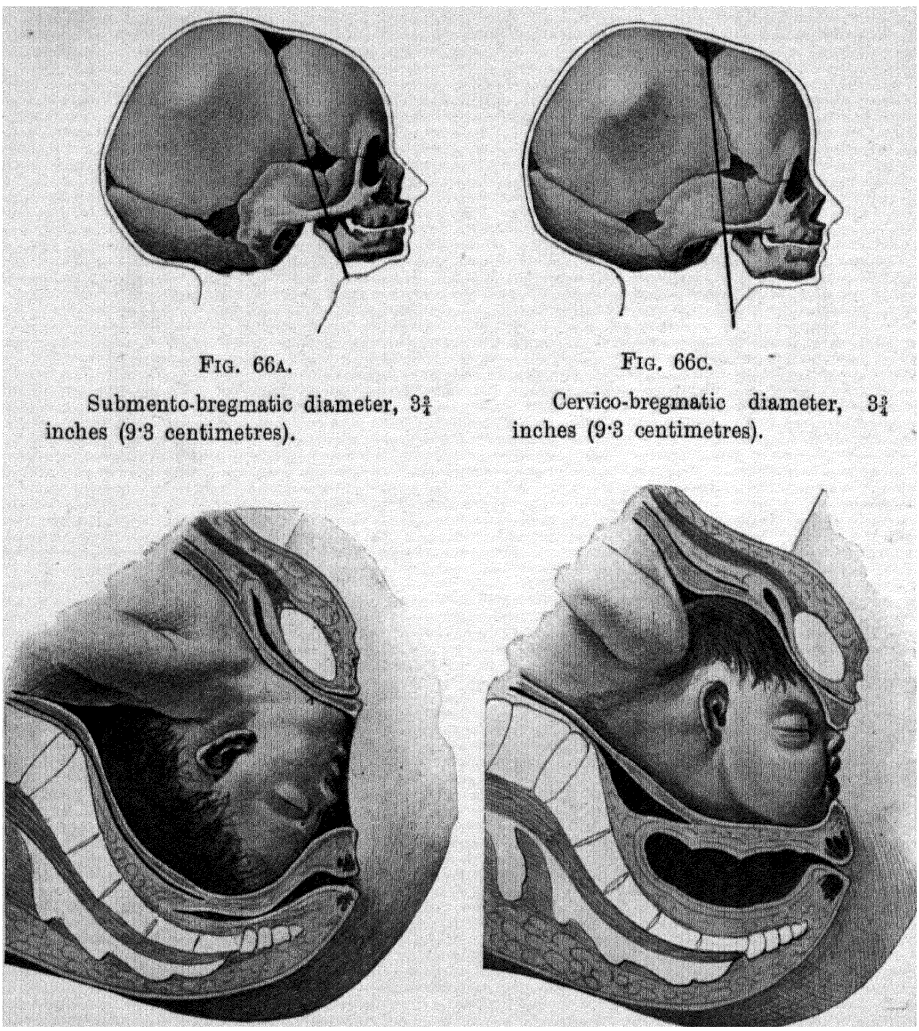


FIG. 66A.

Submento-bregmatic diameter, $3\frac{3}{4}$ inches (9·3 centimetres).

FIG. 66C.

Cervico-bregmatic diameter, $3\frac{3}{4}$ inches (9·3 centimetres).

FIG. 66B.

Showing the diameter thrown across the pelvis in face presentation with the head completely extended.

FIG. 66D.

Showing the diameter thrown across the pelvis when the face is presenting and the chin is posterior.

This is the diameter thrown across the pelvis when the head is not completely flexed (Fig. 65C).

Submento-bregmatic.—From the junction of the head with the neck in front to the middle of the anterior fontanelle (bregma), $3\frac{3}{4}$ inches (9·3 cm.) (Fig. 66A). This is the diameter thrown across the pelvis when the face is presenting (Fig. 66B).

Submento-vertical.—From the junction of the head with the neck (Fig. 67A), in front to the farthest point on the vertex,

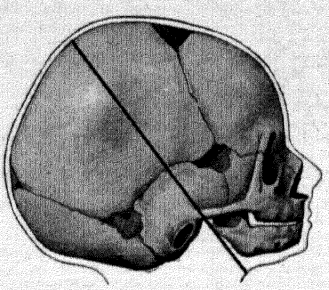


FIG. 67A.

Submento-vertical diameter, 4½ inches (11·3 centimetres).

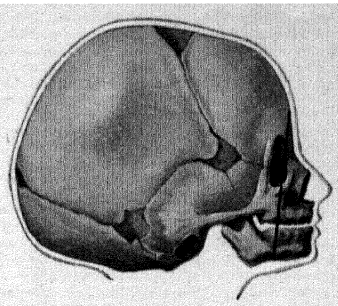


FIG. 68A.

Mento-nasal diameter, 1½ inches (3·7 centimetres).

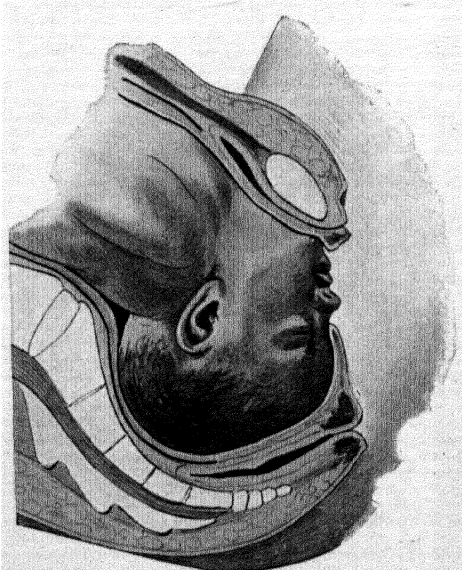


FIG. 67B.

Showing the diameter thrown across the pelvis when the face is presenting and the head is not properly extended.

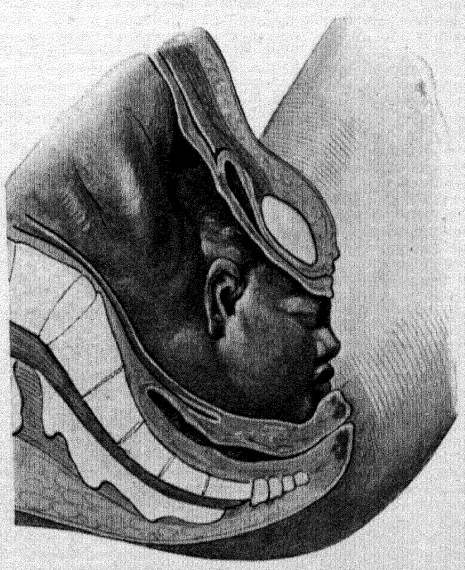


FIG. 68B.

Showing the vertical diameter of the face which is induced for delivery of the crushed head after the operation of cranioclasm.

4½ inches (11·25 cm.). This is the diameter thrown across the pelvis when the face is presenting and the head is not properly extended (Fig. 67B).

Mento-nasal.—From the tip of the chin to the orbital plate of the frontal bone, 1½ inches (3·7 cm.) (Fig. 68A). This, the vertical

diameter of the face, is that which is induced for delivering the crushed head after the operation of cranioclasm (Fig. 68B).

Transverse Diameters.

Bi-parietal.—From the points farthest apart on the parietal eminence, $3\frac{3}{4}$ inches (9·3 cm.) (Fig. 69A). This is the largest diameter entering the antero-posterior diameter of the brim in a flattened pelvis (Fig. 69B).

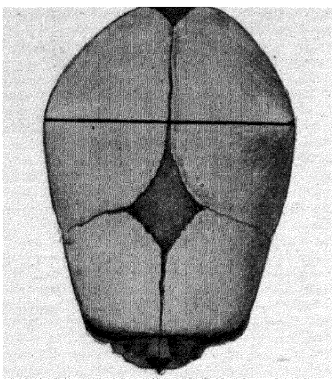


FIG. 69A.

Bi-parietal diameter, $3\frac{3}{4}$ inches (9·3 centimetres).

Bi-temporal.—From the points farthest apart on the coronal sutures, $3\frac{1}{2}$ inches (8·7 cm.).

Bi-mastoid.—From the points farthest apart on the mastoid processes of the temporal bone, 3 inches (7·5 cm.) (Fig. 70).

Superparieto-subparietal.—From above one parietal eminence to below the other, $3\frac{1}{4}$ inches (8·1 cm.) (Fig. 71A). This is the transverse diameter which engages in the pelvis, owing to the lateral flattened flexion of the head (Naegele obliquity) (Fig. 71B).

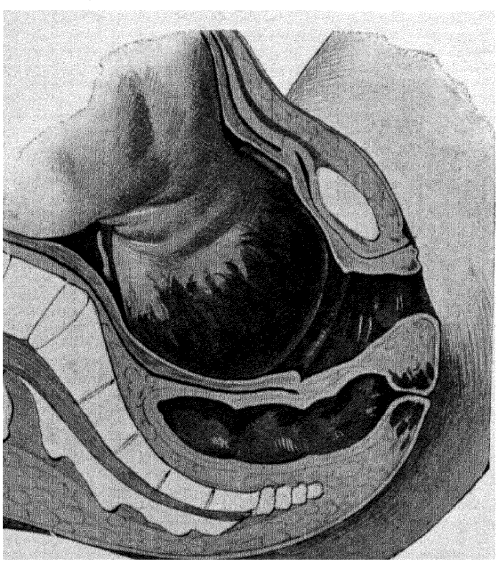


FIG. 69B.

Showing the largest diameter entering the transverse diameter of the brim in a flattened pelvis.

Circumference of the Fœtal Head.—The smallest circumference of the fœtal head is that taken in the plane of the sub-occipito-bregmatic diameter. It measures 11 inches (27·5 cm.). A somewhat larger circumference is that taken in the plane of the suboccipito-frontal diameter, the circumference which commonly distends the vulval orifice to normal plane. The largest is that taken in the plane of the occipito-mental diameter. It measures 14 to $14\frac{1}{2}$ inches (35 to 36 cm.).

The circumference of the fœtal head taken in the plane of the occipito-frontal diameter, measures $13\frac{1}{2}$ inches (34 cm.). This is the

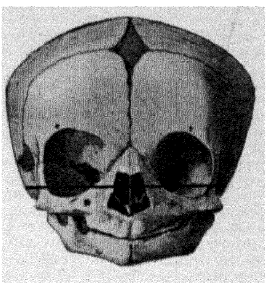


FIG. 70.

Bi-mastoid diameter 3 inches (7·5 centimetres). The incompressible base. As it is impossible to reduce the length of the bi-mastoid diameter by an obstetrical operation, a flattened pelvis must have one diameter at the brim at least 3 inches long, or a generally contracted pelvis must not have any diameter smaller than 3 inches, to enable the crushed head to be extracted.

circumference that distends the vulval outlet in the birth of an unreduced occipito-posterior position, and accounts to a great extent for the severe rupture of the perineum that takes place.

The heads of males are, on the average, rather larger than those of females, and the size of the skull and the degree of its ossification increase somewhat with successive pregnancies.

DIAMETERS OF THE FŒTAL TRUNK

Bis-acromial.—Between the points farthest apart on the shoulders, $4\frac{3}{4}$ inches (11·8 cm.).

Bi-trochanteric.—Between the points farthest apart on the great trochanter, 4 inches (10 cm.).

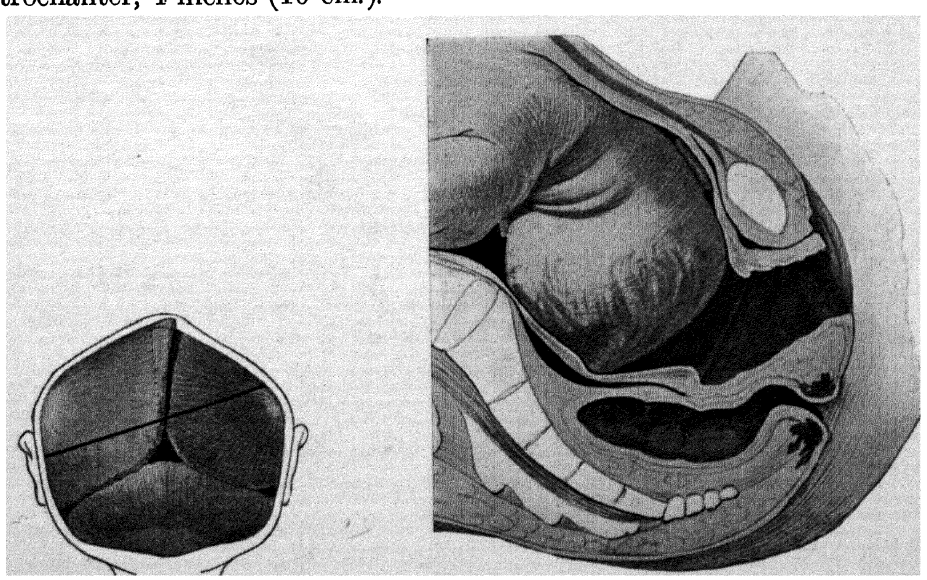


FIG. 71A.

Superparieto-subparietal diameter, $3\frac{1}{4}$ inches (8·1 centimetres).

FIG. 71B.

Showing the transverse diameter which engages in the flattened pelvis owing to the lateral flexion of the head (Naegele obliquity).

CHAPTER XXVII

THE PHENOMENA OF LABOUR

WHY labour comes on at the end of forty weeks' gestation is not known. Menstrual periodicity may have something to do with it, as it usually occurs at what would have been the time for the tenth menstrual period after conception. In post-maturity it is often found that the labour is just four weeks later than was expected. However, patients who have a three-weekly instead of a four-weekly cycle do not bring forth fully developed babies after thirty weeks' gestation.

The degree of distension of the uterus has nothing to do with the onset of labour. In cases of hydramnios the uterus may be very much larger than it is normally at full time without any sign of the onset of labour. In cases in which an extra-uterine pregnancy continues to term, a process of mock-labour, with contractions of the body of the uterus and dilatation of the cervix, may come on at term, although there is no distension of the uterus.

Infarction of the placenta has been suggested as the cause of the onset of labour, and the fact that in albuminuria of pregnancy there is often an abnormal amount of infarction of the placenta together with spontaneous occurrence of premature labour seems to give some support to this theory, but in cases of intra-uterine death of the fœtus, the placenta may show extensive white infarction without causing any contractions of the uterus.

The most likely explanation is that some substance is produced in the ripe placenta which excites the labour-centre in the cord.

For the consideration of the phenomena of labour the uterus must be divided into three parts which behave differently during labour.

1. **The Cervix.**—This is dilated mechanically, playing a passive part except that there is relaxation of its circular fibres.

2. **The Lower Uterine Segment,** the part of the uterine body within 3 inches of the external os. No definite anatomical

landmark can be given as the upper limit of the lower uterine segment, except that in front it corresponds with the lower limit of firm attachment of peritoneum to the uterine muscle. The lower uterine segment has its shape altered during labour from that of a hemisphere to that of a cylinder, its walls becoming stretched and thinned as labour advances until there is room for the fœtus

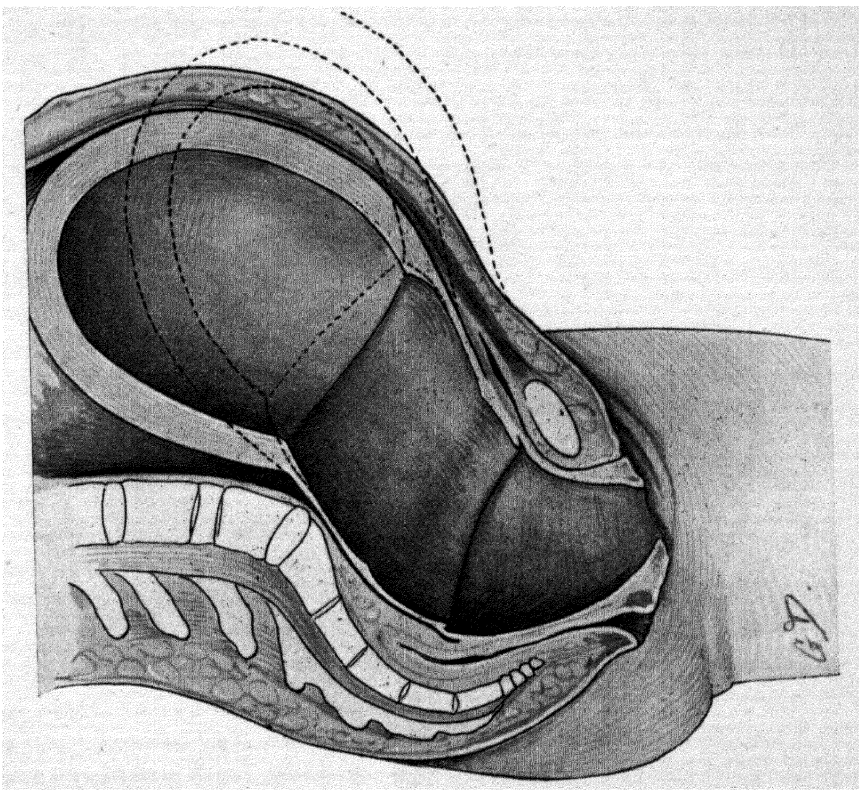


FIG. 72.—DIAGRAM TO SHOW THE THICKENED UPPER UTERINE SEGMENT AND THE THIN LOWER UTERINE SEGMENT.

The dotted line shows the position assumed by the uterus during contraction.

to pass through. After the child is born the muscle-fibres being no longer stretched undergo retraction, and the walls become thicker.

The stretching and thinning in normal conditions are not a source of danger, but if the placenta is attached to the lower uterine segment, or if there is obstruction to the onward passage of the fœtus, the results are serious.

3. **The Upper Uterine Segment.**—This comprises the greater part of the body of the uterus. The walls of this part of the uterus become progressively thicker from retraction of the muscle-fibres as

labour advances, and as the contents of the upper uterine segment are more and more accommodated in the lower segment and cervix.

In labour the lower uterine segment, cervix, vagina, pelvic floor, and vulval outlet are dilated until there is one continuous "birth-canal".

The forces which bring about this dilatation and expel the ovum are supplied by the contractions and retraction of the uterine muscle, with assistance in the second and third stages from the abdominal muscles, including the diaphragm.

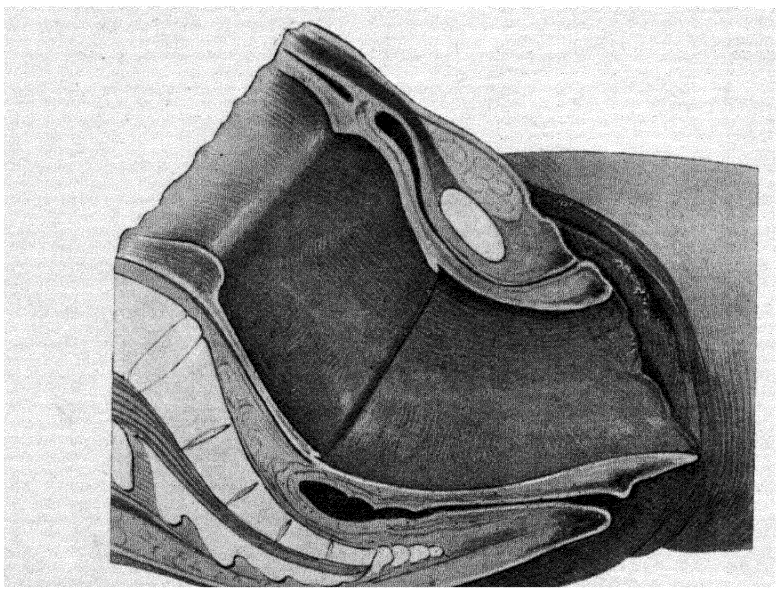


FIG. 73.—THE "BIRTH-CANAL".

The lower uterine segment, cervix, vagina, pelvic floor and vulval outlet have been dilated and form a continuous canal. There is still a slight ridge marking the lower limit of the cervix.

The muscle-fibres of the uterus can be divided for description into three groups :—

(*a*) The external layer. Longitudinal bundles of fibres which may be looked upon as starting a little above the internal os in front, passing right over the fundus, and finishing a little above the internal os behind.

(*b*) The largest group consists of bundles which interlace in all directions, enclosing blood-vessels and obliterating their lumen during contraction.

(*c*) The internal layer. Circular bundles of fibres which run round the body of the uterus.

The muscular fibres of the uterus can contract, relax, and retract. When contracting, the fibres become shorter and thicker. In re-

traction they do not return to their original length, although the active contraction has passed off.

In relaxation muscle-fibres lengthen and become thinner, returning to the original length. If contraction is followed by relaxation, only temporary shortening is produced. If retraction accompanies contraction and no relaxation follows, some of the shortening of the muscle-fibres is permanent.

Retraction is a property which, though not peculiar to uterine muscle, is more marked in the uterus than in any other organ. It is the expression of that tone, always present in healthy muscle which adjusts the tension of the fibres to variations in their length. It is evident that retraction occurs independently of active contraction, and, moreover, contraction can be superimposed on retraction. If there is no retraction, each individual contraction starts at the same point, as regards the size of the uterus, as its predecessor, relaxation and lengthening of the muscular fibres following each contraction as the result of the stretching effect of the uterine contents. When retraction is present, however, each successive contraction starts at the point where its predecessor left off, the uterine cavity becoming permanently smaller as the result of each successive contraction, thus preventing the child slipping back.

A simple simile showing the value of retraction was given by Dakin. Suppose that a man standing on a cliff had to haul up by a rope a heavy weight which was lying on the beach. If when his muscles are tired of contracting they relax, down goes the weight, and he has to start again after a rest, *ab initio*. If, however, when he is getting tired of contracting his muscles, he takes a turn of the rope round a post, he can stop contracting and yet lose no ground, beginning his second set of contractions, not from the original starting point, but from the point to which the first set had carried the weight.

When the child is being expelled the retraction of the uterine muscle keeps the inner surface of the uterus in contact with the child, as it were moulded to it. When the placenta is expelled retraction enables the uterine walls to come together so that there is only a potential cavity.

For the pathological effects of retraction see Obstructed Labour (p. 463).

During pregnancy the internal os is kept closed, or almost closed, by a tonic or permanent contraction of its circular fibres, such as occurs in the sphincter muscles of other hollow viscera.

Rhythmical contractions of the muscular fibres of the body of the uterus, followed by relaxation, and not accompanied by any

retraction, occur all through pregnancy. They cause no dilatation of the internal os.

Forcible dilatation of the internal os causes contraction of the body of the uterus, and conversely contraction of the body of the uterus causes dilatation of the cervix. This is spoken of as the "polarity of the uterus".

The Stages of Labour.—Labour is divided into three stages :—

1. The *first stage*, or stage of dilatation, lasts from the onset of the true labour pains until the os uteri is fully dilated.

2. The *second stage*, the stage of expulsion of the child, lasts from the full dilatation of the os uteri until the child is born.

3. The *third stage* lasts from the birth of the child until the placenta and membranes are delivered.

Premonitory Symptoms.—During the last two weeks of pregnancy, or occasionally rather earlier, the uterus sinks a little. If the patient has suffered from a sense of oppression and difficulty in breathing, she will now feel more comfortable and breathe with more freedom. This is sometimes spoken of as "lightening". At the same time she will be likely to have frequency of micturition, on account of the pressure of the uterus on the bladder. Not all patients are conscious of this change in the position of the uterus, but a good many are, and some multiparæ recognize the fact that labour is likely to set in before the lapse of many days after the alteration.

"False" pains are common during the last two or three weeks, *i.e.* pains which are not true labour pains. Their presence may make the patient think that labour has begun, or she may recognize the fact that they are "only niggling pains" or "only belly-ache" and not labour pains. These false pains may be distinguished from labour pains in the following way :—

1. True labour pains are felt in the lower part of the back ; "false" pains in the abdomen.

2. True labour pains occur with a certain regularity, and the hand placed on the uterus feels it harden during a pain. "False" pains occur at irregular intervals, and are not necessarily accompanied by hardening of the uterus.

3. If the internal os admits a finger, the membranes will be felt to become tense during a true labour pain, not during a "false" pain.

These "false" pains are often caused by gastro-intestinal disturbance, and may be relieved by an aperient.

Signs of Labour.—The signs that labour has commenced are three :—

1. The pains; 2. The shortening and dilatation of the cervix; and 3. The show.

1. **The Pains.**—Labour pains are at first felt in the back, and occur with a certain amount of regularity. The intervals between the pains may be as long as half an hour at first, and gradually become shorter, while the pains become longer and stronger. Each pain begins gradually, works up to its period of greatest intensity, and then gradually dies away. The uterus is felt to harden during the pains.

The pains are spoken of as being *involuntary*, *inhibitable*, *peristaltic*, and *intermittent*. Although they are beyond the control of the patient's will, occurring even when she is unconscious, they may be inhibited, lessened in frequency, or temporarily abolished by emotion, nervousness at first sight of the attendant, distension of bladder or rectum ; also they may be increased in strength and frequency by various stimuli, *e.g.* stretching of the cervix or perineum, administration of a hot enema.

The fact that the pains are intermittent, *i.e.* that each contraction is followed by a period of rest, is of great importance to both the fœtus and the mother during the first and second stages of labour. During a pain the circulation through the uterine wall is stopped, and if the uterus contracts continuously the fœtus dies from want of oxygen. Continuous or tonic contraction with retraction during the second stage—an abnormal condition which will be described in a later chapter—exhausts the mother, and is likely to cause injury to her soft tissues by pressure. The intervals between the pains allow the placental circulation to be re-established, and give the mother time to recover from the fatiguing effect of the contraction. The uterus is a very large muscle, and a long-continued contraction uses up a good deal of the patient's energy.

Further descriptions of the pains can be left until the different stages of labour are described.

2. **The Shortening and Dilatation of the Cervix.**—If the cervix is not sufficiently dilated to allow the finger to feel the bulging of the bag of membranes during the pains, its shortening is the safest sign on which to base an opinion that labour has begun. The cervix of a woman who has not borne a child before is, at the beginning of labour, a thick-walled canal at least an inch long. The circular fibres round the internal os relax when labour begins, and its edges are dragged apart by the contraction and retraction of the

longitudinal fibres of the uterus, while the lower part of the cervical canal remains at first unaltered. As the internal os is dragged open, the cervix is dilated from above downwards, becoming shorter and shorter, until at length there is left no projection into the vagina,

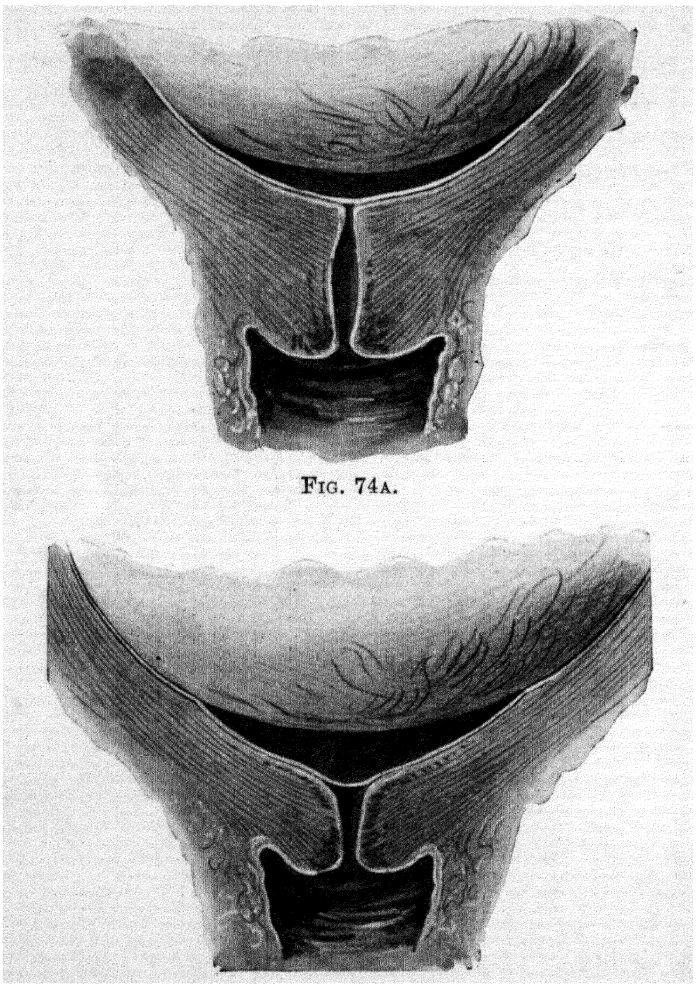


FIG. 74A.

FIG. 74B.

Dilatation of the cervix in labour, from above downwards. In the upper figure the cervical canal is intact. In the lower figure the internal os and the upper part of the canal have been dilated while the lower part of the canal is unaltered; shortening of the cervix has occurred.

but only a more or less thick rim at the external os, the whole cervix being "taken up," and its cavity made one with the cavity of the body of the uterus. Without true shortening of the cervix it is foolish to diagnose that a primigravida is in labour (Figs. 74, 75).

In women who have borne children, the external os will often admit the finger before labour has begun, and the finger-tip can

sometimes be passed through the internal os. In this case the projection of a small bag of membranes during a pain will be a proof that labour has begun. Too much stress must not be laid on the condition of the cervix. Sometimes, even in a primigravida, the cervix is completely taken up before labour has begun.

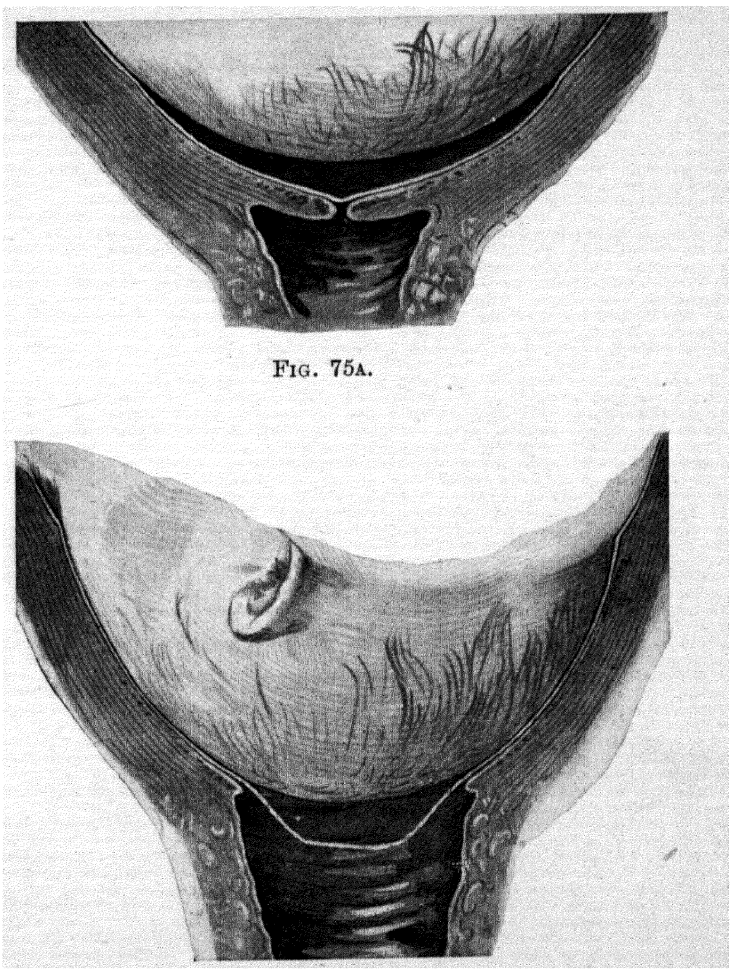


FIG. 75A.

FIG. 75B.

Further stages of dilatation of the cervix. In the upper figure a rim of cervix is still left. In the lower figure the cervical canal has been obliterated.

3. **The "Show".**—This is an increase of mucous discharge from the vagina, derived from the cervix, mixed with a little blood. Its absence cannot be taken as a proof that labour has not begun. As the internal os is dragged open, the membranes are separated from the lower uterine segment, and a variable amount of oozing of blood results.

The First Stage of Labour.—The effect of the contractions of the uterus is to increase the general intra-uterine pressure. At the same time the contraction and retraction of the longitudinal fibres drags open the internal os. The dilatation of the internal os must cause a separation between the chorion and decidua in its immediate neighbourhood. Thus a small "bag of membranes," the separated part of the chorion with the amnion and the amniotic fluid inside it, is formed, and this bag of membranes is forced into the internal os by the increase of intra-uterine pressure. The bag of membranes makes the best dilator of the cervix—a fluid wedge which is forced farther and farther into the cervix, exerting great pressure on, but doing no harm to, the maternal tissues. As long as the bag of membranes remains intact neither mother nor fœtus can suffer any injury from pressure. Normally the bag of membranes dilates the cervix until the os is about 3½ inches across, and then ruptures, being no longer supported by the margins of the os. If the vertex is presenting, it fits the lower uterine segment so well that the head acts as a ball-valve, and does not allow too great pressure on the bag of membranes. During the first stage the fœtus is moved downwards very little, if at all. The uterus actually becomes longer during a pain, being straightened and made to assume a form more pear-shaped than globular, by the contraction of its circular fibres. This has been described as the "form-restitution force". When a certain amount of liquor amnii has left the uterus, a good-sized bag of membranes having been formed, a new form of pressure comes into play, *viz.* the *fœtal axis-pressure*, due to the direct pressure of the uterus on the fœtus. The extent to which this force acts in the first stage of labour is indirectly proportional to the amount of liquor amnii. In hydramnios there can be no fœtal axis-pressure until the membranes have ruptured. When there is a deficiency of liquor amnii the fœtal axis-pressure will come into play early. The upper pole, normally the breech, is pressed on by the fundus of the uterus, while the lower pole, normally the head, is pressed down on to the lower uterine segment and cervix. At the beginning of a pain a little more liquor amnii is forced into the bag of membranes; then the head comes down as a ball-valve and separates the liquor amnii which is left in the uterus from that which is in the bag, sometimes called the "after-waters" and "forewaters". If the presenting part does not fit the lower uterine segment closely, the bag of membranes is likely to be pressed down in an elongated form, rather like the finger of a glove, and to rupture before the os is fully dilated. This occurs with any malpresentation and with contracted pelvis.

During the early part of the first stage the pain is usually not very severe. The patient walks about the room as a rule, leaning on the nurse's shoulders or on the bed-post, when a pain comes on, which is at first only every half-hour or twenty minutes. Towards the end of the first stage, however, the pains may be very distressing to the patient, recurring frequently, and, as no advance is perceptible to her, apparently doing no good. Vomiting is not uncommon towards the end of the first stage. The pains of this stage are, until near the end, purely involuntary, the patient making no use of her voluntary muscles as she does during the second or expulsive stage.

It is sometimes impossible to draw a hard-and-fast line between the end of the first and the beginning of the second stage. If the bag of membranes projects far down into the vagina before the os is fully dilated the patient may be conscious of the presence of a foreign body, and begin to "bear down," using her voluntary muscles.

The pain in the first stage is due partly to the cramp-like pain of uterine contraction, and partly to the stretching of the cervix.

Disadvantage of Too Early Rupture of the Membranes.—If the membranes rupture too soon the fluid wedge is lost, dilatation becomes more difficult, and the first stage is lengthened. Until the longitudinal fibres have dragged the os open sufficiently for the head to enter, nothing is pressed into the os to dilate it. The liquor amnii drains away, and the child, being no longer protected by this fluid, becomes pressed on by the uterus to an extent that may be dangerous, and more important, the maternal circulation to the placenta may be interfered with by the long-continued contraction and retraction. The anterior lip of the cervix is likely to be nipped between the head and the symphysis pubis, and consequently becomes œdematous and thick, and causes mechanical obstruction to the advance of the head. If this happens the anterior lip should be pressed upwards above the greatest diameter of the head. During the second stage a further delay occurs because the head is pressed back towards the sacrum by the fœtal axis-pressure.

Disadvantages of Too Late Rupture of the Membranes.—If the membranes remain unruptured when the os measures 3½ inches across, the onset of the expulsive pains is retarded, the cervix not receiving the pressure of the hard head which should stimulate the uterus to increased activity. The amnion, which is a tough, strong membrane, is likely to be pushed through the chorion, which is

weaker and more easily torn. The result of this is that, while the amnion advances, the chorion stays in its place, and so becomes separated from the amnion and is likely to be partially retained in the uterus when the placenta and amnion come away in the third stage of labour. If the part of the amnion which forms the bag of membranes does not rupture before the head is born, it may tear higher up or may not tear at all, the head in either case being born with a bag of amnion covering it. This condition in which the child is said to be born "with a caul," may cause its death from suffocation if no attendant is present. If the amnion is so tough that it does not tear at all, the placenta may be dragged out as the child is born, but this is very unlikely after the beginning of the eighth month. If the placenta is not easily separated, the uterus may possibly be inverted—*i.e.* turned inside out. If the bag of membranes remains intact after full dilatation of the os, it should be ruptured by pressure with a finger-tip during a pain.

The Second Stage.—After the rupture of the membranes and escape of some of the liquor amnii it is not uncommon for a short pause to occur before the onset of the typical expulsive pains, the uterus, as it were, collecting itself before making more vigorous efforts. In some multiparæ, however, the child may be born almost immediately after rupture of the membranes.

As has been said before, there has been very little, if any, descent of the fœtus during the first stage. The resistance offered by the cervix and lower uterine segment has now been overcome, and if the bony pelvis is of normal size the presenting part can be pushed down on to the pelvic floor, the resistance of which has now to be overcome by the downward pressure of the uterine contractions, aided by the action of voluntary muscles—the muscles of the abdominal wall and the diaphragm.

While the pelvic floor is being stretched the cavity of the pelvis is partly emptied of the organs which normally occupy it.

The pelvic floor may be looked on as being made up of two triangles—one anterior and the other posterior. The *anterior triangle* has its base or fixed side at the symphysis pubis, and its apex at the anterior part of the cervix. The *posterior triangle* has its base at the lower part of the sacrum and the coccyx, and its apex at the edge of the perineum. The anterior triangle, with the bladder, is pulled upwards, the anterior lip of the cervix retreating out of reach of the finger. If it is necessary to pass a catheter during the second stage of labour, it is found that the urethra is stretched so that the urine in the bladder is not reached until the tip of the

catheter has arrived at a level above the top of the symphysis pubis. The whole of the bladder is not above the symphysis, but its lower part is too much compressed to be able to contain urine. The *posterior triangle*, meanwhile, is pushed down in such a way that the anus is opened, and may measure as much as 1½ inches from back to front, a good deal of the anterior wall of the rectum being exposed. The posterior wall of the lower uterine segment and cervix, not being drawn up nearly as much as the anterior, is stretched and thinned. The movement of the two pelvic triangles has been compared to the action of double swing-doors, which swing apart from one another, allowing the formation of a wide passage without any movement of their bases or fixed points.

The pains of the second stage of labour are stronger and of longer duration than those of the first stage, and the intervals between them are shorter. Towards the end of the second stage each pain may last as long as a minute or more, with intervals of two or three minutes, and at the end the pains may be almost continuous.

The pain suffered during the second stage is much more severe than that of the first stage. As the head passes through the pelvis the patient may complain of cramp in the legs due to pressure on the sacral nerves. The most acute pain is felt, in first labours, during the forcible stretching of the vulva.

The character of the pains is different from that of the pains of the first stage. The patient may cry out as the pains come on, but she generally takes a deep breath, and then holds her breath and "bears down" with all the force of her expiratory muscles, often crying out again as the pain passes off. During the height of the pain there may be expiratory groans or grunts. These expiratory or expulsive efforts are partly voluntary but largely reflex, due to the presence of a foreign body in the vagina. To aid her expulsive efforts the patient will often place her feet against some fixed object, such as the bed-post, and pull on a towel tied to the same fixed point.

During a pain the rate of the fœtal heart-beat is slowed. Unless the child is beginning to suffer from the long-continued pressure, either in the placental circulation or on its head, or both, the heart-beat regains its normal rapidity between the pains.

The presenting part is forced down with each pain on to the pelvic floor, distending this structure and pressing it downwards. During the intervals between the pains, however, the pelvic floor pushes the presenting part up again, often in a series of small jerks. Retraction plays an important part now, the cavity of the uterus remaining a little smaller after each successive contraction than it was before it, so

that the ground gained by each contraction is not completely lost during the succeeding interval. In a primigravida the head will be seen at the vulva for a considerable time before it can emerge. Finally after being pushed down and then pushed back again many times, a time comes when it remains stationary at the end of a contraction, distending the vulval orifice. This is called the "crowning" of the head, and signifies that the pelvic floor has been so much stretched that it can no longer push the head upwards during the intervals. The next pain generally expels the head, which emerges in a forward and downward direction. It is important for the student to realize how much the head goes *forward*. The uterus and abdominal muscles are pressing the head mainly *downwards*, while the muscles of the pelvic floor are pressing *upwards* and *forwards*. The resultant of these two forces is mainly *forwards*. The axis of the outlet of the bony pelvis is downwards and forwards, that of the soft parts below the bones is almost directly forwards.

As the head passes through the vulva of a primigravida the pain due to the stretching of the vulval orifice will be very severe, and will probably cause the patient to cry out, and so cease from bearing down. This has been called the "safety-valve action" for the protection of the perineum, because the perineum is likely to be torn if the patient bears down hard while the head is passing through the vulval orifice.

In first labours the hymen is torn posteriorly, and the fourchette is often, but not always, lacerated. The so-called "inevitable" laceration is that of the fourchette.

The body of the child is generally born by the next pain, if not by the pain which expels the head, followed by a gush of liquor amnii, often mingled with blood.

The Caput Succedaneum.—The part of the head which is most in advance is free from pressure, while all the rest of the head is being pressed on. Consequently, as a result of the venous congestion, plasma exudes into the scalp covering the most advanced part of the head, and an œdematous swelling of the scalp is formed, called the *caput succedaneum*.

A caput succedaneum may be formed before the rupture of the membranes in cases in which the head fits the lower uterine segment so tightly that the liquor amnii in the bag of membranes below the head is completely shut off from the rest of that fluid. As a rule, however, a caput succedaneum is not formed until after the rupture of the membranes. If this occurs before the os is fully dilated the head is pressed down into the os, and the whole of the fœtus is

under pressure, except the part of the head which bulges through the os.

Later a caput succedaneum will be formed if the head fits the pelvis or vulval orifice tightly, the part most in advance being still free from pressure, while all the rest of the fœtus is under pressure. The caput succedaneum formed in the second stage usually occupies a different situation from that formed in the first stage, owing to the rotation of the presenting part, which will be described later. In cases in which the head has been exposed to severe and long-continued pressure the caput succedaneum may contain blood-corpuscles, as well as plasma.

The caput succedaneum, unlike the cephalhæmatoma, to be described later, does not increase in size after birth, but gradually disappears in the course of a few hours or days (Fig. 234).

If some other part presents—*e.g.* the face or breech—a swelling will be formed over the part most in advance exactly comparable with the caput succedaneum.

Moulding.—The changes in the shape of the head brought about by pressure are called moulding. The bones of the base of the skull are incompressible, and are joined to each other in such a way that no movement is possible between them, but the bones of the vault of the skull are compressible, and the sutures allow of a certain amount of movement between the individual bones. The parietal bones and the tabular portions of the occipital and frontal bones can be bent by pressure, and when much compressed the parietal bones override the occipital and frontal bones, and the anterior parietal bone, being less pressed on than the posterior, overrides its fellow. By means of this moulding the diameters of the skull most pressed on become diminished in size to a considerable extent.

The Third Stage.—The uterus follows down the body of the child, and after its expulsion the fundus reaches up to a point a little below the umbilicus.

As a rule, there are no vigorous pains for at least ten or fifteen minutes after the expulsion of the child, the uterus, which now contains only the placenta and membranes, remaining retracted without definite contractions. Sometimes, in the absence of artificial stimulation, there may be no marked contraction for an hour. During this time, however, the hand placed lightly on the uterus will feel slight rhythmical contractions, not severe enough to be noticed by the patient. After a time, which varies very much in different cases, the placenta is expelled either into the vagina or into the bed.

As the uterine walls become thicker and the internal surface of the uterus becomes smaller, the placental site shrinks with the rest of the internal surface until it reaches a stage when detachment must occur unless the placenta is abnormally adherent. In accidental hæmorrhage (see p. 483), separation may occur in the first stage with only a moderate amount of retraction. This shrinkage causes partial detachment of the placenta if it is not abnormally adherent. The uterus then treats the placenta as a foreign body, and expels it, pushing it out into the vagina. It is common to find a mass of blood-clot on the maternal surface of the placenta, formed by oozing of blood from the part of its site from which the placenta was separated first. This bleeding must help to detach the rest of the placenta, but it is not a constant factor in its separation. If the uterus becomes flabby, on account of imperfect retraction, when part of the placenta has been separated, bleeding takes place from the exposed placental site. With the next contraction the blood that has been poured out between the uterine wall and placenta is squeezed flat, and more of the placental surface is separated from the uterine wall. The part of the placenta to leave the uterus first is usually a point on the fœtal surface between the edge and the insertion of the cord. As the placenta is expelled it drags the membranes after it, with the amnion now outside and the chorion inside. The separation of the membranes from the uterine wall takes place through the decidua, part of which comes away attached to the chorion, while the rest remains in the uterus. During the first stage the membranes have been separated from most of the lower uterine segment. After the birth of the child the decrease in the size of the cavity results in the membranes being thrown into loose folds and attached only in places. The expulsion of the placenta normally completes the detachment of the membranes from the uterine wall. The amnion is a tough membrane, firmly attached to the root of the cord, and is certain to be dragged out by the placenta. The chorion is attached to the edge of the placenta, but its intimate contact with the amnion is more important from the point of view of the third stage of labour. If the chorion is still in contact with the amnion it will almost certainly come out whole with that membrane, but if it has been largely separated from the amnion after too late rupture of the membranes its connection with the decidua is likely to prove a stronger one than that with the placenta, and the chorion, or a large part of it, may stay behind when the placenta and amnion are born.

There is generally a gush of blood, not amounting to more than a few ounces, just as the placenta is expelled. If the uterus does not retract well after the placenta is separated from its walls, hæmorrhage

occurs; but if it is well retracted, as usually happens, there is not more than a thin trickle of blood coming away after the birth of the placenta. The uterus is then felt as a hard, round ball about the size of a fœtal head, the top of the uterus reaching up to about halfway between the pubes and umbilicus.

The average amount of blood lost in normal labour is from half a pint to a pint; about 4 or 5 ounces before the birth of the placenta, and the rest with it.

Duration of Labour.—Labour in primiparæ lasts on an average about fifteen to twenty hours. In multiparæ, seven to ten hours can be taken as the average time. The first stage in primiparæ usually lasts about twelve to fifteen hours, the cervix taking much longer to dilate than in multiparæ. In the second stage the perineum and the orifice of the vagina offer much greater resistance in primiparæ than in multiparæ. In primiparæ over twenty-eight years of age still greater resistance may be expected from all the soft parts, increasing with advancing years, although some primiparæ over forty years of age have easy labours. Very seldom, in "elderly" primiparæ—*i.e.* women of thirty-five and over—there is an added difficulty, *viz.* comparative immobility of the sacro-coccygeal joint.

In some multiparæ labour may last only two or three hours. It is not very uncommon for the child to be born in two or three pains after full dilatation of the os in multiparæ.

It is foolish to attempt to prophesy more than approximately how long labour will last in any given case.

CHAPTER XXVIII

OBSTETRICAL DIAGNOSIS

CERTAIN terms used in connection with the fœtus and its relation to the uterus must be explained.

Lie.—By the "lie" of the child is meant the relation which the long axis of the child bears to that of the mother. The lie may be longitudinal, oblique, or transverse.

Presentation.—The "presentation" depends on the part of the child which occupies the lower segment of the uterus, lying just above the internal os. When the head occupies the lower segment of the uterus, if it is flexed on the spine, there is a vertex presentation; if extended on the spine, a face presentation; if midway between flexion and extension, a brow presentation. If the breech occupies the lower part of the uterus, there is a breech presentation. If a knee or a foot lies lowest, the presentation is said to be a knee presentation or a footling, both of which are varieties of breech presentation. If the child lies transversely or obliquely, there is generally a shoulder over the internal os, so that it is called a transverse presentation (or more correctly a shoulder presentation).

Position.—By the term "position" is meant the relation that some given part of the child bears to the front or back of the mother. If the back is directed to the front, the child is in a dorso-anterior position. If the chin in a face presentation is directed towards the back, we speak of a mento-posterior position, and so on.

Attitude.—The term "attitude" refers to the relation of the different parts of the child to one another. If the back, head and limbs are flexed the child is said to be in an attitude of flexion; if extended, in an attitude of extension. The usual attitude is one of flexion. The back is arched, with a dorsal convexity; the

head is bent towards the chest; the thighs are bent up towards the abdomen; the knees are bent, so that the feet are near the buttocks, and the arms and forearms are bent and folded on the chest (Fig. 76).

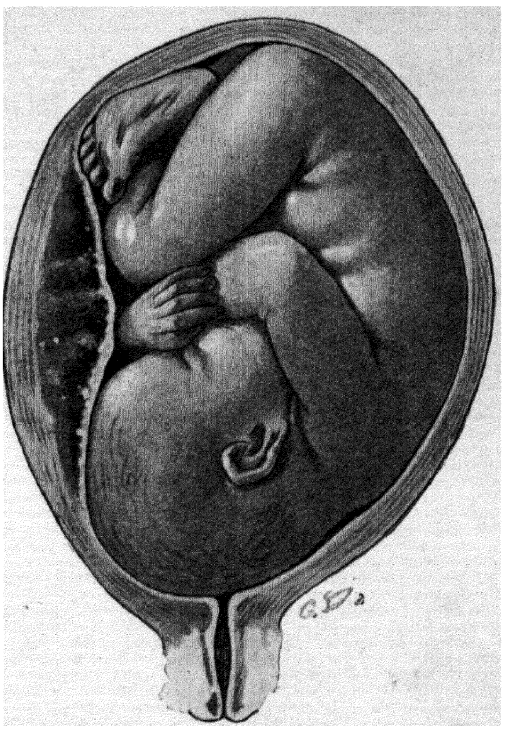


FIG. 76.

The usual attitude of complete flexion. The lie is longitudinal. The presentation is by the vertex.

The common lie is longitudinal, and the head usually presents. In 96 per cent. of cases at full time the child lies longitudinally, with the head in the lower part of uterine segment, and the breech in the fundus. The reason for this is found in the fact that at full time the fœtus has to adapt itself to the shape of the uterus. In the early months of pregnancy the liquor amnii is comparatively more abundant, and the fœtus can float freely; but as pregnancy advances, and the fœtus rapidly increases in size, the quantity of liquor amnii becomes comparatively less. Consequently at full time the fœtus can no longer float freely, but has to adapt itself to the shape of the uterus. When the attitude is one of complete flexion, the full breech—*i.e.* the buttocks with the adjacent parts of the thighs and the feet—constitutes a mass larger than the head. The cavity of the uterus at full time is pear-shaped, with the larger end uppermost; therefore the fœtus fits into it best when the breech lies in the upper part of the uterus, and the head in the lower part.

In premature labour presentations other than those of the head are much more common than in full-time labour—for two reasons: first, because the liquor amnii is comparatively more abundant; and, secondly, because the head is comparatively larger in premature children than in those born at full time.

If the head is disproportionately large at full time, *e.g.* in hydrocephalus, the child is likely to present by the breech, the enlarged head being larger than the breech, and so occupying the fundus, the larger end of the uterus.

If there is excess of liquor amnii (hydramnios), malpresentations are likely to result, the child being able to move about freely, and not having to adapt itself to the shape of the uterine cavity.

If the pelvis is contracted and the head cannot readily enter the brim, a malpresentation is likely to occur.

If the child lies obliquely towards the end of pregnancy, and there is not an excessive quantity of liquor amnii, the contractions of the uterus at the beginning of labour will tend to convert the lie into a longitudinal one. The reason for this is that the uterus becomes more pear-shaped when it contracts, and so its walls, which could be pushed out of shape by the fœtus while lax, press on the two ends of the fœtus and tend to alter its lie.

The movements of the fœtus also assist in making it assume a longitudinal lie. A shoulder or breech presentation is more likely to occur with a dead than with a living child, because of the absence of movements and the absence of tonicity.

The back of the child is much more commonly directed towards the front than towards the back of the mother. This, again, is due to the fact that the child has to adapt itself to the shape of the uterine cavity. This must, during relaxation, be much less concave behind than in front, because of the convexity forwards of the lumbar part of the spine on which it lies. The concavity of the fœtal body fits the convexity of the maternal spine when the back of the fœtus is directed forwards.

If the back of the fœtus is directed towards the back of the mother, the two convexities are in contact, and the fœtus cannot fit the shape of the uterine cavity unless its back is less flexed than it is normally.

In angular curvature of the spine, if the angle is situated low down in the dorsal region, the curve of the lumbar spine is altered, so that the maternal spine presents a surface which is concave forwards. In this case the fœtus is likely to lie with its back in the hollow of the maternal spine.

In cases in which the mother's abdominal wall is weak (pendulous belly), the uterus sags forward, and is not held up against the spine. In these cases malpresentations are common, because the shape of the uterus is much less definite when it is insufficiently supported by the abdominal wall.

The pregnant uterus has usually a slight right lateral obliquity, *i.e.* it leans towards the right side. There is usually also some rotation to the right, the anterior surface looking slightly to the right, the right side looking slightly backwards, the posterior surface looking slightly to the left, and the left side looking slightly

forwards. The transverse diameter of the uterine cavity is thus in what may be looked on as the right oblique diameter of the mother's abdomen. The antero-posterior diameter of the child occupies this, the greatest, diameter of the uterus when the back lies in front and to the left.

Abdominal Examination.—Abdominal examination is most important, and should always precede vaginal examination.

By abdominal examination it is possible to ascertain :—

1. The lie and presentation.

2. Whether the presenting part has entered the pelvis or not, and so to form an idea as to the relative sizes of the presenting part and the brim of the pelvis.

3. The presence of abnormal conditions, such as excess of liquor amnii, twin pregnancy and abdominal tumours.

4. Whether the child is alive or not.

5. Some idea as to the size of the child.

When a patient is seen early in labour, or before labour has begun, it may be impossible to diagnose the presenting part by vaginal examination. In some cases one can say that the presenting part is almost certainly not the vertex, but cannot distinguish whether it is the face, the breech, or the shoulder. By abdominal examination at this stage such a diagnosis is almost always possible, unless the amount of fat in the patient's abdominal wall or the amount of liquor amnii is excessive.

The patient should lie on her back, with her head on a pillow, her abdomen uncovered, and her knees slightly drawn up.

The fingers of both hands must be used, and laid nearly flat on the abdomen. If the abdominal wall is thin, it may be extremely easy to make out exactly how the various parts of the child are arranged. In cases in which there is a great deal of fat in the abdominal wall, or when the patient keeps her abdominal muscles rigid, more will be made out by "dipping" with the fingers than by palpation. The hands must be warm, and the patient, if nervous, must be engaged in conversation and put at her ease.

It is best to examine the abdomen systematically, in the following manner :—

1. Ascertain the outline of the uterus : then palpate the fundus with both hands. If the breech occupies the fundus a large body will be felt rather irregular in outline, not so round or hard as the head. When the fingers are moved downwards on to the back, they will not feel anything corresponding to the prominences of the shoulders between the breech and the trunk. A knee or a foot,

or both, can generally be felt at a short distance from the breech, at a slightly lower level.

If the head occupies the fundus, a harder, rounder, smoother and more movable mass than the breech will be felt. The anterior shoulder will probably be felt, and the head can be moved independently of the body. As a rule, no small part of the fœtus can be felt near the head. The fundus of the uterus is usually

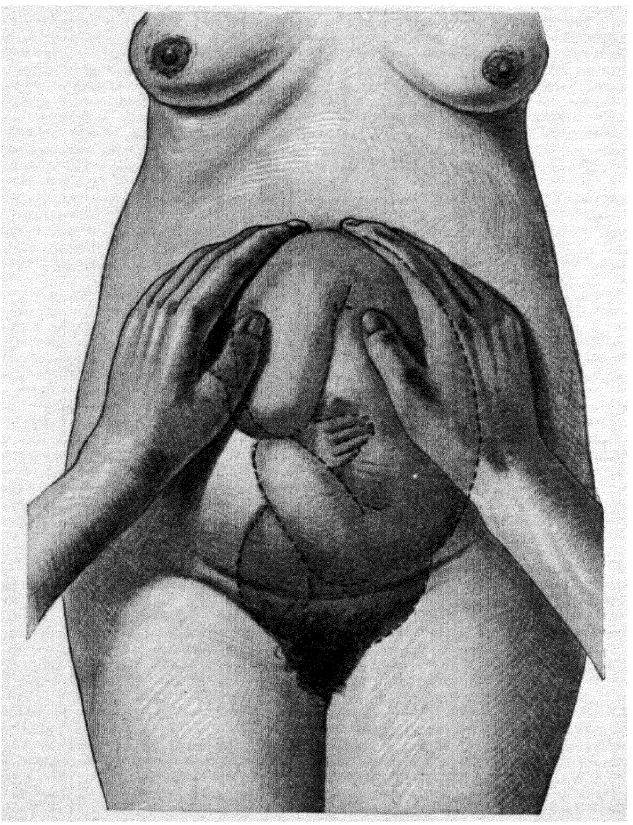


FIG. 77.—ABDOMINAL PALPATION.

The breech is found to occupy the fundus.

narrower when it contains the head than when it contains the breech (Fig. 77).

2. Next palpate the sides of the abdomen to feel in which of them the back lies. If the back of the fœtus is directed more to the front than behind, a broad, smooth resisting surface will be felt on one side of the abdomen, and on the other side small knobs or lumps—the limbs. If these small parts are felt all over the front of the abdomen, the back must be directed to one side and backwards, and deeper palpation in the flank may be necessary

to ascertain on which side it lies. During this part of the examination some idea can be gained of the amount of liquor amnii that is present (Fig. 78).

3. Next grasp the lower part of the abdomen, just above the pubes, with the fingers and thumb of one hand with the heel of the hand directed downwards. In longitudinal lies either the head or the breech will now be grasped by the hand. If the head is above the brim, try to make out its different parts. If the fingers

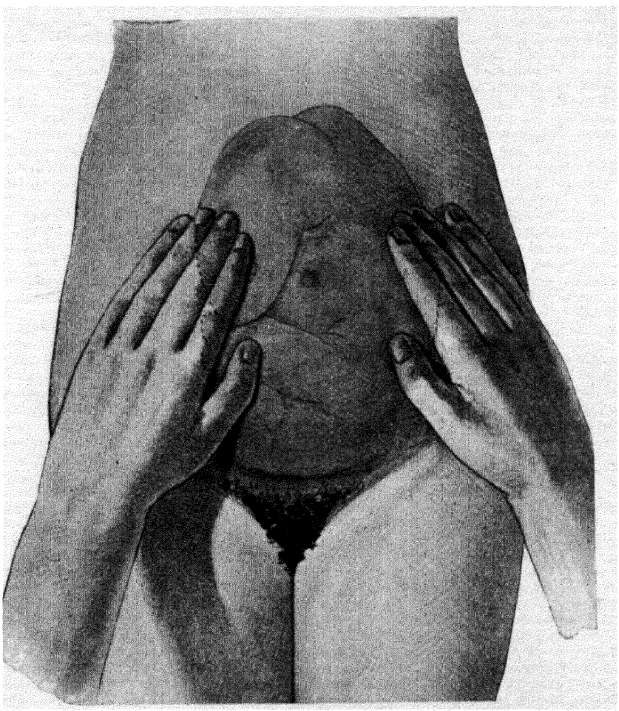


FIG. 78.—ABDOMINAL PALPATION.

On the left side the back is felt as a broad smooth resisting surface; on the right side the limbs are felt as small movable parts.

glide off the back on to a smooth part of the head without encountering any prominence, you know that the head is flexed, and that you are feeling the occiput. In such a case you may feel the forehead as a prominence on the opposite side of the brim to the occiput. If the head is extended, a deep groove will be felt between the back and the occiput. If the breech occupies the lower part of the uterus, it will be felt as a softer and much less definitely rounded mass than the head. The lower part of the uterus is broader when it contains the breech than when it contains the head.

If the presenting part is above the brim, it should be pressed

down with both hands to ascertain whether it can be made to enter the brim.

4. In primigravidæ the presenting part is usually engaged in the brim before labour begins, sometimes as early as the 28th week. In such cases the attendant must stand facing the patient's feet, and press with the tips of his fingers deeply at the sides of the pelvis. A good plan is to place the tips of the fingers on the sides of the

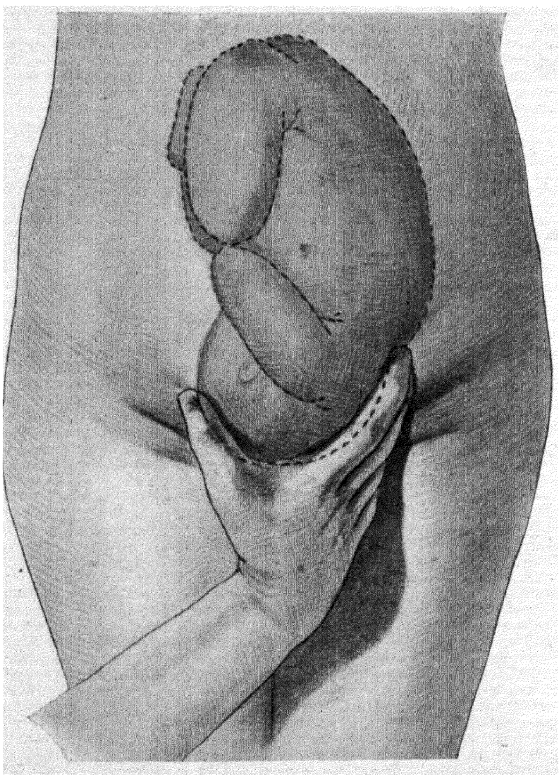


FIG. 79.—ABDOMINAL PALPATION.

The head, which is well flexed, has not sunk deeply into the brim of the pelvis, and can be palpated with one hand. The anterior part of the head is much more prominent than the posterior part.

brim first, and then press them towards the middle line. The presenting part will be felt between the hands. If the head is presenting, one side of it will feel more prominent than the other—the fore part if the head is flexed, the occiput if the head is extended (Fig. 80).

If the fœtus is lying transversely, or, rather, obliquely, the head will probably be felt in one iliac fossa, and the breech a good deal higher up on the other side (Fig. 81).

The presence of twins may be diagnosed by the finding of two heads and backs.

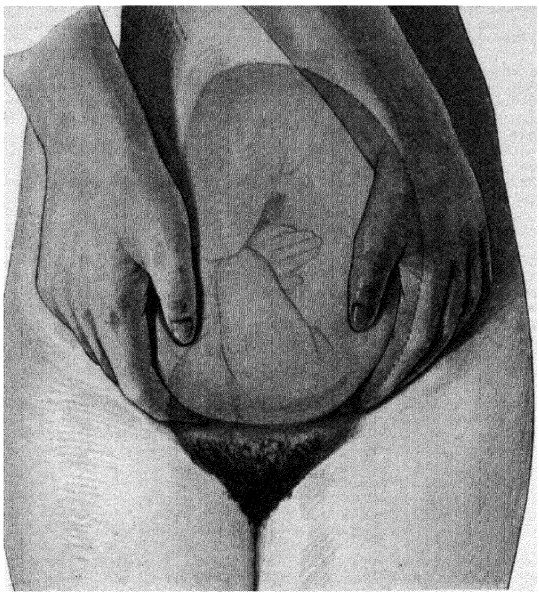


FIG. 80.

The head, which is well flexed, has sunk into the brim of the pelvis too deeply for palpation as in Fig. 80; both hands must be used, the tips of the fingers being pressed in deeply at the sides of the pelvis.

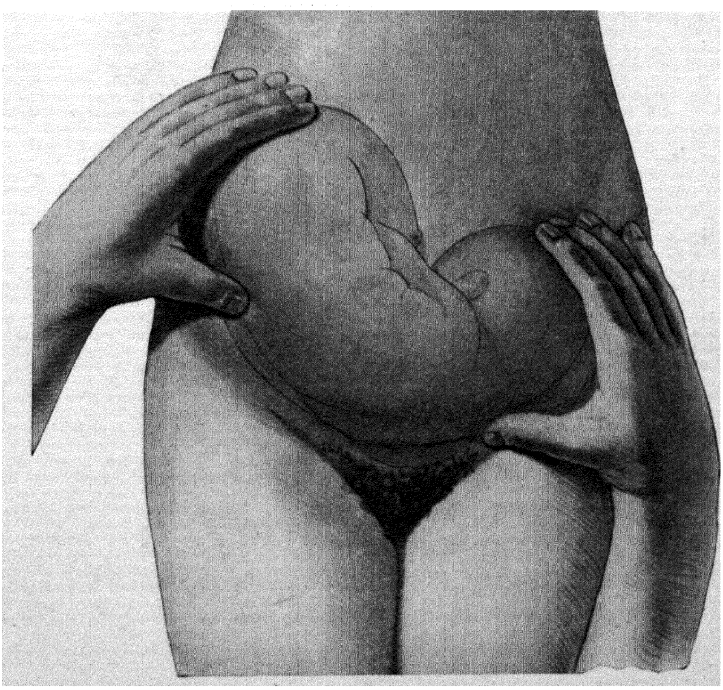


FIG. 81.—ABDOMINAL PALPATION.

The fœtus is lying obliquely. The head can be felt in the left iliac fossa, and the breech at a higher level on the right side. In most cases of oblique lie the breech is nearer the middle line than in this figure.

Auscultation.—The fœtal heart must next be listened for. It is heard best by listening over the back of the fœtus in vertex and breech presentations, and over the chest in face presentations. It may be heard over a large area in some cases, but the point of maximum intensity is usually as indicated below. If the back is felt in front and to one side in a *vertex presentation*, the heart will be best heard an inch or two to that side of the middle line. Take the mid-point of Poupart's ligament, and imagine a line drawn from this point to the umbilicus. The middle of this line is the best place at which to listen.

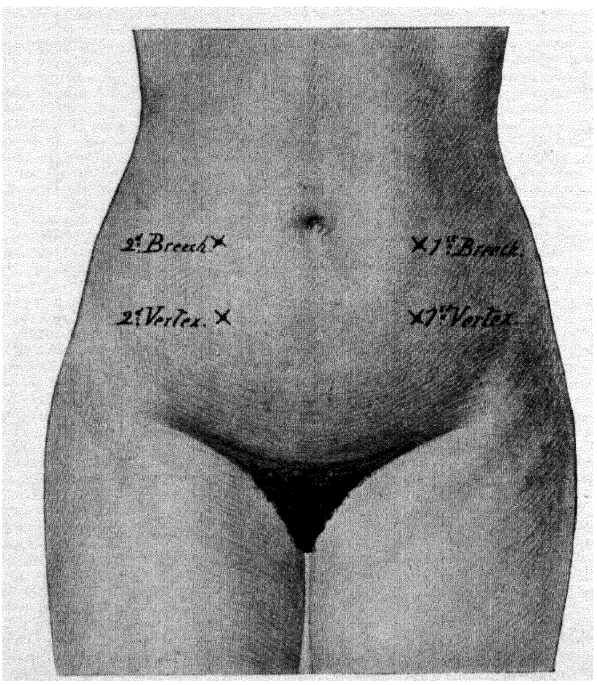


FIG. 82.—AUSCULTATION OF THE FŒTAL HEART.

The crosses indicate the points where the fœtal heart-sounds are heard best in dorso-anterior positions with vertex and breech presentations respectively.

In *occipito-posterior* positions—*i.e.* when the back is directed to one side and backwards—the heart is best heard farther from the middle line, often quite in the flank.

In *breech presentations* the heart will be heard at a point higher up than in vertex presentations—at the level of, or a little above, the umbilicus. The reason for this is that the breech does not engage in the brim so early in labour as does the vertex; it sits *on* the brim rather than *in* it.

When the back is extended, in *face presentation*, the fœtal heart

is best heard on the side in which the limbs are felt—*i.e.* by listening over the chest, not over the back (Fig. 82).

Vaginal Examination.—Before vaginal examination an inspection should be made to determine the presence or absence of any vulval lesions, such as vulval warts, venereal ulcers, varicose veins, or abnormal discharges. Vaginal examination should be as systematic as abdominal examination. The points to be observed are :—

1. The condition of the vaginal walls.
2. The state of the rectum and bladder—whether empty or full.
3. The condition of the cervix, and the extent of its dilatation.
4. The state of the membranes—whether intact or ruptured.
5. To confirm the identity of the presenting part as determined by abdominal examination, its position, its mobility, and the depth to which it has descended.
6. The size of the diagonal conjugate diameter, if the presenting part has not descended too deeply.
7. Whether the umbilical cord or a limb is presenting or prolapsed.
8. The presence or absence of pelvic tumours.

After the hands and external genitals have been made aseptic, the first finger or first and second fingers of either hand, most commonly the right, are inserted into the vagina. The patient lies on her left side, with her left hand on the small of her back, and her right arm lying loosely on the bed.

Before the finger is inserted the right labium is raised by the other hand, so that the examining finger touches nothing until it is inside the vagina. The condition of the vaginal walls is noticed—whether moist and well lubricated by secretion, as in normal labours, or dry, as in certain abnormal conditions. If the rectum is full of fæces, the posterior vaginal wall will be felt to be bulged forward by a mass which can be dented by pressure with the finger-tip. The cervix is then examined. The external os may be too small to admit the tip of the finger, or the finger may enter a thick-walled canal about 1 inch long, closed at the internal os. The internal os may admit the finger although the cervical canal is still present. Later the canal becomes shortened until only the external os is left, the canal having been entirely "taken up". If the internal os admits the finger the membranes may be felt either stretched across the internal os or bulging into it, and the presenting part may be felt through them. If the membranes have ruptured, the presenting part will be felt easily in most cases ; but if it has not yet entered the brim, it will be felt high up, or not felt at all if the examining fingers are short.

If the presenting part is felt, the fingers must confirm the diagnosis made on abdominal examination, whether vertex, breech, face limb, or shoulder.

If the vertex is presenting, the fingers should be carried up behind the symphysis pubis, and then swept backwards in the middle line over the head. In doing this they will meet with the sagittal suture, which must be followed until a fontanelle is reached. If three sutures meet at this spot, it is the posterior fontanelle; if four, the anterior. The fingers then trace the sagittal suture to its other extremity, and feel and recognize the other fontanelle. If overlapping of bones is felt at a fontanelle it is usually the posterior.

If the presenting part cannot be felt from below by fingers of ordinary length, the reason may be that the presenting part is unusually high up, or that the labia are unusually large from the presence of œdema or of a large quantity of fat. The former condition may be caused by a malpresentation, a contracted pelvis, placenta prævia, or the presence of a tumour in the pelvis. In any case, if abdominal examination has not revealed the character of the presentation, an anæsthetic must be given, the whole hand passed into the vagina, and the pelvis thoroughly explored.

An attempt should always be made to measure the diagonal conjugate diameter, if the presenting part has not descended too deeply. Two fingers must be used, as the middle finger can reach nearly an inch farther than the forefinger. If the tip of the middle finger can feel the promontory of the sacrum, the base of the forefinger is pressed against the lower border of the symphysis pubis, and the point of contact marked by a finger of the other hand Then, when the fingers are withdrawn, the length of the diagonal conjugate diameter can be ascertained by taking the measurement between the mark on the base of the forefinger and the tip of the middle finger. If the diagonal conjugate diameter can be measured with one finger of normal length the pelvis must be contracted.

CHAPTER XXIX

HEAD PRESENTATIONS

THERE are three varieties of cephalic or head presentations :—

1. Vertex presentations, when the head is flexed on the trunk.
2. Face presentations, when the head is extended on the trunk.
3. Brow presentations, when the attitude of the head is midway between flexion and extension.

VERTEX PRESENTATIONS

Vertex presentations, which occur in about 96 per cent. of all cases of labour, for the reasons which were explained on p. 281, are divided into four, according to the position of the back of the fœtus or of the occiput.

The four positions are :—

1. The left occipito-anterior, L.O.A. The occiput is directed to the left and in front.
2. The right occipito-anterior, R.O.A. The occiput is directed to the right and in front.
3. The right occipito-posterior, R.O.P. The occiput is directed to the right and behind.
4. The left occipito-posterior, L.O.P. The occiput is directed to the left and behind.

DIAGNOSIS OF THE FIRST POSITION, L.O.A.

Abdominal Examination.—The breech occupies the fundus of the uterus, the back is felt to the left and in front, the limbs are felt on the right side, and the head is felt in the pelvis, or, in multiparæ with relaxed abdominal walls, at the brim, with its most prominent part on the right. The fœtal heart is heard best below and to the left of the umbilicus (Fig. 83A).

Vaginal Examination.—The sagittal suture is found to be lying in the right oblique diameter of the pelvis, with the posterior fon-

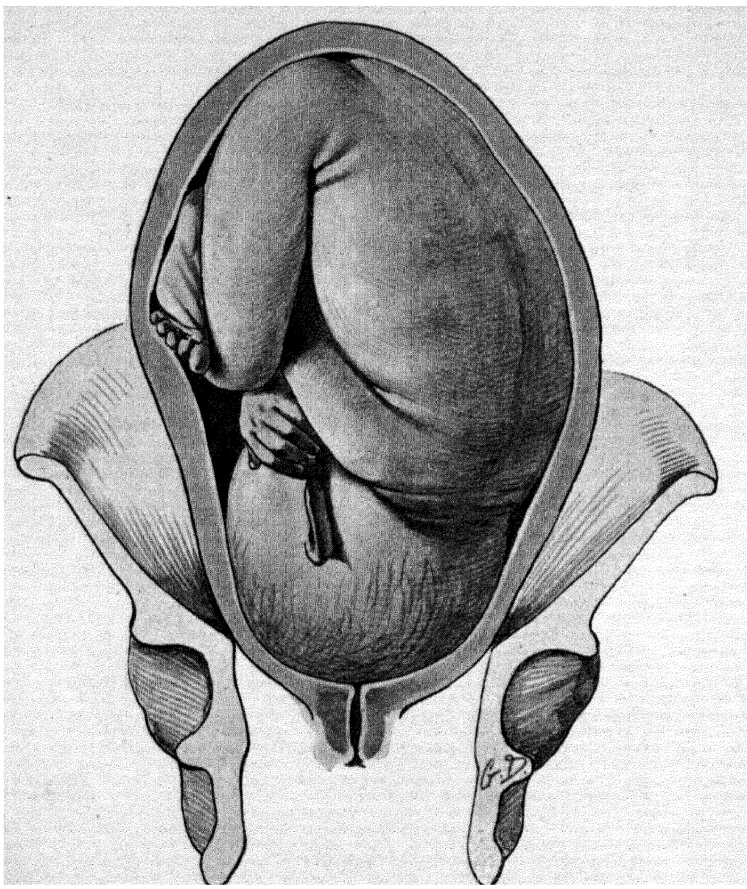


FIG. 83A.—FIRST POSITION OF THE VERTEX, L.O.A.

tanelle in front and to the left, while the anterior fontanelle is felt higher up behind and to the right (Fig. 83B).

DIAGNOSIS OF THE SECOND POSITION, R.O.A.

For the diagnosis of the second position of the vertex the above paragraphs should be read with the word "right" substituted for left, and *vice versâ;* the back is felt to the right with the limbs to the left, and so on (Figs. 84A and B).

DIAGNOSIS OF THE THIRD POSITION, R.O.P.

Abdominal Examination.—The breech occupies the fundus; the limbs are felt over the front of the uterus; the back is found

behind and to the right, and is felt less easily than in the dorso-anterior positions. The head is felt at the brim of the pelvis, usually higher up than in anterior positions, with its most prominent part to the left. The fœtal heart is heard best below and to the right of the umbilicus (Fig. 85A).

Vaginal Examination.—The sagittal suture is found to be lying in the right oblique diameter of the pelvis, with the posterior fontanelle behind and to the right, the anterior fontanelle in front and to the left (Fig. 85B).

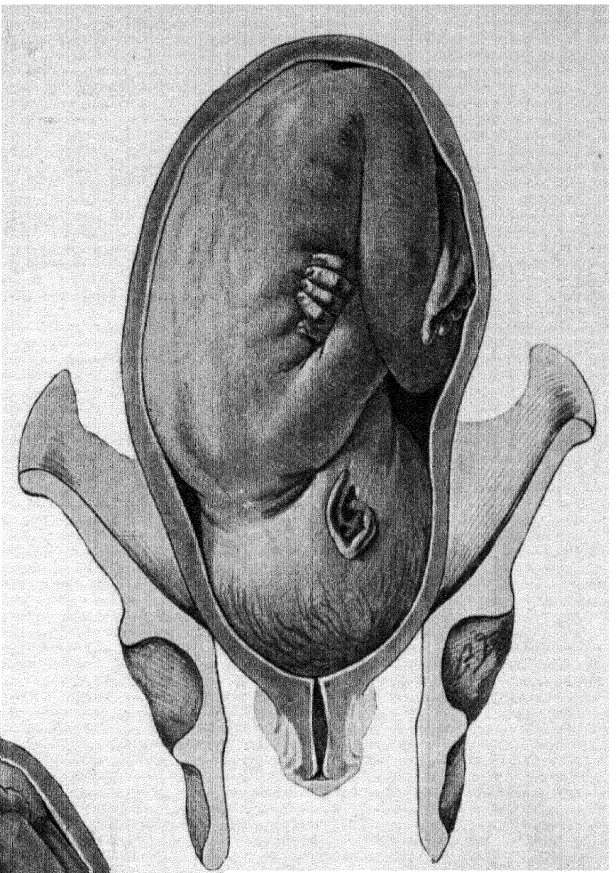


FIG. 84A.—SECOND POSITION OF THE VERTEX, R.O.A.

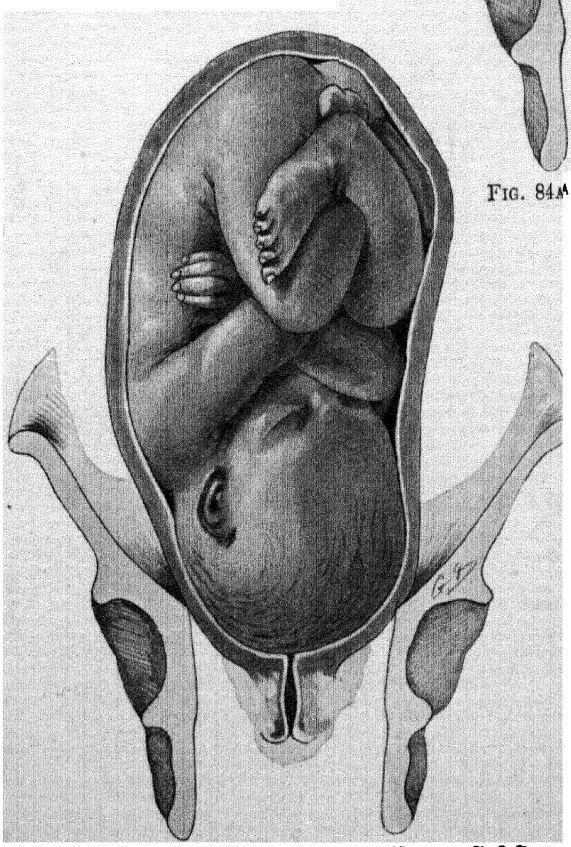


FIG. 85A.—THIRD POSITION OF THE VERTEX, R.O.P.

DIAGNOSIS OF THE FOURTH POSITION, L.O.P.

The two preceding paragraphs should be read with substitution of the word "right" for "left" and *vice versâ* (Figs. 86A and B).

Relative Frequency.—The first position of the vertex, L.O.A., is the most common, occurring in about 60 per cent. of all cases of labour.

The third position is more common than the second, and the fourth position is the least common.

MECHANISM OF LABOUR

By the term *mechanism* is meant the series of changes in position and attitude which the presenting part has to make in its passage through the pelvis and the pelvic floor. The mechanism

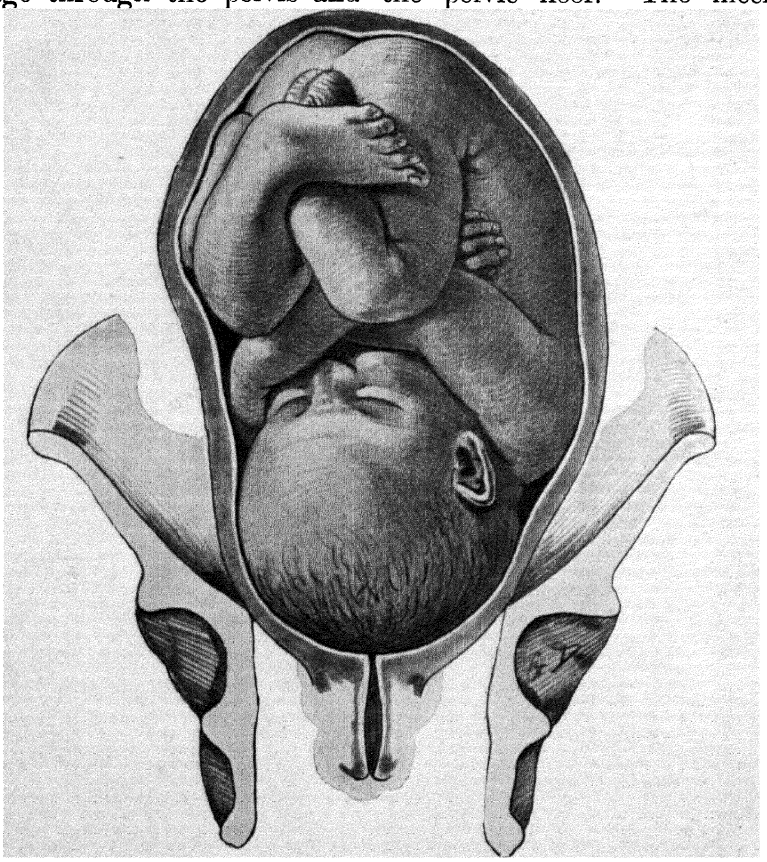


FIG. 86A.—FOURTH POSITION OF THE VERTEX, L.O.P.

of labour should be studied with the pelvis and the dummy fœtus, as well as by careful observation during labour.

The head is a more or less oval body which fits fairly tightly into the canal through which it is pushed. The longest diameter of the pelvis is transverse at the inlet, oblique in the cavity, and antero-posterior at the outlet. At the outlet the pelvic floor offers resistance to the head on both sides and behind, while it leaves a free space in front. Consequently the head, which enters the pelvis in an oblique diameter, or between the transverse and one

1. L.O.A.

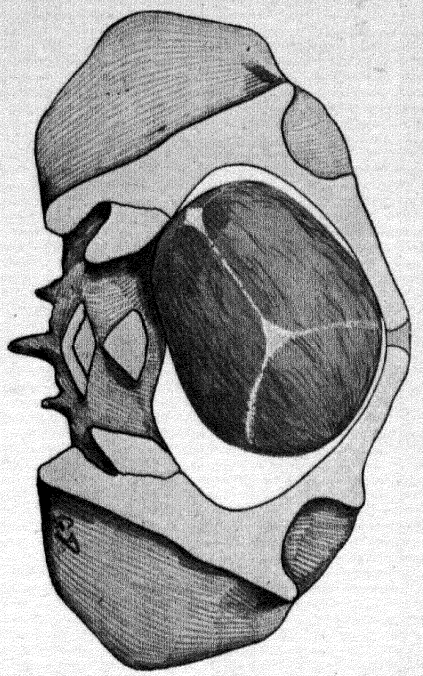


FIG. 83B.

2. R.O.A.

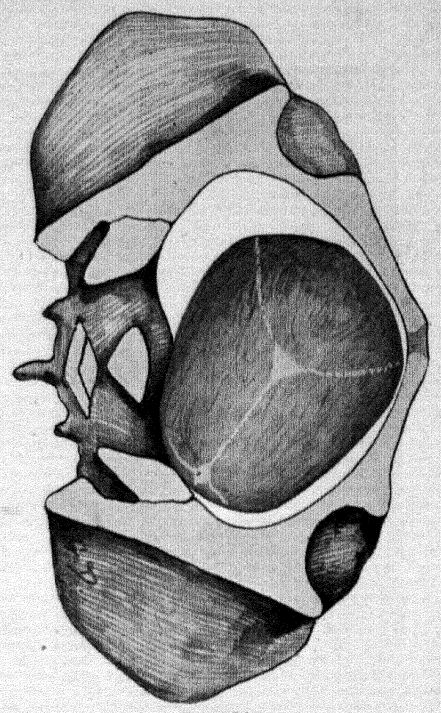


FIG. 84B.

3. R.O.P.

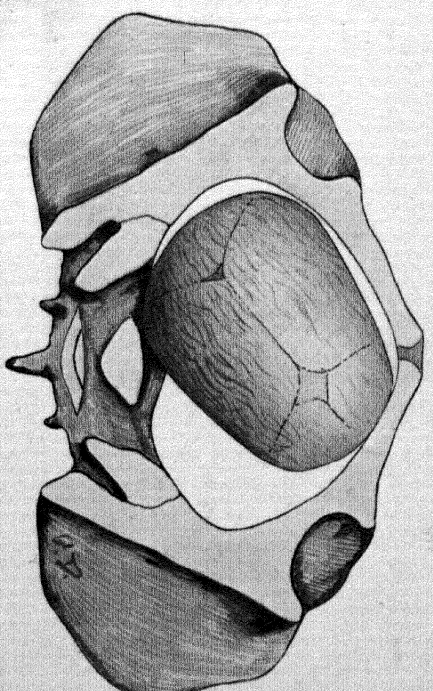


FIG. 85B.

4. L.O.P.

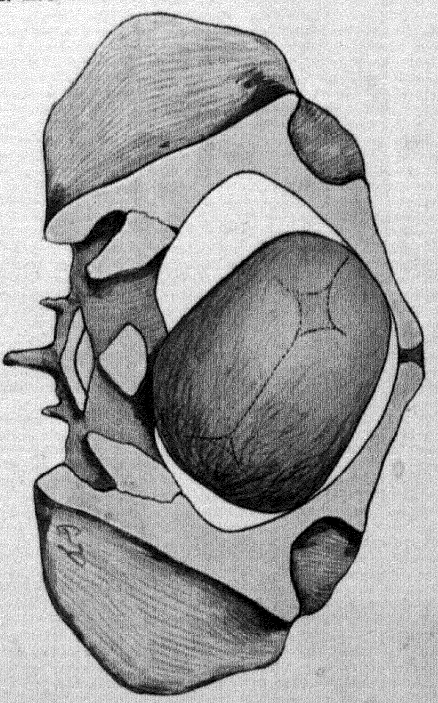
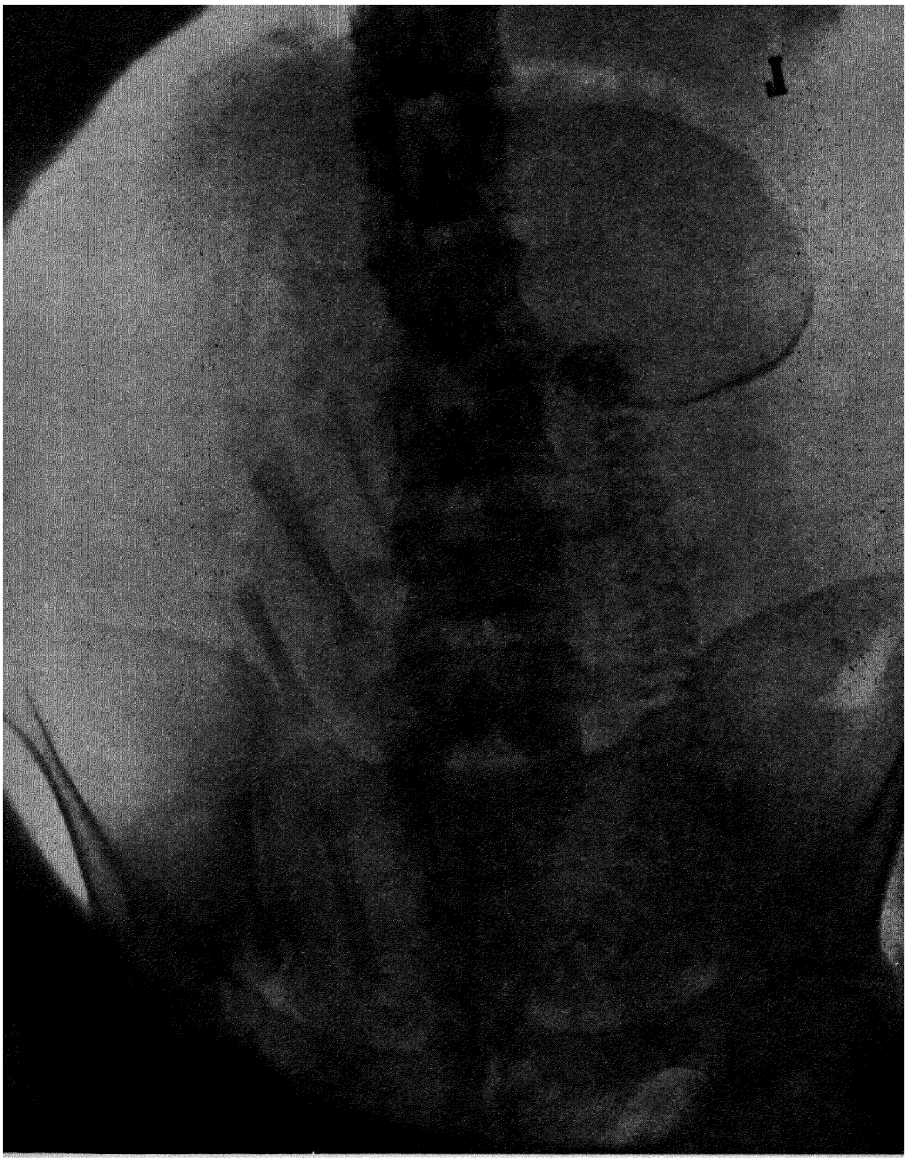


FIG. 86B.

The four positions of the vertex as seen from below, and as felt by the examining fingers in vaginal examination.



[*From the Radiological Department of the Middlesex Hospital.*

SKIAGRAM OF A BREECH PRESENTATION WITH EXTENDED LEGS.
THIRTY-FIFTH WEEK OF PREGNANCY.

of the oblique diameters, does not maintain the same position throughout its passage, but undergoes some rotation and also some change in its attitude. If the head and the pelvis are both of normal size, the soft parts have more to do with the mechanism of labour than have the pelvic bones.

First Vertex, L.O.A.

While the head is descending it makes four movements :—

Flexion,	Internal rotation,
Extension,	External rotation.

Flexion.—The head is flexed before labour begins, as part of the general attitude of flexion which occurs under normal conditions. If this flexion of the head is not complete before the forces of labour come into play it becomes complete—*i.e.* the head becomes flexed until the chin meets the chest—as the head is pressed down on to the lower uterine segment and cervix. The reasons for this complete flexion, by means of which the occiput descends more than the forehead, are—

1. The shape of the head. 2. The head lever.

The Shape of the Head.—(*a*) The occiput and forehead are pressed against the sides of the canal. The slope at the posterior end of the head is much steeper than is that at the anterior end, consequently the occiput can descend more easily, with less friction, than can the forehead.

(*b*) Any ovoid body being pushed through a tube will tend to adapt its long diameter to the long axis of the tube. When the head is completely flexed its longest diameter, the vertico-mental, is lying in the long axis of the canal, while the shortest longitudinal diameter, the suboccipito-bregmatic, measuring $3\frac{3}{4}$ inches, is lying across the canal.

The Head Lever.—When the breech is pressed on by the fundus of the uterus, the fœtus being subjected to fœtal-axis pressure, the *head lever* comes into play. The occipito-spinal joint is nearer to the occiput than to the forehead, so the head can be looked on as being a lever with a short posterior arm and a long anterior arm. As the fœtus is pressed downwards the long anterior arm meets with more resistance, and so is more retarded than the short posterior arm—*i.e.* the forehead does not descend so deeply as does the occiput. The importance of the head lever has been exaggerated. There is more room in the front of the pelvis than at the back, therefore whatever part of the head is in front will descend more readily. If the occiput is in front flexion is thus favoured, as the greater resistance is posterior.

When the head is engaged in the brim, the sagittal suture is found to be lying in the right oblique diameter of the pelvis. The effect of complete flexion is to bring the posterior fontanelle, which

lies in front and to the left, to a lower level than that of the anterior fontanelle, which lies to the right and behind.

Internal Rotation.—As the head is pressed further downwards the occiput, being lower than the forehead, first meets the resistance of the pelvic floor, which can be looked on as a sloping gutter between the two levatores ani leading to a free space in front under the symphysis pubis (Fig. 58B). As the occiput is pushed down, it rotates away from the resistance of the pelvic floor, moving forwards through one-eighth of a circle, along the left side of the pelvis, towards the free

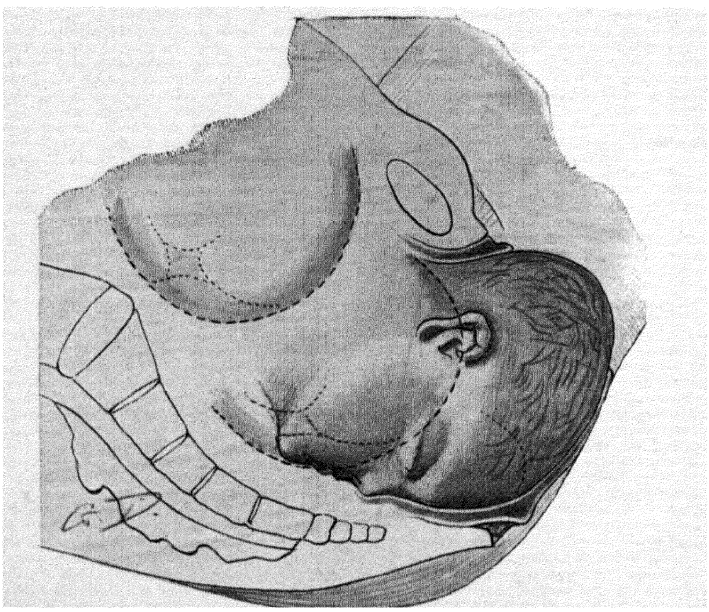


FIG. 87.—INTERNAL ROTATION.

The anterior fontanelle is seen to point towards the right and behind at first, and directly backwards later when internal rotation has taken place. In the figure extension has begun and the chin has left the chest.

space under the pubic arch. It is doubtful whether the shape of the pelvis has any influence on the mechanism of labour when both pelvis and head are of normal size. It will be seen, however, that the "rifling" of the pelvis, that is, the fact that the greatest diameter is transverse at the brim and antero-posterior at the outlet, if it has any effect on the mechanism, will tend to produce the same rotation as that brought about by the soft parts. The head thus comes to lie with the sagittal suture in the antero-posterior diameter of the pelvis, the occiput and posterior fontanelle in front below the pubic arch, the forehead and anterior fontanelle behind in the hollow of the sacrum, the nape of the neck being against the back of the symphysis pubis, the chin still in contact with the chest (Fig. 87).

Extension.—The head is now acted on by two forces. The uterus and abdominal muscles are pressing it downwards, while the muscles of the pelvic floor are pressing it upwards and forwards.

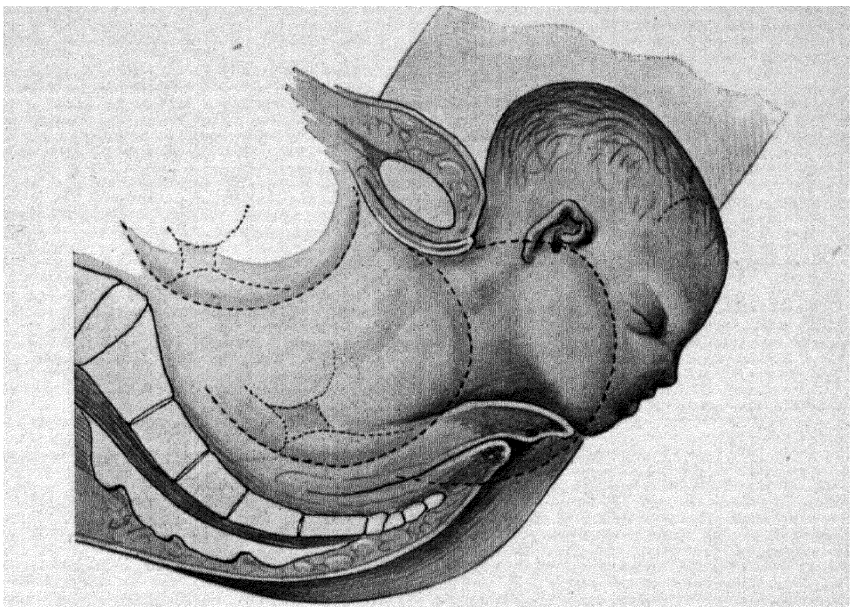


FIG. 88.—EXTENSION OF THE HEAD.

The occiput is seen to move forwards and upwards over the symphysis as the head emerges, the face and chin escaping from under the perineum.

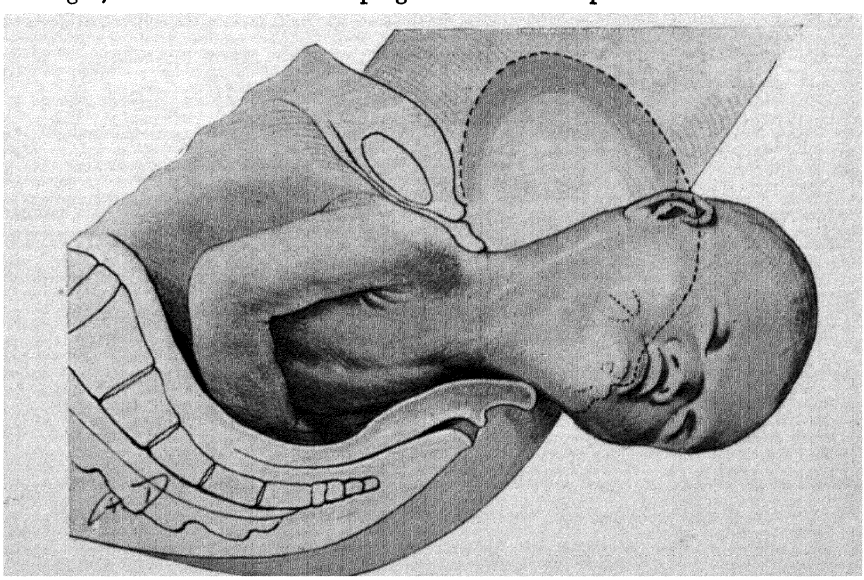


FIG. 89.—THE FIRST MOVEMENT OF EXTERNAL ROTATION.

The head is seen to have rotated so that the face looks to the right instead of backwards as it did at the moment that the head was born.

The resultant of these forces acts in a forward direction—the downward and upward pressures counterbalance one another, and the head has to go forwards. It cannot go forward as a whole because the nape of the neck is fixed against the symphysis pubis. The only way in which the head can go forwards, as it must to follow the curve of the birth-canal, is by a movement of *extension*, the chin leaving the chest, and the occiput escaping under the pubic arch. The occiput is free already, and the vertex stretches the vaginal outlet until the head can emerge, the vertex, forehead, face, and chin successively gliding forward from under the perineum (Fig. 88).

External Rotation.—There are now two movements: 1. Restitution or untwisting; 2. External rotation.

Restitution.—As the head descends with its suboccipito-frontal diameter in the right oblique diameter of the pelvis the shoulders enter the pelvis in the left oblique diameter. When internal rotation of the head takes place the head is twisted a little on the shoulders. As soon as it is completely born it resumes its natural position with regard to the shoulders, turning with the occiput towards the mother's left thigh. This movement, which is performed as soon as the head is free, sometimes almost with a jerk, is called *restitution*, because by it the neck becomes untwisted and the head is restored to its natural relation to the shoulders.

Second Movement: External Rotation.—As the shoulders descend the right and anterior, being the lower, meets the resistance of the pelvic floor before the left, and so rotates to the free space in front, as did the occiput. The shoulders now occupy the antero-posterior diameter of the pelvis. As they rotate the head rotates with them, the occiput making a further movement towards the mother's left thigh. This brings the head into the position which it occupied at the beginning of labour, the face to the right and the occiput to the left (Fig. 89).

It will be noticed that the internal and external rotations are in opposite directions, the back of the head occupying the same position to the left at the end of the second stage of labour as it occupied at the beginning.

The shoulders then emerge, the right one escaping under the pubic arch, while the left slides over the perineum, followed by the rest of the body, which is usually born with no difficulty, being smaller than either the head or shoulders. The arms are usually folded on the chest, with the hands near the chin.

Second Vertex, R.O.A.

The occiput lies to the right and in front. In its internal rotation it travels along the anterior part of the right side of the pelvis to reach the middle line. Extension takes place as above. The shoulders enter in the right oblique diameter of the pelvis. When the head is free the occiput turns towards the mother's right thigh. The left shoulder rotates to the front, and the head makes a further rotation with the occiput towards the mother's right thigh.

Third and Fourth Vertex, R.O.P. and L.O.P.

The mechanism in the occipito-posterior positions depends on whether

1. The head is well flexed; or
2. The head is incompletely flexed.

The Head is well flexed.

Mechanism.—If the head is *well flexed* the occiput is in advance when the head meets the resistance of the pelvic floor. To escape from this resistance the occiput makes a *long rotation,* through three-eighths of a circle, to reach the free space under the pubic arch.

In the *third position* the occiput lies behind and to the right. It rotates along the right side of the pelvis to reach the front, the shoulders rotating with it from the left oblique diameter of the pelvis into the right oblique. When the head is born the first movement of external rotation carries the occiput towards the mother's right thigh. The left shoulder is the anterior and so rotates to the front, the occiput making a further movement towards the mother's right thigh.

Thus the mechanism in the third position is seen to be the same as in the second, after the head has made its long rotation. The occiput comes to occupy a position towards the right after emerging, just as it did when entering the pelvis.

In the *fourth position* the occiput makes a long rotation along the left side of the pelvis. The occiput rotates towards the mother's left thigh as soon as the head is born, the right shoulder comes to the front, the final stages being just the same as when the head lies in the first position.

When asked why some cases of occipito-posterior positions cause difficulty, many students reply that the reason is that the occiput has to make a long rotation and that therefore labour is prolonged. This is not correct. If the head is fully flexed, as it must be for the long

rotation to occur, there is no delay in the labour and no difficulty. The cause of difficulty is that in some cases flexion is incomplete, and therefore the normal long rotation does not occur.

The Head is incompletely flexed.—In some cases flexion is incomplete when the head lies in the third or fourth position. There are two reasons for this incomplete flexion:—

(*a*) When the back of the fœtus lies against the front of the uterus, with the spine flexed, the concavity of the fœtal body fits the convexity of the maternal spine. The tighter the abdominal muscles of the mother the more complete will flexion be. When, however, the back of the fœtus lies against the maternal spine the two convexities are in contact with one another. The fœtal spine has then a tendency to become less completely flexed, so as to fit the maternal convexity better. This causes slight extension of the head. The tighter the mother's abdominal muscles are the more likely it is that this slight extension of the head will occur. Consequently incomplete flexion of the head in occipito-posterior positions is most common in primiparæ.

(*b*) Herman has pointed out that when the occiput lies to the front, with the sagittal suture in one of the oblique diameters of the pelvis, the biparietal diameter, the largest transverse diameter of the head, lies in the other oblique diameter. When, however, the occiput occupies the posterior part of one of the oblique diameters the biparietal diameter does not lie in the other oblique, but in a smaller diameter, which is encroached on by the promontory of the sacrum. When the head is pressed down into the pelvis in this position, the biparietal diameter is hindered from descending if the pelvis is small or the head large, and so the forepart of the head descends more easily than the occiput, and the head enters the pelvis incompletely flexed. While the head is above the brim extension may go on until a face presentation is produced, but if the head enters the pelvis incompletely flexed further extension is impossible, as this would cause a still larger diameter to engage in the pelvis, and the pressure of the pelvic bones would not allow this to occur.

If flexion is incomplete the occipito-frontal diameter of the head, which measures 4½ inches, has to pass through the pelvis, instead of the suboccipito-frontal, which measures 4 inches, or the suboccipito-bregmatic, which measures 3¾ inches. It is this and the fact that sometimes neither the occiput nor the forehead is sufficiently in advance to influence rotation that explain why some cases of occipito-posterior positions cause difficult and prolonged labour. (see Fig. 64B).

Mechanism in Occipito-posterior Positions with Incomplete Flexion.—When the head is pressed down on to the pelvic floor the occiput is not the lowest part of the head, not having descended as much as it would have done if there were complete flexion.

The forehead is now as low as the occiput, and being at the anterior end of the oblique diameter of the pelvis, meets the resistance of the pelvic floor before the occiput. The forehead, therefore, goes to the front, to the free space under the pubic arch, rotating through one-eighth of a circle, while the occiput makes a short rotation backwards into the hollow of the sacrum. It is important for the student to understand *why* the occiput rotates into the hollow of the sacrum. The occiput goes to the back simply because the forehead goes to the front, the forehead being the important factor in the internal rotation because it is lower than the occiput, and therefore meets the resistance of the pelvic floor first. The root of the nose is now fixed against the back of the symphysis pubis. If the head is not too large it will be born in the following way: The root of the nose becomes the fixed point, instead of the nape of the neck as in normal cases, round which the head revolves. The head is pushed forward by the pelvic floor, and is born by a *movement of flexion*, the vertex emerging first, followed by the occiput. As soon as the occiput has escaped from under the perineum the head extends, the forehead, face, and chin emerging from under the pubic arch. The vulval orifice is stretched by the occipito-frontal instead of by the suboccipito-frontal diameter, and so a severe rupture of the perineum is likely to result (see pp. 472 to 477).

In some cases the position of the head remains oblique, neither the occiput nor the forehead being sufficiently in advance to influence rotation. In such cases no advance will take place, *i.e.* the head will not descend further, until some assistance is given. Even if rotation of the forehead to the front and of the occiput to the back, as described above, take place, if the head is large and hard so that sufficient moulding does not occur, or if the pelvis is smaller than normal, the head may not be born by the natural forces (see p. 325).

CHAPTER XXX

MANAGEMENT OF LABOUR

THE first rule in the management of labour is that the accoucheur should go as soon as he is sent for. His presence may be unnecessary for some hours, but it is not safe to count on this. If he goes at once he may find, *e.g.* a malpresentation, presentation or prolapse of cord, a pre-eclamptic stage, or, if he is seeing the patient for the first time, a contracted pelvis, and the sooner these conditions are diagnosed the more successfully and the more easily can they be dealt with. When the patient can afford it, the nurse arranges for the supply of antiseptics, sterilized overalls, accouchement sheet, swabs and cotton-wool, catheter, thermometer, nail-brush, douche-apparatus, enema-syringe, mackintosh sheets, and sterilized ligatures for the cord. In poorer class practice the accoucheur must take most or all of these with him, besides his rubber gloves, midwifery forceps, needles, needle holder, scissors, catgut and silkworm gut sutures, and hypodermic syringe. The drugs that are most likely to be wanted are some preparation of opium, chloral hydrate, pituitary extract, and ergot.

The Arrangement of the Bed.—A single bed is more convenient for the labour and for the lying-in than is a double bed. Two mackintosh sheets should be provided. One is placed on the mattress, with a blanket over it. The other is arranged on the right side of the bed, on top of the sheet, hanging over the edge so that it can drain into a foot-bath or slop-pail. If the bed sags in the middle a "fracture-board," or leaf of a table, should, if possible, be placed under the mattress, otherwise blood and liquor amnii will tend to gravitate into the middle of the bed and make an unnecessary mess. If the patient can afford it, a large clean pad of absorbent wool should be placed on the upper mackintosh and changed as often as is necessary.

The Patient's Dress.—The best costume consists of nightgown, petticoat, and dressing-gown. During the second and third stages

the night-gown is pinned up towards the armpits and so kept clean and out of the way. The vulva, thighs and buttocks should be covered with sterile towels.

By abdominal palpation and auscultation the presentation and position are diagnosed, and also whether the presenting part has entered the brim of the pelvis or is still above it. If the presenting part has not yet entered the brim, an attempt must be made to find out whether or not it can be made to enter. If the attendant has not time to stay with the patient indefinitely he makes a vaginal examination to investigate the size of the os, and then decides from the degree of dilatation, the strength and frequency of pains, and the fact that the bag of membranes is still unruptured or not, whether he must stay or can safely leave the patient for a time.

Only experience, and judgment of each case on its merits, will teach the student when he can safely leave for a time. If the os is not more than halfway dilated in a primipara and there are no unusual features about the case, he can go away for a time; but it is not safe to leave a multipara at this stage. It is far better for the patient's safety and for the doctor's reputation that he should stay for some hours unnecessarily than that he should be away when the child is born. If the patient is nervous, especially in a first labour, the doctor should not stay in her room all the time, but remain near at hand.

Management of the Premonitory Stage.—An enema of soap and water should be given, and if the patient's bowels have not been properly opened, a dose of an ounce of castor oil. The patient may have a warm bath, after which the external genitals and surrounding skin are thoroughly cleansed.

Management of the First Stage.—If everything is found to be normal the patient should be told that all is going well. She is usually much relieved when she hears that everything is "straightforward". It is unwise to allow oneself to be pressed into making any but very vague prophecies as to the probable duration of the labour.

If the vertex is presenting, with the occiput to the front, there is no need for the patient to stay in bed, and a distinct advantage in her walking about, resting on a chair or sofa when necessary. The weight of the liquor amnii and fœtus helps in the dilatation of the cervix, and the pressure on the lower uterine segment and cervix stimulates the uterus to contract. During the first stage the patient is not usually conscious of any progress, and is more

likely to be discouraged, nervous, fractious, and clamorous for assistance or relief if she is kept lying down than if she is allowed to walk about. If, on the other hand, the vertex lies in the third or fourth position, or there is any malpresentation, the patient must be kept in bed during the first stage to diminish the likelihood of early rupture of the membranes.

The pain during the first stage of labour is usually not very severe, though in primigravidæ it may cause a good deal of distress and sometimes vomiting, when the cervix is beginning to dilate. There is no object in telling a woman to bear down during this stage

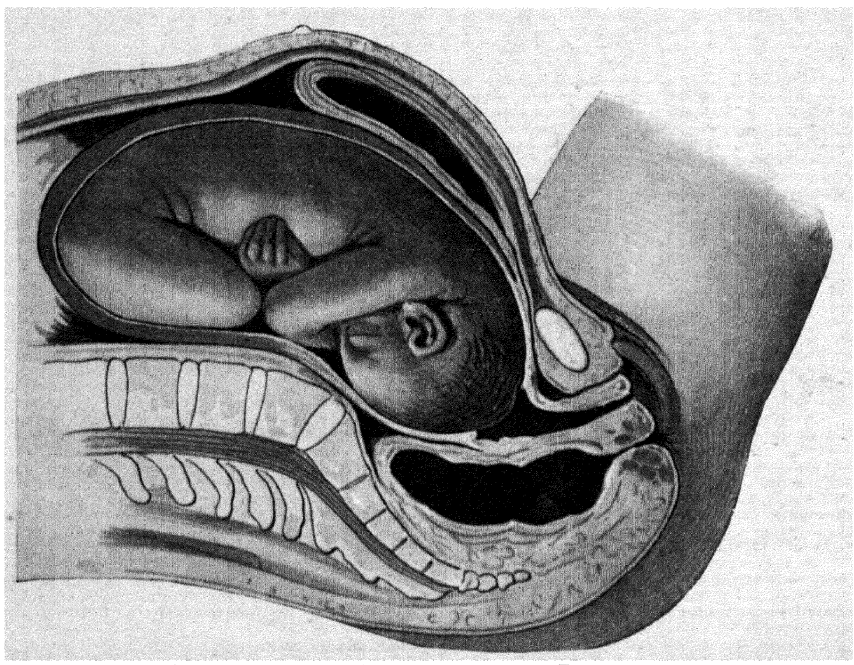


FIG. 90.—FULL BLADDER DURING LABOUR.

The ridge felt as the hand passes down the abdomen from above is a frequent cause of mistakes in diagnosis.

as is often done by nurses. No good can be done by bearing down before the dilatation of the os is complete or nearly complete, and the patient's strength and pluck are exhausted by such fruitless efforts. Many women experience a feeling of relief and comfort when the lower part of the back is pressed on or rubbed during a pain.

There is usually a frequent desire to pass water during this stage. If the bladder becomes full and the patient cannot empty it, a soft catheter must be passed, as a full bladder has an inhibiting effect on the uterine contractions. If the rectum is not empty an enema should be given.

The patient should be encouraged to take light food during the first stage, and to rest if she becomes tired and inclined to sleep. The vulval region having been thoroughly washed with soap and water by the nurse after the enema has acted, frequent swabbing with an antiseptic lotion during the second stage is advisable.

Management of the Second Stage.—During the second stage the patient must stay in bed. Until the head is distending the vaginal orifice, it is good practice to let her rest her feet against the bedpost and pull on a towel fastened to some fixed point. She should be encouraged to hold her breath and to bear down during the pains.

If the patient is not seen until the second stage has begun the lower abdomen should be palpated carefully, and if the bladder is found to be distended a catheter should be passed. If the head is filling up the pelvis, the bladder will be found to be lifted up so much that the catheter has to be passed a good deal further than usual before the flow of urine begins. It may be necessary to put a gloved finger into the vagina to guide the tip of the catheter. A celluloid or rubber catheter should be used, never a glass one.

Care of the Perineum.—In all cases of labour, especially in primiparæ, care should be taken that no unnecessary laceration of the vulva occurs. If the pains are strong and matters are left entirely to nature, a good deal of laceration of the perineum may be caused during the birth of the head. A tear of the fourchette in a primigravidæ is sometimes called an "inevitable laceration," but even this is not absolutely inevitable. A tear of the perineum begins, as a rule, in the posterior vaginal wall, and it is difficult to believe that application of greasy substances or of fomentations to the skin of the perineum, or "support" to the perineum given by the hand of the accoucheur can have any good effect in preventing a tear.

The management of the actual delivery of the head may be summed up under the following headings :—

1. Do not let the head be born too quickly.
2. Keep the head flexed until the occiput has escaped under the pubic arch.
3. If possible, do not let the head be born at the height of a pain.

As soon as the head begins to appear at the vulva the patient's feet should be removed from the bedpost, if she has been pressing

them against it in her expulsive pains, and if she has been pulling on a towel this must be taken away. She should be told not to hold her breath, but to cry out if she wishes to do so. If the pains are violent, the patient rather unmanageable, and there seems to be a danger of rupture of the perineum, it is good practice to administer a little chloroform during the end of the second stage. The accoucheur sits on the side of the bed facing the patient's feet, and pulls on the occiput during a pain if the perineum is being stretched to a dangerous extent. While he pulls on the occiput with his

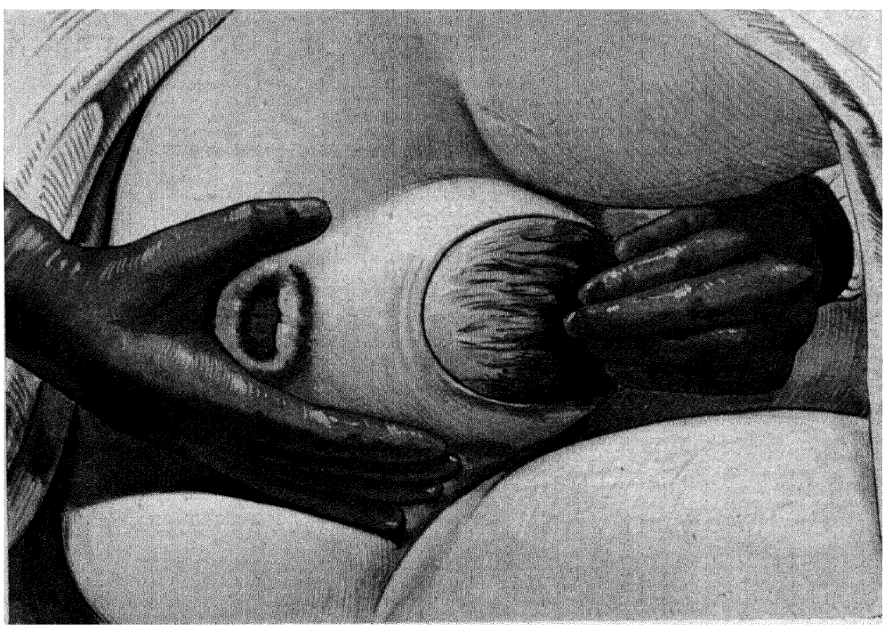


FIG. 91.—CARE OF THE PERINEUM.

The left hand is preventing sudden expulsion of the head, while the fingers and thumb of the right hand are gently helping the head forwards by pressure on each side of the anus. This pressure is exerted in an interval between two pains. Towels have been omitted for the sake of clearness.

fingers he presses the forehead upwards with his thumb. He also keeps the occiput from going forwards too soon if it shows any tendency to do so. If the head begins to extend before the occiput is free under the pubic arch and the biparietal diameter has begun to pass through the vaginal outlet, a larger diameter than the suboccipito-frontal will distend the vulva and a tear will result. The perineum should not be pressed on by the hand. If this is done the uterus and abdominal muscles are stimulated to more powerful efforts, and the pressure on the perineum must tend to cause too early extension of the head. When the vulval orifice has been

holding the vertex, otherwise a violent pain may drive the shoulders through the vulva suddenly, causing unnecessary laceration. Directly the head is born a finger should be passed into the vagina to feel whether a loop of cord is round the neck or not. If it is the loop should be slipped over the head, or, if this cannot be done, over the shoulders. If the loop cannot be slipped either way, the cord should be cut and the child's end, *i.e.* the end from which the artery is spurting, picked up and compressed or tied as soon as possible.

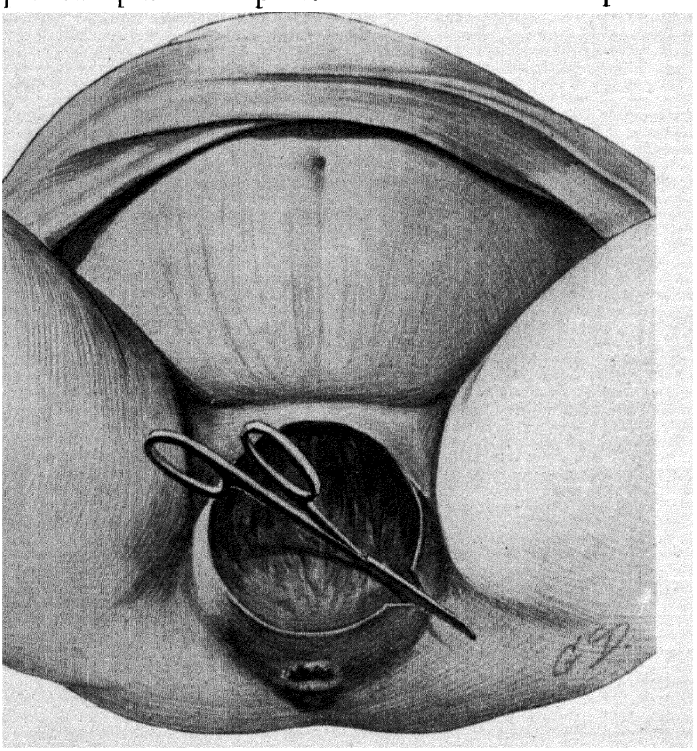


FIG. 92.—EPISIOTOMY.

The pair of scissors have made an incision as deep as is necessary and should now be withdrawn.

The left hand should now be placed on the mother's abdomen, which should be covered with a sterile towel, and should follow down the fundus as the rest of the child is born. The shoulders usually follow rapidly after the birth of the head. The perineum must be watched carefully during the birth of the shoulders, especially if it has been slightly torn already by the head. It can be protected to a certain extent by directing the child's body forwards as much as possible, supported in the right hand.

The rest of the body quickly follows, the right hand guiding it

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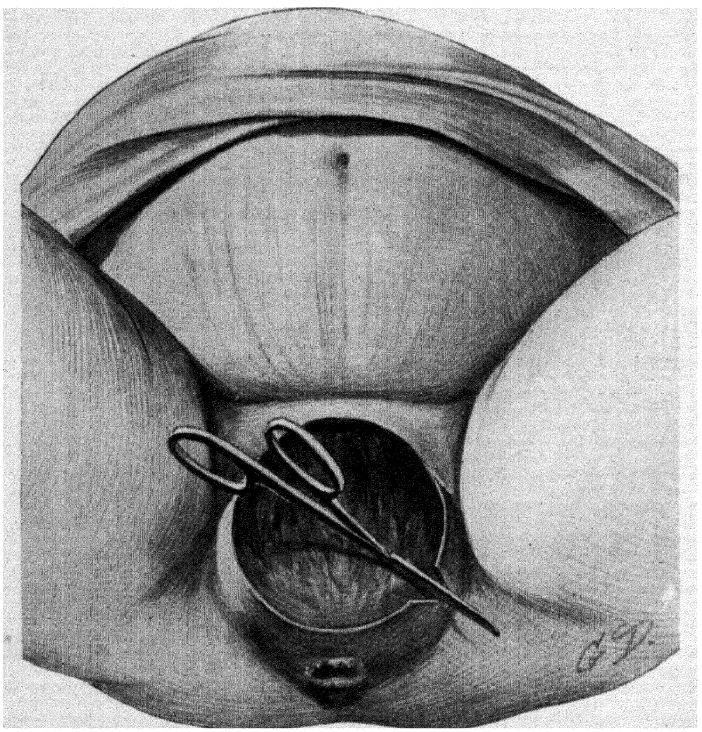


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The rest of the body quickly follows, the right hand guiding it

forwards and laying it on the bed while the left hand follows the uterus down.

The mouth and nostrils of the child are gently wiped, and if it does not breathe or cry at once it is stimulated by the doctor blowing on it or smacking it lightly on the buttocks. If this does not make it cry, it should be treated as is directed on page 617.

Extraction of the Shoulders.—If the shoulders do not descend after the birth of the head, the mother should be exhorted to bear down. If the shoulders still do not move, and the child's face is getting blue, their birth must be assisted. Sometimes all that is necessary is to insert a finger and make sure that the shoulders lie in the antero-posterior diameter of the outlet. If the shoulders have not rotated into the antero-posterior diameter they must be rotated by digital pressure. If there is still delay after rotation of the shoulders is complete there are three methods that may be adopted:—

1. Pushing from above, by the hand on the fundus.
2. Pulling on the head.
3. Pulling on the anterior axilla.

Any one of these methods may be successful, but none is free from danger if much force is used. The first method may rupture the perineum, the second may injure the cervical nerves or the sterno-mastoid muscle, and the third may fracture the clavicle. The best thing to do is to combine the three, when very little force need be used. The neck is pressed gently backwards so that a finger may be passed through the axilla. The tip of the finger must not press into the axilla, but must go beyond it so that the pressure on the axilla is made by the middle section of the finger. Then gentle traction is made by this finger while the other hand pulls on the head, so that the shoulders are extracted by a gentle pull in a forward direction, exerted partly on the head and partly in the axilla, while at the same time the nurse makes downward and backward pressure on the fundus.

Separation of the Child.—The cord should not be tied until the child has cried vigorously, the pulsation has ceased except in the last few inches from the umbilicus, and the umbilical vein has collapsed. If it is tied immediately, the child is deprived of 2 or 3 ounces of blood which should have been drawn out of the placenta by the expansion of the lungs. As these 2 or 3 ounces correspond to 2 or 3 pints in an adult, the importance of waiting a few minutes before tying the cord is evident. The cord should be tied about 2 inches from the umbilicus, a reef-knot being used, care being taken

that the umbilicus is not pulled on during the tying of the ligature. It is not necessary to tie a second ligature (except in the case of uniovular twins, see p. 405), as the mother does not bleed from the cord, only a few drachms of fœtal blood oozing from the cut end. It is usual, however, to tie two ligatures, and cut between them, to prevent this slight escape of blood into the bed. The ligatures generally consist of three or four strands of packthread tied into a knot at each end. They should be boiled and left in the boiled water or some antiseptic solution until wanted.

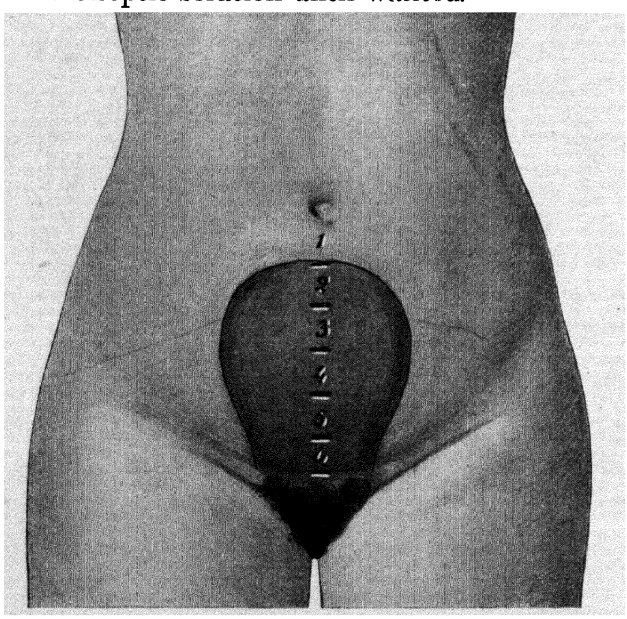


FIG. 93A.—THIRD STAGE OF LABOUR.

Diagram to show the height of the fundus when the placenta is still in the uterus.

Management of the Third Stage.—The third stage of labour is a natural and physiological process, and whatever may be done by men of large experience, it is most unwise for a beginner to interfere with it unless hæmorrhage is occurring. Forcible stimulation of the uterus is likely to result in contractions which will cause partial separation of the placenta before the proper time, with consequent hæmorrhage, and possibly retention of chorion or a portion of the placenta.

The student must thoroughly understand what is meant by the term "expression of the placenta". In the management of a normal labour the placenta is expressed from the vagina, not from the uterus. In normal conditions the uterus expels the

placenta into the vagina, and the attendant expresses it from the vagina by pressing on the uterus, if the abdominal muscles do not complete its expulsion. This is the only method of expression which is legitimate in normal cases. If the placenta is expressed from the uterus there is danger of a portion of it being released. In cases in which bleeding occurs from the placental site before the placenta has left the uterus the placenta must be expressed from the uterus by squeezing (*vide* p. 509), but this method is kept for such abnormal cases. The uterus must never

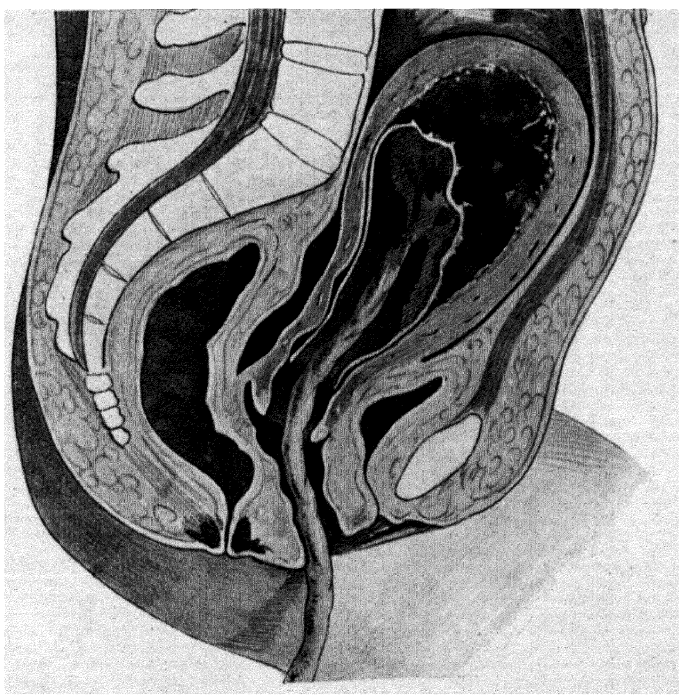


FIG. 93B.—THIRD STAGE OF LABOUR.
The placenta is still *in situ*.

be pressed on when it is not contracting, as such treatment may cause *inversion* of the uterus, *i.e.* it may be turned inside out.

It is best to have the patient lying on her back during the third stage. There is an advantage in this position if the abdominal wall is fat or flabby, as the uterus is easier to feel when the patient is on her back than when she is on her side. Another advantage is that blood is less likely to collect in the uterus when the patient is on her back. The fundus reaches to about an inch below the umbilicus. The uterus ought not to feel round but flattened antero-posteriorly, so that it fits very well into the hand with the thumb in front and the fingers behind. The left hand should be placed

on the abdomen with the thumb uppermost, the palm turned toward the patient's feet. The ulnar border is then sunk into the abdomen so that the fundus of the uterus lies in the hollow of the hand, and any distension is at once noticed. When the uterus is held in this way so that enlargement cannot fail to be noticed, there is no need to stimulate it unless it bleeds. If the blood is running out it will be seen; if it is retained the uterus will increase in size. If the student does not feel confidence in his own powers of observation, he can press the fundus gently downwards from time to time to see

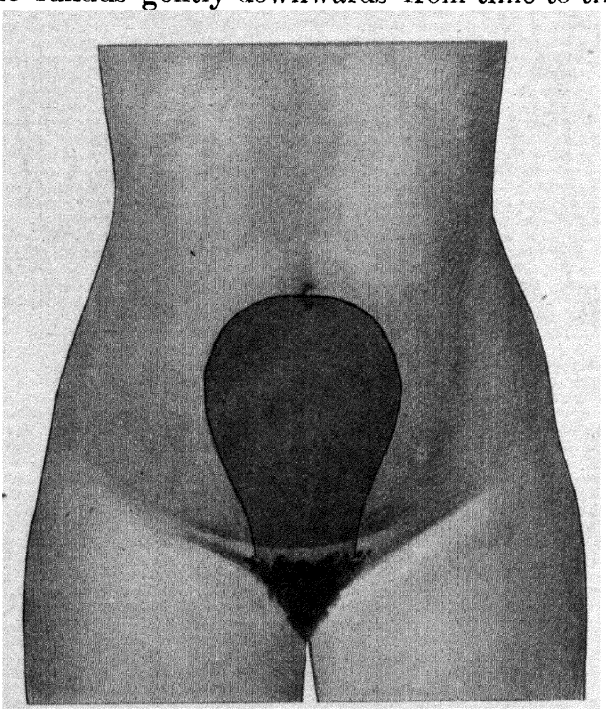


FIG. 94A.—THIRD STAGE OF LABOUR.

Diagram to show the height of the fundus when the uterus is perched on the placenta. (Compare with Fig. 93A.)

whether more than a trickle of blood escapes. If the uterus gets larger under his hand, he should stimulate it gently with the tips of his fingers. After a few minutes the uterus generally begins to contract again, and before long the placenta is expelled into the vagina. Sometimes, if the patient makes voluntary expulsive efforts, it may be expelled into the bed (Figs. 93A and 93B).

Signs that show that the Placenta has been expelled into the Vagina

1. The cord moves down. This sign is most to be relied upon if a knot has been tied close to the vulva after the slack of the cord has been pulled out of the vagina. In a case of doubt the

fundus may be gently pushed down. If the extra length of cord expressed does not return on letting the fundus rise again, the placenta has been separated.

2. The uterus rises up, and feels smaller, rounder, and more movable. It is now perched on the placenta, and so the fundus reaches to the level of or just above the umbilicus. At the same time it is more easily grasped as a whole, although it is rounder,

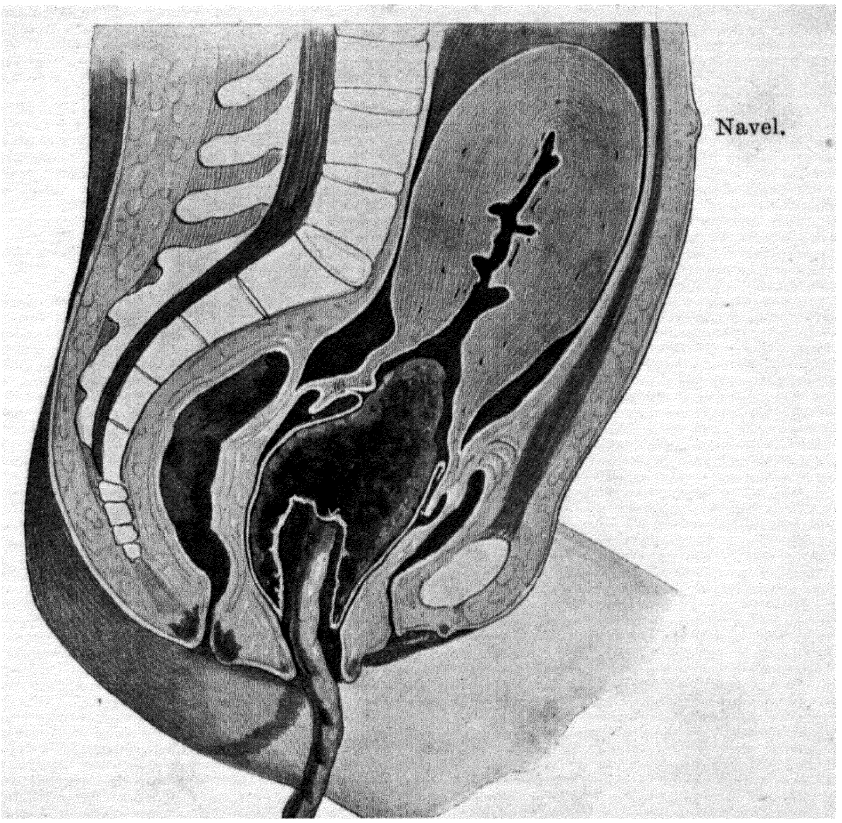


FIG. 94B.—THIRD STAGE OF LABOUR.

The placenta has been expelled into the vagina, and the uterus, perched on the placenta, has risen to a higher level than it reaches in Fig. 93B.

and the fundus has lost the sort of edge that it often has while the placenta is still in the uterus (Figs. 94A and 94B).

3. There is frequently a little gush of blood when the placenta leaves the uterus. This does not prove that the placenta is in the vagina, but, if there has not been any bleeding before, makes it very likely that the placenta is ready to come away.

Now is the time for "expression," if the patient is not able to expel the placenta by straining. The accoucheur grasps the uterus with his left hand, makes it contract by stimulation with

the tips of his fingers if it is not contracting, and presses it downwards and backwards at first, and then directly downwards. As the placenta comes out of the vulva it is received in the right hand, and gently drawn away from the mother. If the third stage has been left to nature, the membranes generally slip out after the placenta. If, however, they do not come away with gentle traction on the placenta, they should be taken between the finger and thumb and very gently pulled. The last parts to be separated then glide out. The left hand must still be kept on the uterus until it is certain that it is well retracted and not inclined to bleed. At the end of the third

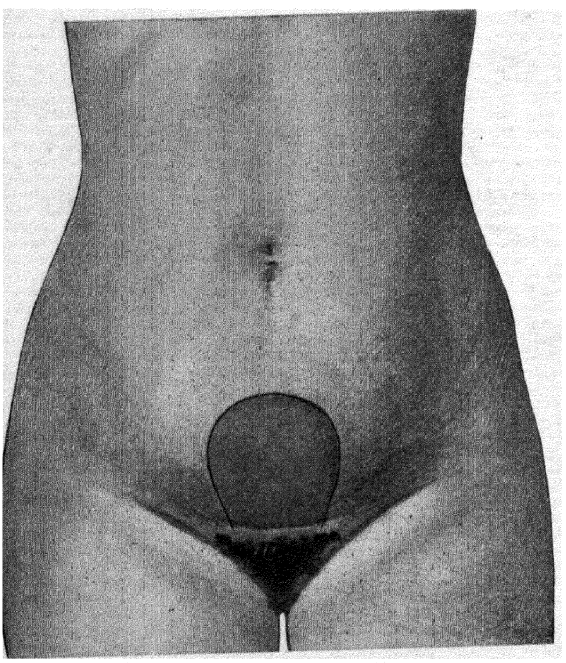


FIG. 95A.—THE END OF THE THIRD STAGE OF LABOUR.

Diagram to show the height of the fundus when the uterus is empty, contracted and retracted. (Compare Figs. 93A and 94A.)

stage of labour, when the uterus is empty and retracted, the fundus reaches halfway between the umbilicus and the pubes (Figs. 95A and 95B). A few hours later, the fundus reaches 5¼ inches above the pubes owing to the recovery of the pelvic floor and progressive retraction of the lower uterine segment.

Examination of the Placenta and Membranes.—The placenta and membranes must always be thoroughly examined as soon as possible. If the membranes have been inverted during birth, so that the amnion is on the outer side, as commonly happens, the placenta must be gently pushed out through the hole in the membranes,

so that its maternal surface can be examined. This is best done by placing the placenta on the palms of both hands, maternal surface upwards. If there is much adherent clot it should be removed either with the fingers or by washing. The maternal surface will be seen to be marked by numerous furrows, or *sulci*, dividing the placenta more or less into lobes. When the surface is made roughly concave, all these lobes should fit into one another. If the placenta is torn, but complete, it will be seen that the sides of the tear meet without any tissue being missing. If, however, any part is retained, a gap will be seen which cannot be filled up completely by making the surface concave.

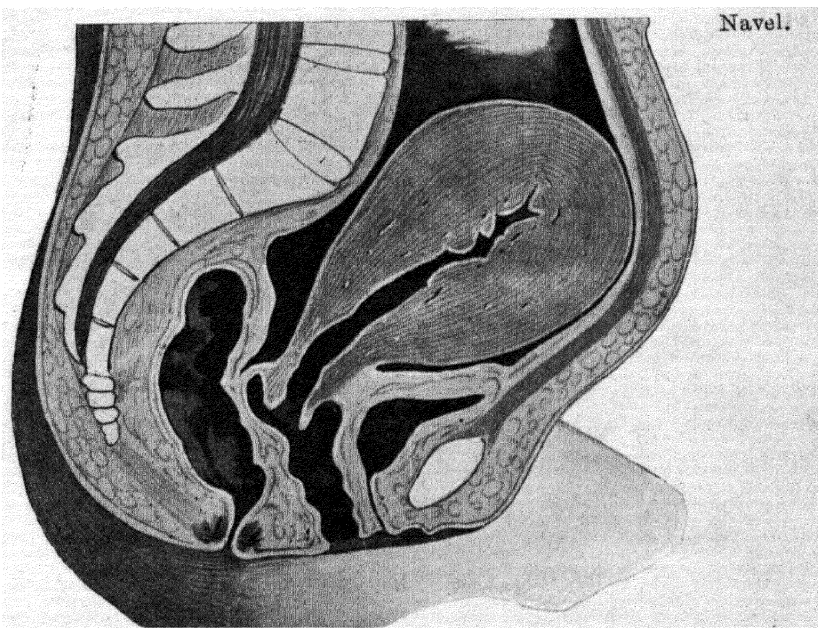


FIG. 95B.—THE END OF THE THIRD STAGE OF LABOUR.

The uterus is empty, contracted and retracted, and reaches to a much lower level than in Figs. 93B and 94A.

Having satisfied himself as to the condition of the maternal surface of the placenta, the attendant proceeds to examine the membranes. These should form a bag, complete except for the hole through which the child passed. The amnion and chorion should be gently separated from one another, and each examined separately. Some care is generally necessary in doing this until the edge of the placenta is reached, but the amnion can be separated easily from the placenta right up to the insertion of the cord.

The amnion is a tough, thick, translucent membrane. No portion of it is likely to be retained, as it is not attached to the uterus. The chorion, on the other hand, is attached to the decidua,

and so it is not uncommon for portions of it to remain behind. It should form a bag, and should be attached all round to the edge of the placenta. If chorion is missing from any part of it, a careful search must be made to ascertain whether the membrane has simply been torn at this point, or whether part of it has been torn off and retained in the uterus. A blood-vessel may be found running off the placenta on to the chorion, and returning to the placenta a little further along. Such a vessel is called an *aberrant vessel*, and is of no importance.

A more important condition is that in which two blood-vessels, an artery and a vein, run off the edge of the placenta, going to a small detached island of placental tissue called a *succenturiate placenta*. If this has come away, together with the main placenta, it will be plainly seen. If it is retained, there must be a hole in the chorion corresponding to it, and a pair of vessels torn through at the edge of the hole. Succenturiate placentæ are not very common, but the possibility of their occurrence should never be forgotten in an examination of the placenta, as a careless examination would fail to reveal the fact that such an island of placental tissue had been left behind. They are found most commonly in association with cases of placenta prævia.

The chorion, when separated from the amnion, is found to be friable and is not translucent. On its uterine surface are seen fragments of soft reddish tissue, the decidua. The reason why such a careful examination is important is that, if a piece of placenta is retained it may cause postpartum hæmorrhage, and subsequently will cause subinvolution of the uterus and bleeding if it continues to live, and septic poisoning if it dies and becomes infected.

Retention of a Piece of Chorion.—If only a small portion of chorion is retained it will probably be discharged with the lochia and not cause any trouble. If, however, a large portion of chorion is found to be retained, two fingers inserted into the vagina will discover whether it is hanging out of the cervix. If so, it may be removed. If it is entirely inside the uterus it is safest to leave it (see p. 518).

Examination of the Perineum.—The vulval outlet must be examined carefully for lacerations. These are a source of danger during the puerperium, affording absorbing surfaces, so anything more than a minute laceration must be sewn up. It is not enough to make an inspection of the skin-surface of the perineal body—the

labia must be separated, and the lower part of the posterior vaginal wall examined. All ruptures of the perineum require careful suturing, as is described on page 474.

Vaginal and vulval lacerations seldom cause much bleeding unless they involve the tissues round the clitoris or varicose veins, when the bleeding may be severe.

It is good practice, although not essential, to give a dose of liquid extract of ergot, one teaspoonful in a wine-glassful of water, or a hypodermic injection of ergotin after the birth of the placenta, to aid in the contraction and retraction of the uterus.

Management of Cases of Occipito-posterior Position with Incomplete Flexion.—Early in labour diagnosis of an occipito-posterior position may often be made without difficulty by abdominal palpation. The fact that flexion is incomplete may be suggested by early rupture of the membranes. Obliquity of the uterus has some effect in causing flexion or extension of the head, and some good may be done by placing the patient on her side so that the back of the fœtus shall lie uppermost, *i.e.* she should lie on her left side for a third position of the vertex and her right for a fourth position. To do any good this position must be assumed fairly early in labour, at a time when incomplete flexion is seldom diagnosed. Later on in labour the position can usually be diagnosed readily on vaginal examination, and the fact that the flexion is incomplete is recognized by the low situation of the anterior fontanelle and the ease with which it is felt. But in some cases, when the head has been long delayed in the cavity of the pelvis, in spite of good pains, diagnosis may be difficult. Abdominal palpation may be unsatisfactory, as most of the liquor amnii has drained away, the patient is straining, and uterine contractions are frequent. Vaginal examination may be unsatisfactory, as the sutures and fontanelles may be much obscured by the caput succedaneum and by overlapping of the bones. In these circumstances a common practice, and a very bad one, is to apply the forceps and pull vigorously. The forceps is likely to slip off, with more or less damage to the fœtal head and to the maternal tissues, and unless axis-traction forceps is used delivery of the head is likely to cause a severe degree of laceration of the perineum. A careful examination should be made to ascertain the cause of the delay in labour. If an ear can be felt its free border will point in the direction of the occiput, and will show that the occiput has rotated into the hollow of the sacrum. If the accoucheur is in doubt as to the position of the occiput, he should give an anæsthetic and insert his whole hand into the vagina, when there will be no difficulty in proving

that the occiput is behind, the nape of the neck and spinous processes of the cervical vertebræ being felt with certainty. He will then recognize that the delay is due to the fact that the occiput has not rotated properly, owing to the incomplete flexion of the head. It is often a difficult matter to determine the proper time at which to interfere in these cases. As long as the head is advancing with the pains the case may be left to nature. When, however, no further

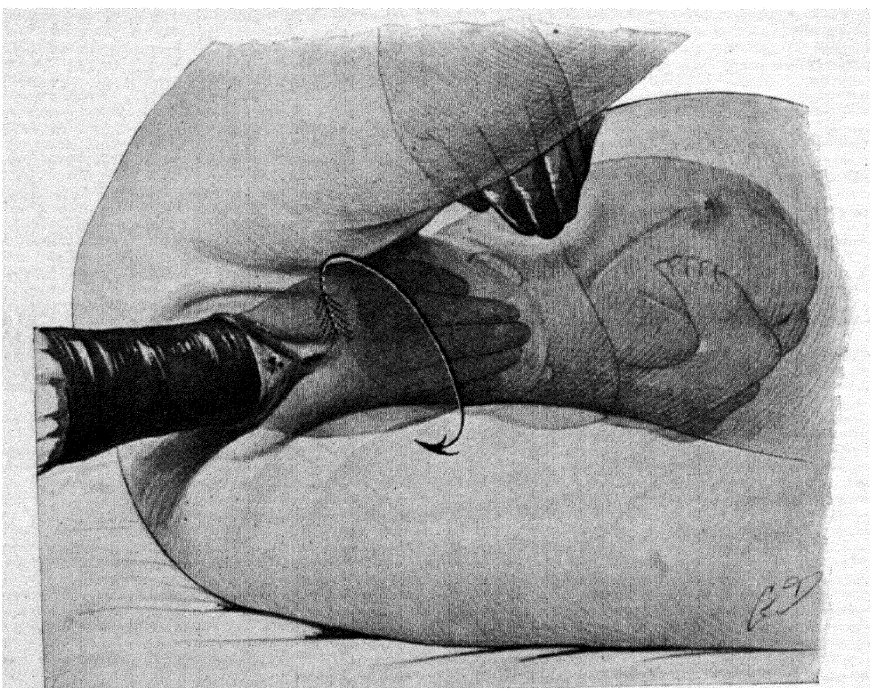


FIG. 96.—BIMANUAL ROTATION OF THE CHILD IN PERSISTENT R.O.P. POSITION.

The right hand, squeezed in between the pelvic wall and the head, is rotating the head, while the left hand, placed on the abdomen, is rotating the body by pressing the left shoulder forwards and to the left. This is the best method for ordinary use.

advance is apparent in spite of good pains, interference is necessary Obviously the ideal treatment is

1. To flex the head.
2. To help the occiput to rotate forwards.

Head Flexion.—Repeated attempts at flexing the head are to be deprecated, as they entail frequent insertion of the fingers into the vagina and consequently increase the risk of sepsis.

To flex the head, push the forehead upwards during a pain. If the forehead can be pushed up the occiput will come down, and the suboccipito-frontal diameter will be engaged in the pelvis instead

of the occipito-frontal diameter. Attempts to flex the head are harmless, except as stated above, but often fail.

If the head has been flexed successfully rotation of the occiput to the front will be brought about by the natural forces. If the attempt at flexion fails manual rotation should be performed.

Manual Rotation.—In the third position, the patient lying on her left side, the right hand should be inserted between the head and the right side of the pelvis. This hand is then swept forward

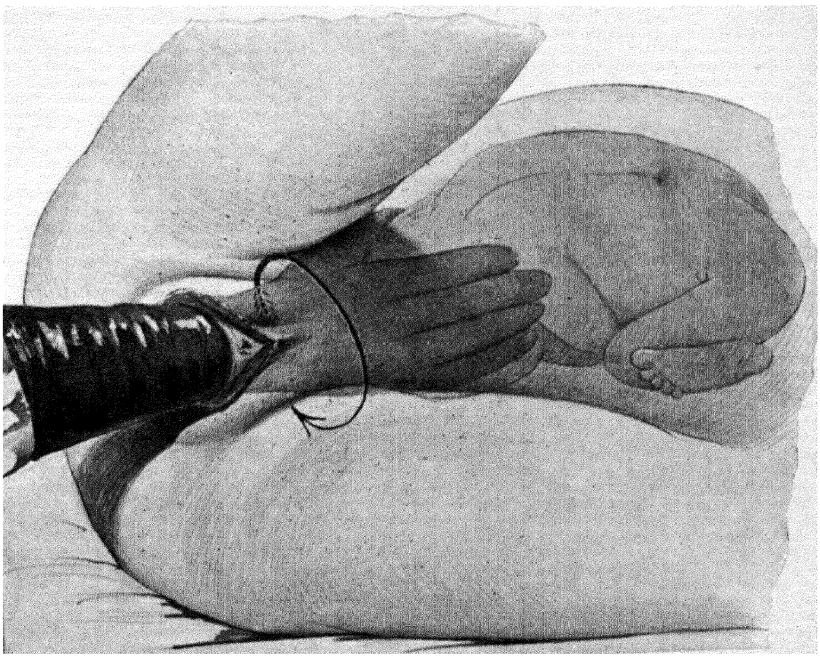


FIG. 97.—MANUAL ROTATION OF THE HEAD AND SHOULDER IN PERSISTENT R.O.P. POSITION.

The disadvantage of this method, compared with that shown in Fig. 96, is explained in the text.

and to the left in an interval between the pains, while at the same time the left hand, placed on the mother's abdomen, grasps the anterior shoulder as well as it can and pushes it in the same direction. The internal hand works at a greater advantage with the patient on her side than when she is on her back. No great force must be used, lest the lower uterine segment be ruptured. As a rule this manual rotation is not difficult if the patient is under an anæsthetic. It is not enough to rotate the head, the body must also be rotated by the external hand displacing the shoulder, or the head will soon reassume its old position with the occiput in the hollow of the

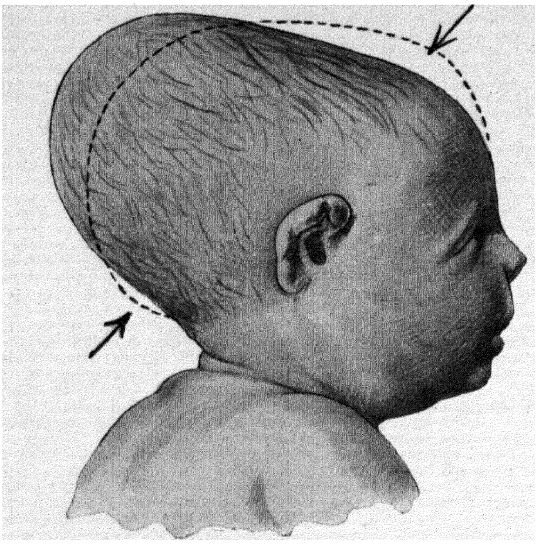


FIG. 98.—MOULDING OF THE HEAD IN OCCIPITO-ANTERIOR POSITIONS.

The dotted outline shows the shape of the head before moulding. The suboccipito-frontal or suboccipito-bregmatic diameter is compressed, while the vertico-mental diameter is increased in length.

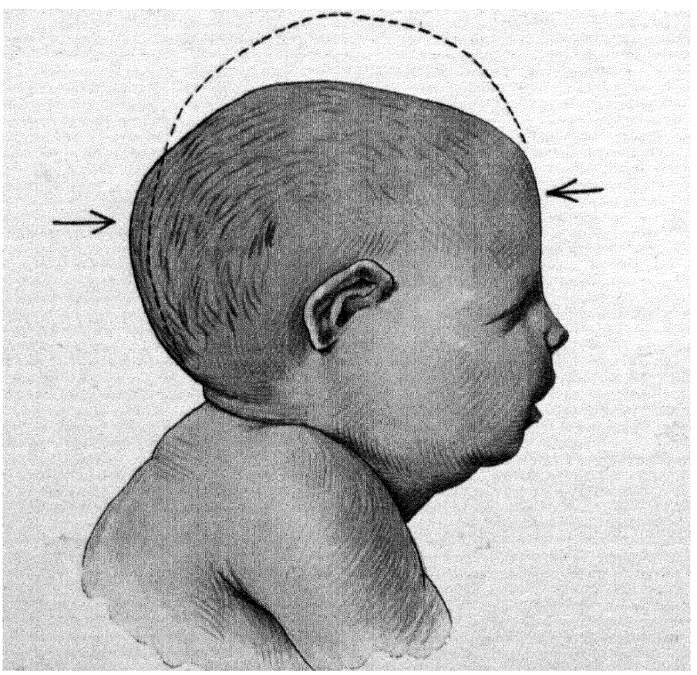


FIG. 99.—MOULDING OF THE HEAD IN PERSISTENT OCCIPITO-POSTERIOR POSITIONS.

The dotted outline shows the shape of the head after moulding. The occipito-frontal diameter has been compressed, with the result that the head has been lengthened in a vertical direction.

sacrum. When the head has been rotated, it can be delivered easily with the forceps or can be left to be expelled by the natural forces.

If the abdomen is not covered with a sterile towel, it will be necessary to clean up the left hand again after it has been used for rotating the shoulder (Figs. 96 and 97).

When successfully carried out this manual rotation is one of the most pleasing operations in midwifery, the alternatives being forcible extraction with the forceps or a very long tedious labour with almost inevitable laceration, sometimes to a terrible extent. The head should never be rotated with the forceps, since if this is done one edge of each blade may dig into the head, causing possibly intracranial hæmorrhage, while the other edge of each blade may split the vaginal wall. If the axis-traction forceps is used, in the rare cases in which manual rotation fails, it may be found that while traction is made on the rods the head rotates as it descends. The forceps should then be taken off and reapplied.

Some obstetricians prefer, if the head is not fixed, having displaced it with the internal hand, to push the hand farther up so as to reach the anterior shoulder, and then to rotate both head and shoulder with the same movement. This entails more risk, as the hand enters not only the vagina but also the uterus, and should only be employed with a perfect aseptic technique and anæsthesia to a surgical degree.

If the child is undoubtedly dead, perforation is the correct treatment, the risk of injury to the mother by manual rotation of the head being thus avoided. With proper management such a termination should be very rare.

Moulding of the Head in Vertex Delivery.—In occipito-anterior positions the greatest squeeze is exerted on the suboccipito-frontal diameter, consequently this diameter is diminished while the diameter at right angles to it, *viz.* the vertico-mental, is increased in size. No change can take place in the shape of the lower jaw, but the head is elongated in an upward and backward direction.

In unreduced occipito-posterior positions the greatest squeeze is in the occipito-frontal diameter, consequently this diameter is diminished in size and the head is elongated in an upward direction, becoming shorter in the antero-posterior and longer in vertical measurements, with a steep high forehead and a straight back to the head with loss of the usual roundness.

(*B*) *ABNORMAL LABOUR*

CHAPTER XXXI

ABNORMAL PRESENTATIONS

ONE of the criteria of normal labour is that the child should present by the vertex. The term "abnormal presentation" may be taken to include presentations other than the vertex. But it must not be assumed that labour with a vertex presentation will be normal and easy, or that in other presentations labour will be abnormal and difficult. Complications other than the presentation may render labour abnormal, and in vertex presentations an occipito-posterior position may give rise to considerable delay and difficulty in labour. Also in some of the abnormal presentations, face and breech for instance, delivery may occur easily and without danger to mother or child.

Under this heading will be considered—

Face Presentations;
Brow Presentations;
Breech Presentations;
Shoulder Presentation, or Transverse lie of the child;
Complex Presentation in which a limb presents with the vertex.

The cause of abnormal presentation is not always easy to determine, and in many cases no satisfactory reason can be given. There are certain conditions, however, in which presentations other than the vertex are particularly liable to occur, and the common factor in many of them is that there is something present which interferes with the easy engagement of the head in the pelvic inlet. Thus any form of pelvic contraction or pelvic tumour, or even the low attachment of the placenta in placenta prævia, may prevent the descent of the vertex into the pelvic brim, and so result in some other part presenting. Marked obliquity of the uterus, such as is frequently seen in multiparous women with a lax abdominal wall, may result in the head being directed against, instead of into, the pelvic brim,

so that extension of the head—resulting in a face or brow presentation—may occur, or the head may slip up into the iliac fossa and the shoulder present. Similarly the presence of more than one fœtus in the uterus may result in one interfering with the engagement of the other. If the fœtus is very small or very large, an abnormal presentation is more likely to occur than with an average-sized child. Thus premature, dead, macerated or malformed fœtuses and monsters all provide an unusually large proportion of malpresentations.

Hydramnios, because it is often accompanied by a small or monstrous fœtus, and because of the undue degree of mobility of the fœtus which it allows, is another condition in which abnormal presentation is unduly frequent.

FACE PRESENTATIONS

In face presentations there is complete extension of the head, so that the occiput is pressed firmly against the back of the neck while the chin is stuck out forwards as far as possible.

Cause

Face presentations may be present before labour begins, or they may be produced secondarily after labour has begun. In the former case they may result from congenital malformations as anencephaly, tumours of the neck large enough to interfere with flexion, or a spastic condition of the muscles of the neck. Such conditions are very rare, and face presentations are more often produced after the onset of labour by difficulty in the entrance of the head into the lower uterine segment and pelvis. This may be due to contraction of the pelvis or large size of the head. The painless contractions of pregnancy by their repeated efforts to force the head into the pelvis, only succeed in producing extension of the head, because its widest diameter (biparietal) encounters the greatest resistance at the brim. Obliquity of the uterus and pendulous belly, by altering the angle at which the uterus is inclined to the plane of the pelvic brim may produce extension of the head. The usual obliquity of the uterus is a lateral displacement of the fundus to the right, so that it follows that the direction in which the uterine force will act is from right to left, as shown in Fig. 100. When the fœtus lies with its back to the left, this obliquely acting force will tend to push the occipito-spinal joint in the direction of the occiput,

and will thus aid flexion. When, however, the fœtus lies with its back to the right, this force will tend to push the occipito-spinal joint in the direction of the face and so cause extension. The same results occur in pendulous belly, only in this case extension is favoured when the fœtus lies with its back to the front, flexion when the back is directed towards the mother's spine.

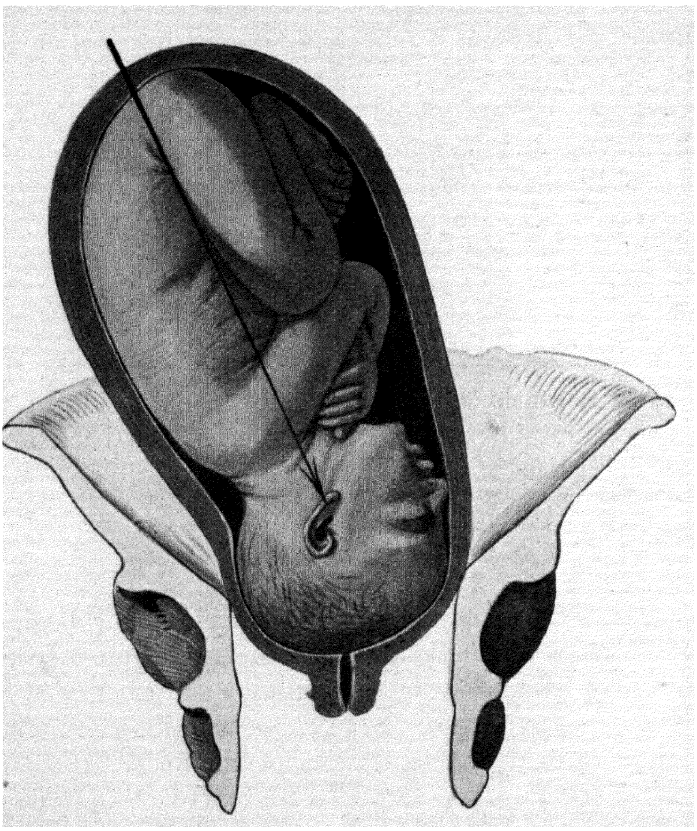


FIG. 100.—PRODUCTION OF A FACE PRESENTATION BY OBLIQUITY OF THE UTERUS.

The line of uterine force tends to push the occipito-spinal joint in the direction of the face and so cause extension, when the fœtal back is to the right.

It is interesting to note that in face presentations it is about as common to find the back to the right as to the left, whereas in vertex presentations the back is towards the left more than twice as often as to the right. This has been taken as showing that a position with the back to right favours the production of face presentations.

These mechanical factors can all act before labour begins, and so produce primary face presentations. The same factors, however, much more commonly bring about face presentations after labour

has started, and the presentation is then considered as secondary. When once extension has commenced each uterine contraction will tend to increase it, as is seen in Fig. 101, which shows that when extension has begun, the line along which the uterine force acts will fall behind the occipito-spinal joint and so increase extension.

The dolicho-cephalic head, in which the occipito-frontal diameter

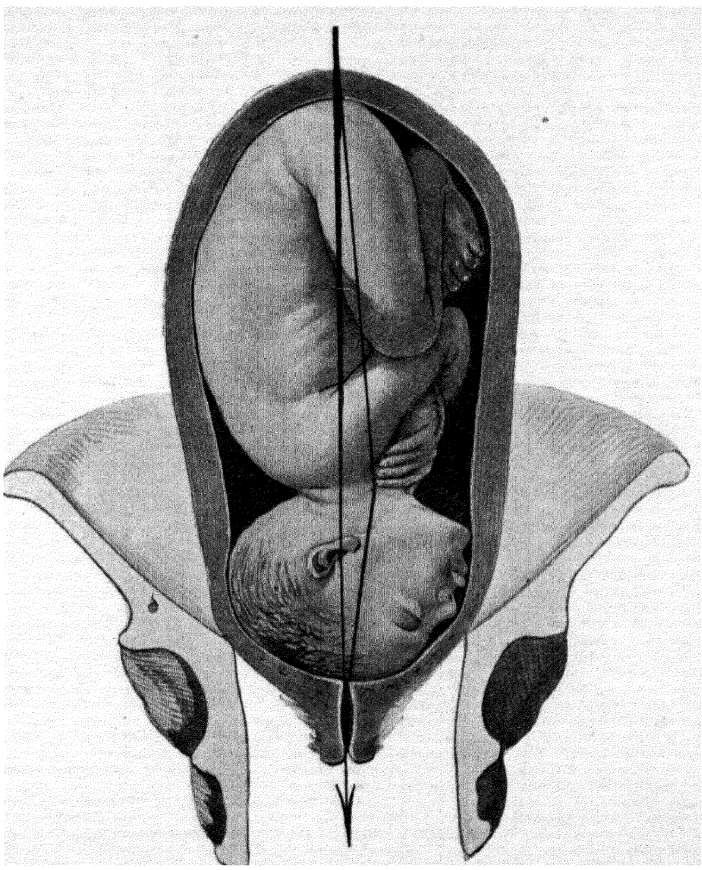


FIG. 101.—PRODUCTION OF FACE PRESENTATION IN A FLAT PELVIS.

Extension occurs because the wide bi-parietal diameter is arrested. Once sufficient extension is present to get the occipito-spinal joint in front of the direction in which the uterine force acts, shown by the arrow, the tendency will be for that force to increase the extension and cause the face to present.

is unusually long, has been regarded as a cause of face presentation, owing to the greater leverage offered by the increased projection of the occipital end of the head. As the moulding in face presentations results in an elongation of the antero-posterior diameter of the head, it is more probable that the shape of the head is an effect rather than a cause of face presentation. Extension of the back, which may occur in consequence of a very short umbilical cord or a cord

relatively short owing to its being round the neck, may also conduce to extension of the head.

Face presentation occurs about once in 250 to 300 labours, and appears to be slightly more frequent in multiparæ than primigravidæ, probably owing to the effect of laxity of the abdominal walls in women who have borne children.

The face replaces the vertex in the pelvis, and the entire face, *i.e.*

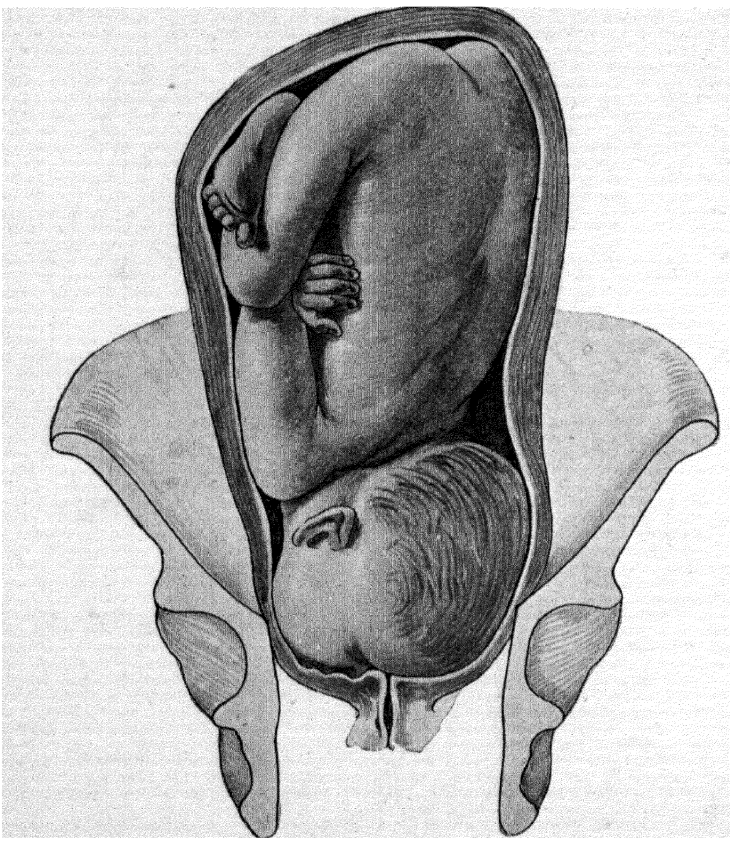


FIG. 102.—FACE PRESENTATION: FIRST POSITION.

The face from the chin to the bregma presents, the submento-bregmatic diameter occupying the right oblique of the pelvic inlet. The back looks forward and to the left, but is extended instead of flexed as in a vertex presentation, so that the breech is more prominent and more easily palpated.

from the chin to the forehead, presents at the brim, so that the mento-bregmatic diameter corresponds to the occipito-frontal and the submento-bregmatic to the suboccipito-bregmatic (see Fig. 66A). The back of the child is extended as well as the head, but the limbs remain flexed on the body, though the extension of the spine and consequent prominence of the abdomen produces a separation of the knees from the elbows (Fig. 102).

Positions.—The chin (Latin *mentum*) is the denominator in face presentations, and four positions analogous to those in vertex presentations are described, but as they are numbered in a different way, special attention must be called to their designation. The positions of the face are numbered according to the position of the vertex from which they would secondarily arise. For instance, if a first vertex position is converted into a face by extension of the head, the face will present with the chin backwards and to the right, and with the long axis of the face in the right oblique diameter of the pelvis. In other words, the first face position is one with the chin opposite the right sacro-iliac synchrondrosis. The position of the back in face presentations is the same as in the corresponding position of the vertex. The four positions of the face are :—

1. The right mento-posterior, R.M.P. The chin is directed to the right and behind. The back is forwards and to the left (Fig. 103).

2. The left mento-posterior, L.M.P. The chin is directed to the left and behind. The back is forwards and to the right (Fig. 104).

3. The left mento-anterior, L.M.A. The chin is directed to the left and in front. The back is backwards and to the right (Fig. 105).

4. The right mento-anterior, R.M.A. The chin is directed to the right and in front. The back is backwards and to the left (Fig. 106).

In this classification it will be noticed that, though starting from a different point (the right sacro-iliac joint), the denominator, in following the four positions in numerical order, moves round the pelvis in the same direction as in the vertex positions, *viz.* that of the hands of a watch.

The third and fourth positions are relatively more frequent than in vertex presentations, no doubt due to the fact that incomplete flexion is usual in third and fourth positions of the vertex, and hence arrest of the occiput at the brim and descent of face is more favoured in these positions. The first position is the commonest, though not nearly in so great a preponderance as the first position in vertex presentations.

Mechanism of Delivery

It is best to consider first the mechanism in the third position, L.M.A., as it corresponds in character to the first vertex; indeed, the only difference is that extension takes the place of flexion while the face is descending. Four movements are described during descent—

Extension,	Flexion,
Internal Rotation,	External Rotation.

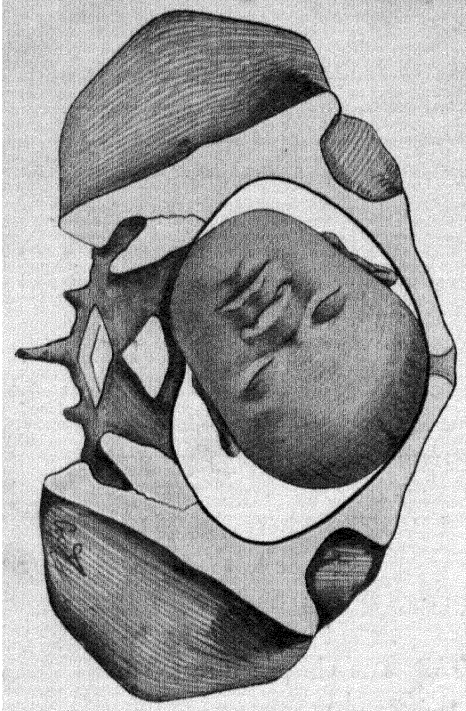


FIG. 103.—FACE PRESENTATION. FIRST POSITION, RIGHT MENTO-POSTERIOR.



FIG. 104.—FACE PRESENTATION. SECOND POSITION, LEFT MENTO-POSTERIOR.



FIG. 105.—FACE PRESENTATION. THIRD POSITION, LEFT MENTO-ANTERIOR.

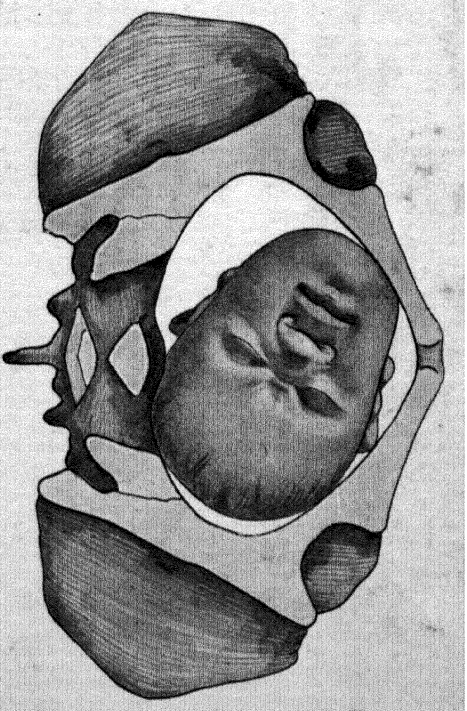


FIG. 106.—FACE PRESENTATION. FOURTH POSITION, RIGHT MENTO-ANTERIOR.

Extension.—The face enters the brim with the chin forwards and to the left, the diameter which engages being the submento-bregmatic, 3¾ inches. The effect of the uterine action on the extended head is to cause an increase of this extension as the head passes down the resistant pelvic canal. The face is acted on by two forces, the uterine pushing it downwards and the pelvic resistance holding it back. The latter has a greater leverage and therefore greater effect on the forehead end of the face—the long arm of the lever—than on the chin, and the forehead is more delayed than the chin, or, in other words, the chin comes down in advance of

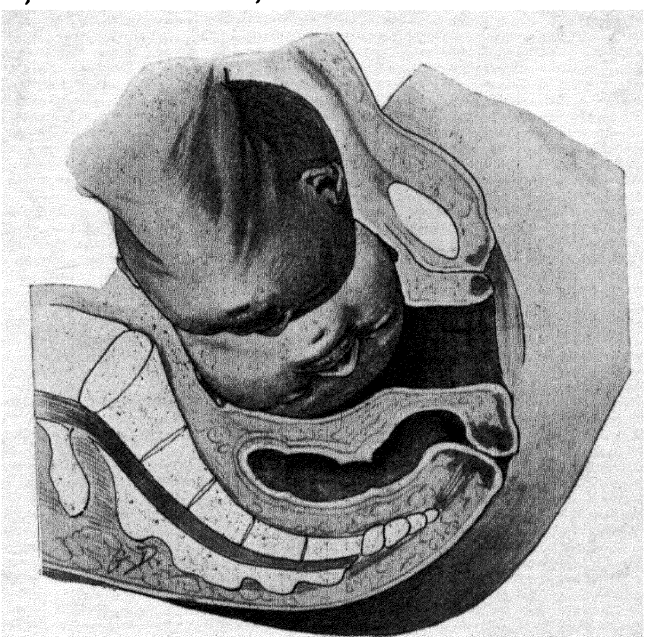


FIG. 107.—FACE PRESENTATION. MECHANISM IN THE FIRST POSITION.

The head descends with extreme extension, so that the chin is in advance. Internal rotation of the chin forwards now occurs.

the forehead, thus causing extreme extension. It is this marked extension which allows the smaller submento-bregmatic diameter to be substituted for the longer submento-vertical. Further, well-marked projection of the chin favours internal rotation by bringing that point first on to the pelvic floor.

Internal Rotation.—Internal rotation of the chin forwards through one-eighth of a circle to the open space under the symphysis pubis occurs, as that point is the first part of the face to meet the resistance of the pelvic floor. The face thus comes to lie with its long axis, the submento-bregmatic or submento-vertical, in the

antero-posterior diameter of the outlet, and the chin in front below the pubic arch (Figs. 107 and 108).

Flexion.—Flexion takes place as soon as the chin has slipped out from beneath the symphysis pubis and results in the birth of the head. It is caused in exactly the same way as extension in vertex cases. The forces of labour push the head downwards, while the muscles of the pelvic floor and perineum push it upwards and forwards. The resultant of these forces acting on the head with the neck firmly fixed against the symphysis pubis causes a movement of flexion (Fig. 109). The vertex stretches the vulva until the occiput escapes over

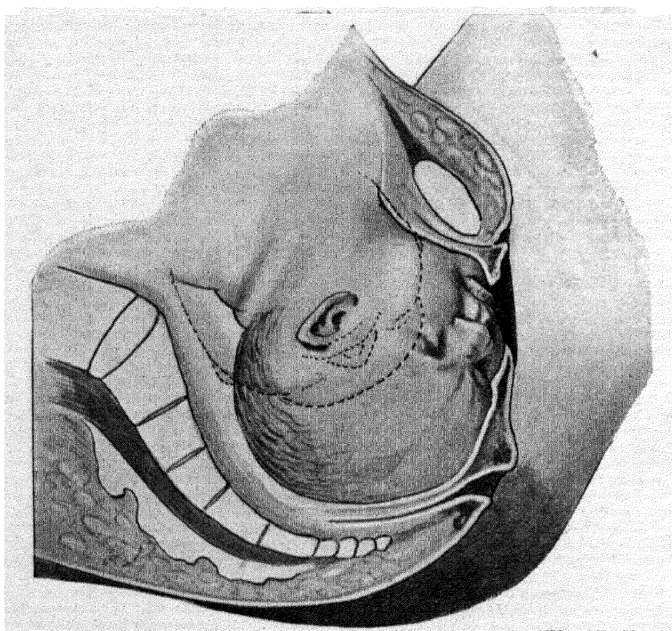


FIG. 108.—FACE PRESENTATION. MECHANISM IN FIRST POSITION.

Internal rotation of the chin almost complete. The chin has rotated from the right side of the pelvis, as indicated by the dotted lines, to under the pubic arch, so that the submento-bregmatic diameter is nearly in the antero-posterior at the pelvic outlet.

the perineum and the head is born, the submento-vertical diameter (4½ inches) occupying the antero-posterior of the outlet (see Fig. 67B).

External Rotation.—External rotation is brought about in exactly the same way as in vertex cases, and consists also of the same two movements. First, there is a movement of restitution due to the internal rotation of the head not having been followed by the shoulders. As soon as the head is born it is free to resume its usual relation to the shoulders, and therefore the slight twist of the head on the shoulders is undone, the face turning through an

eighth of a circle to the mother's left. The second movement is caused by the shoulders rotating from the left oblique into the antero-posterior diameter of the outlet. The anterior shoulder, the left, meets the resistance of the pelvic floor first and rotates forward through one-eighth of a circle to the open space under the pubic arch, and this movement of the shoulders is followed by the head externally, the face turning a further one-eighth of a circle to the mother's left. The complete movement of external rotation is thus two-eighths of a circle or double that of the internal rotation.

The left shoulder is now under the pubic arch and the right on the perineum. The shoulders emerge and are followed by the rest

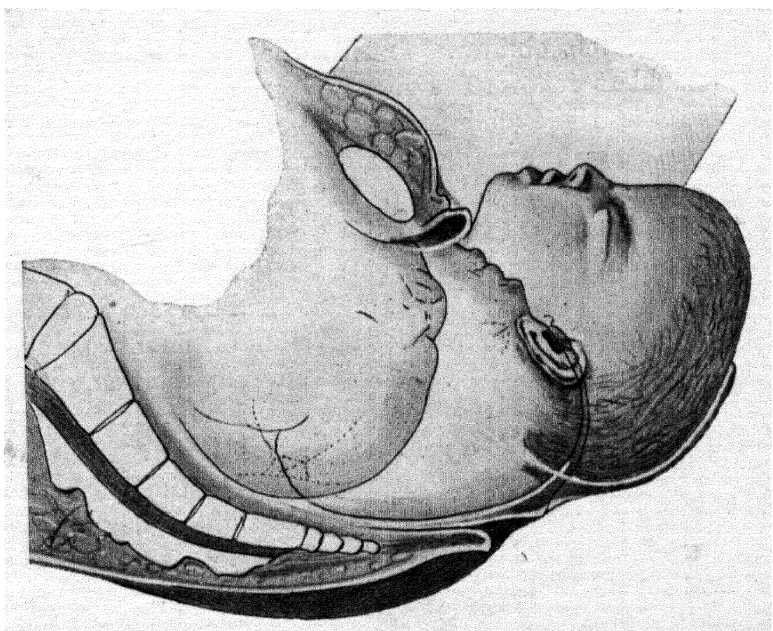


FIG. 109.—FACE PRESENTATION. MECHANISM.

Internal rotation has occurred, bringing the chin under the pubic arch. The head now escapes by a movement of flexion, its submento-bregmatic and then submento-vertical diameters in turn distending the outlet.

of the body, which is born laterally flexed round the symphysis pubis.

The mechanism in the fourth position is exactly similar to that of the third, except that right is substituted for left, and so requires no special description.

The mechanism in the first and second positions is a little more complicated, because the chin is pointing backwards, but is so like the mechanism in occipito-posterior positions of the vertex that a brief consideration will suffice.

In the first position, R.M.P., the long diameter of the face is in the right oblique diameter of the pelvis, with the chin opposite the right sacro-iliac joint. Marked extension brings the chin first on to the sloping gutter of the pelvic floor, and, in accordance with the usual rule, it is rotated round the right side of the pelvis forwards to the open space under the symphysis pubis. During this long internal rotation the face turns through three-eighths of a circle. The neck now becomes fixed behind the symphysis and the chin emerges from under it, and flexion occurs, the face, vertex, and occiput escaping in turn over the perineum. External rotation now occurs as the result of the internal rotation of the shoulders. As the face enters the pelvis in the right oblique diameter the shoulders come down in the opposite, the left oblique. During the internal rotation of the head the shoulders follow to a lesser degree, *i.e.* they rotate from the left into the right oblique, or two-eighths of a circle. This brings the child's right and anterior shoulder from opposite the right obturator foramen across the symphysis to opposite the left obturator foramen. When the head has escaped, the first movement of external rotation occurs (restitution), *i.e.* the one-eighth of a circle twist of the head on the shoulders is undone and the face turns through that amount to the side to which the chin originally pointed, the right; later, the second movement of external rotation, due to the anterior shoulder rotating back from the left side to under the symphysis, makes the head take a further one-eighth of a circle external rotation, so that now the face looks directly to the mother's right. The internal rotation in this position is three-eighths, and the external the usual two-eighths. The birth of the body follows as before.

The mechanism in the second position corresponds absolutely with that in the first.

In cases in which extension is insufficient to bring the chin in advance on to the pelvic floor, its forward rotation may not occur and a persistent mento-posterior position results. These cases are much less frequent than in the corresponding position of the vertex, but, when they do occur, produce a much more serious state of affairs, as, unless the head is very small or the pelvis very large, natural delivery is impossible. If the chin rotates into the hollow of the sacrum the vertex is pressed down behind the symphysis pubis, while the neck and shoulders occupy the brim. Further progress is impossible because the head cannot pivot round the symphysis pubis. To enable the chin to escape over the perineum a degree of extension impossible in a living and full-sized child would be required. The difficulty here is not that too large a diameter of the head is engaged, but that the head, neck, and shoulders are so wedged into the pelvic

cavity that further advance is arrested. In a dead child or a small premature child, in both of which the head and chest may be soft and compressible, the chin may slip over the perineum and allow the forehead, vertex, and occiput to slide down from behind the symphysis pubis so that the head will be born by flexion. The diameter distending the vulva will be the same as in delivery with the chin forwards (see Fig. 66D).

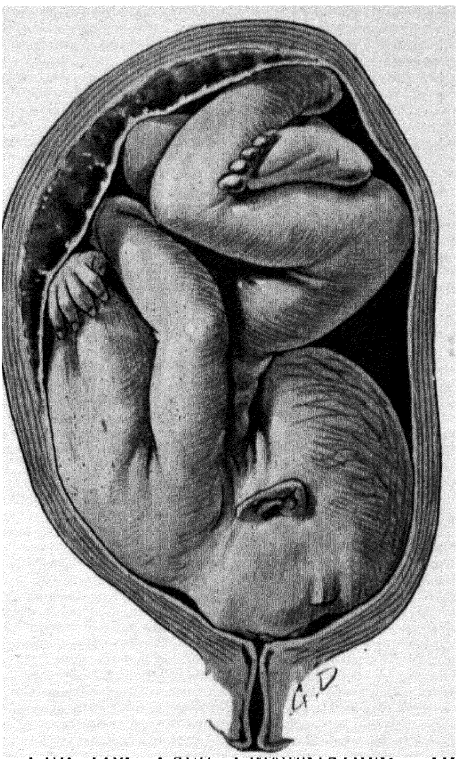


FIG. 110. FACE PRESENTATION. TO SHOW FINDINGS ON ABDOMINAL EXAMINATION.

In dorso-anterior positions, the marked prominence of the occiput will be found on the same side as the back. Above this an interval may be detected before the back is felt running up into the unduly prominent breech.

In dorso-posterior positions the small parts are very distinctly felt owing to the way they are thrust forward towards the abdominal wall, and if the head is not deeply engaged the point of the chin may be recognized above the pelvic brim. On auscultation the heart-sounds may be heard most plainly on the same side as the small parts are felt.

DIAGNOSIS

Abdominal Examination.—The child will be recognized to lie in the long axis of the uterus, with the head at the pelvic brim and the breech at the fundus. The presentation is cephalic, but the differential diagnosis from a vertex—which is the chief problem in abdominal examination—is to be made by discovering that extension has taken the place of flexion. In dorso-anterior positions (first and second) the extension of the spine gives some suggestive features to palpation. The upper part of the child's back—that portion lying below the umbilicus—is not so easily felt as it is in vertex cases, owing to its being hollowed out by extension, while the lower part of the back and the breech—the portion above the umbilicus—projects markedly and is more easily palpated than in a vertex (see Fig. 110). If the head has not sunk into the pelvis, the marked prominence of the occiput may be detected on the same side as the back. The chin can rarely be detected, as it is lower down and

behind. But, contrasting the findings in the case of the flexed head in a vertex presentation with those in the extended head, it will be noticed that the most prominent part of the flexed head (the forehead, which is higher and more easily felt) is on the opposite side to the back, while here the most prominent part is on the same side as the back, *viz.* the round hard mass of the occiput, which is now higher and more easily felt. Above this rounded prominence an interval may be noticed before the back can be felt running up into the prominent breech. If the head has sunk into the pelvis it may be found that the fingers cannot be inserted so deeply into the pelvis over the occiput, *i.e.* on the same side as the back and breech, as over the forehead. In dorso-posterior positions (third and fourth) the small parts are very distinctly felt, because the extension of the back brings the chest and abdomen with the limbs lying on them close up against the anterior uterine wall and so against the abdominal wall. If the head has not sunk into the pelvic cavity, it may be possible to recognize the rounded point of the chin on the same side as the limbs. By auscultation in dorso-anterior cases the fœtal heart-sounds may be indistinct and difficult to pick up; in dorso-posterior cases they may be very distinct, owing to the projection of the chest. Hence any case in which the heart-sounds are very distinctly heard over the small parts is suggestive of a dorso-posterior face presentation.

Vaginal Examination.—Early in labour it may be difficult to reach the presenting part. As the face does not fill up the lower uterine segment like the round vertex, the intra-uterine pressure may cause the bag of waters to bulge in an elongated form and to rupture early. When the face has descended into the pelvic brim and there is sufficient dilatation for the presenting part to be explored by the finger, the point of the chin, the mouth and nose, and the bony margins of the orbits will be recognizable and are fairly distinctive. Care should be taken not to injure the eyes in palpating the face. When the face has descended into the cavity and a caput succedaneum formed on the cheeks and lips, it is said that the face can be easily confused with the breech. This mistake is not likely to be made, as the abdominal examination will have shown a cephalic presentation and the nostrils are fairly characteristic and not easily confused with the genital organs. If there is any doubt, the finger should be passed round the sides of the presenting part to feel for an ear. The finding of an ear will settle the nature of the presenting part. The diagnosis of position is made by noting the direction in which the chin points.

Prognosis

The prognosis in face presentations is not necessarily more serious, either for mother or child, than in vertex cases. Many cases of face presentation are delivered naturally and without the slightest difficulty. They are commonly those due to laxity of the abdominal walls in multiparæ, and in such the increased risk to mother and child of delivery by the face is almost negligible. On the other hand, the causes determining the presentation frequently affects the outlook to mother and child, especially in those cases in which some disparity between the size of the head and the pelvic brim is present. Independently of this, however, delivery by the face is *per se* less favourable than delivery by the vertex, as the following considerations will show.

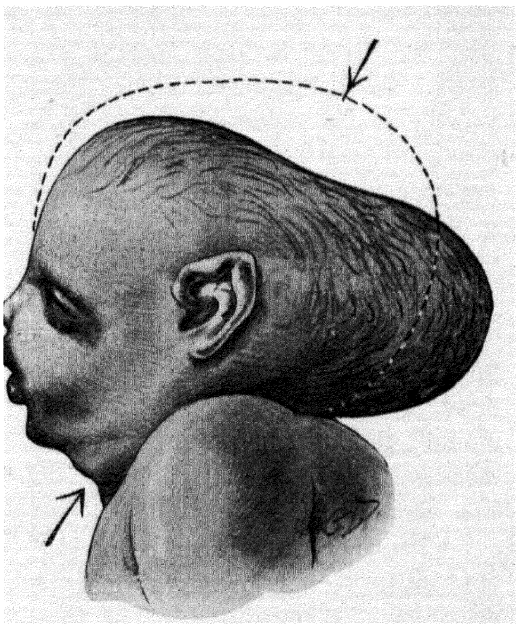


Fig. 111.—Moulding in Face Presentation.

The diameter compressed is one between the submento-vertical and submento-bregmatic. Bulging of the occipital end of the head occurs. The swelling of the face is also shown (see Fig. 115).

There is greater liability to early rupture of the membranes, and, the face being a blunter and less efficient dilator than the vertex, labour is longer.

The diameter presented to the pelvis, one near the submento-vertical, is larger. The uterine forces are applied more tangentially to the head and therefore lose in efficiency.

The prognosis to the mother, and still more to the child, is distinctly less favourable in the first and second positions, because of the internal manipulation and consequent risk of sepsis in the event of non-rotation forwards of the chin. The impossibility of delivering a normal-sized child alive with the chin persistently posterior diminishes the chances of the child in these positions.

Moulding.—In face presentations the diameter compressed is the submento-vertical, or one between it and the submento-bregmatic. There is bulging of the occipital, and to a lesser degree of

the frontal end of the head, with consequent increase of the occipito-frontal diameter (see Fig. 111).

Management and Treatment

Most cases in which the face presents, if uncomplicated by contracted pelvis, end naturally, and hence the question of interference is largely decided by the conditions causing the presentation rather than by the presentation itself. In the cases occurring in multiparous women with a pendulous abdomen, who have had previous easy labours, interference is rarely necessary. In a primipara or a multipara with a bad obstetric history, careful pelvic measurements should be made (see p. 417), if neglected previously. If there is any difficulty in determining the conditions present, whether of the maternal passages or of the position of the presenting part, full examination should be made under anæsthesia, if need be, the whole hand being passed into the vagina.

Face presentations, being exceedingly rare before labour, a diagnosis will not often be made until the onset of labour, although the presence of predisposing conditions, such as pelvic contraction, large head, and uterine obliquity may be recognized and measures taken to obviate difficulty before labour begins. The preventive treatment of face presentations will, therefore, usually depend on recognition at the start of labour.

Various means have been suggested for the conversion of the face into vertex presentations. Such methods may do harm by precipitating rupture of the membranes or by bringing about a more unfavourable presentation—a brow or even a shoulder—and frequently fail in their object, as the face presentation is likely to recur even if the conversion has been successfully accomplished. They are not, therefore, worth detailed consideration. In dorso-anterior positions in which there is a possibility of obstruction later on from backward rotation of the chin, an attempt may be made to produce flexion if the case is seen early in the labour and the head is above the brim. To do this the head should be raised from the pelvic brim by abdominal manipulation. It may be accomplished by pressure upwards of the fingers below the anterior shoulder; these fingers should then press the shoulder towards the child's back while the other hand on the fundus presses the breech towards the child's abdomen, *i.e.* downwards and backwards. By this means the back may be flexed and so produce flexion of the head. In dorso-posterior positions, if the cervix is sufficiently dilated, it may be found possible to introduce the left hand into the uterus, grasp the head and turn the occiput into the anterior position. If the head has

entered the brim, the attempt must be made bi-manually by pressing up the forehead between the pains by two or three fingers in the vagina. This pushes the presenting part out of the pelvis. The other hand on the abdomen presses the occiput downwards into the brim.

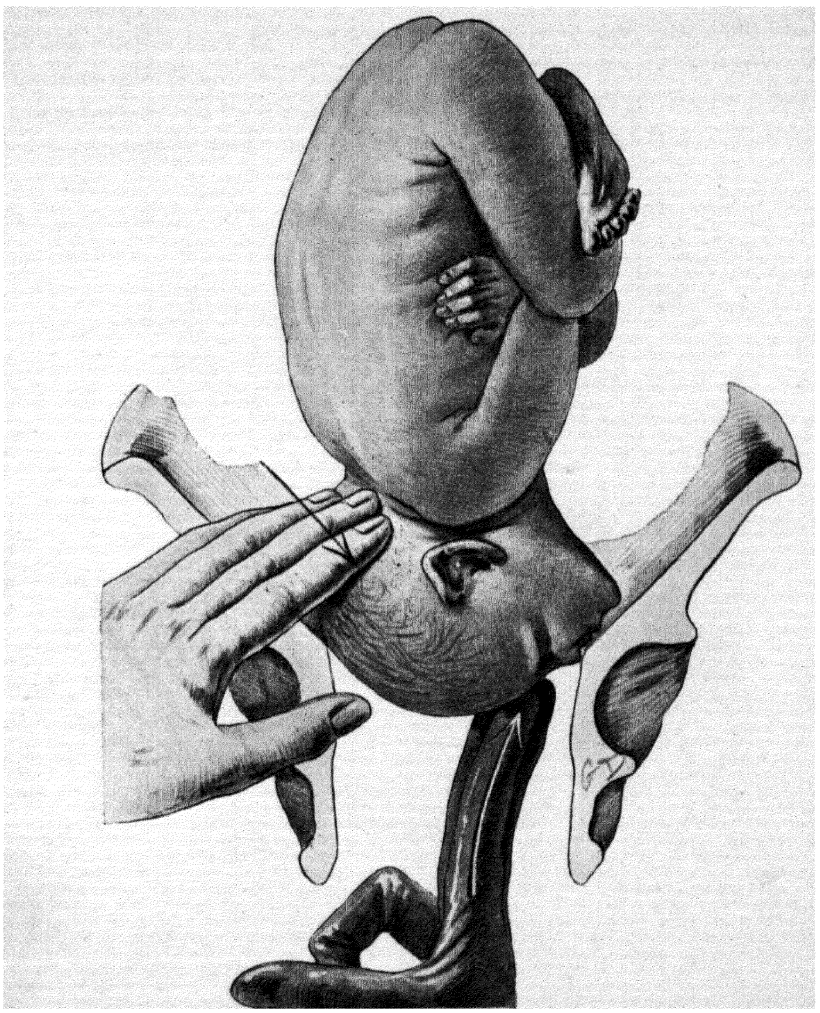


FIG. 112.—METHOD OF ATTEMPTING THE CONVERSION OF A FACE INTO A VERTEX PRESENTATION.

The head is pushed up out of the pelvis by pressing on the forehead with two or three fingers in the vagina. At the same time a hand on the abdomen presses the occiput downwards into the brim.

It is inadvisable to attempt this procedure before rupture of the membranes, unless the os is fully or nearly fully dilated (Fig. 112).

The question of attempting conversion may be shortly summarized thus: if the head is deeply engaged, it is best left alone; if it is above the brim or easily pushed up, conversion to the vertex should be tried,

though success is unlikely, unless the cervix is sufficiently dilated to admit a hand.

In uncomplicated face presentations the management requires little special description. As the face is not as good a dilator as the round vertex, early rupture of the bag of membranes is more of a disadvantage, and hence special precautions should be taken to avoid provoking rupture. Vaginal examinations must be infrequent and made with care, and as soon as the os is half dilated it is best to keep the patient lying down. So long as progress is being

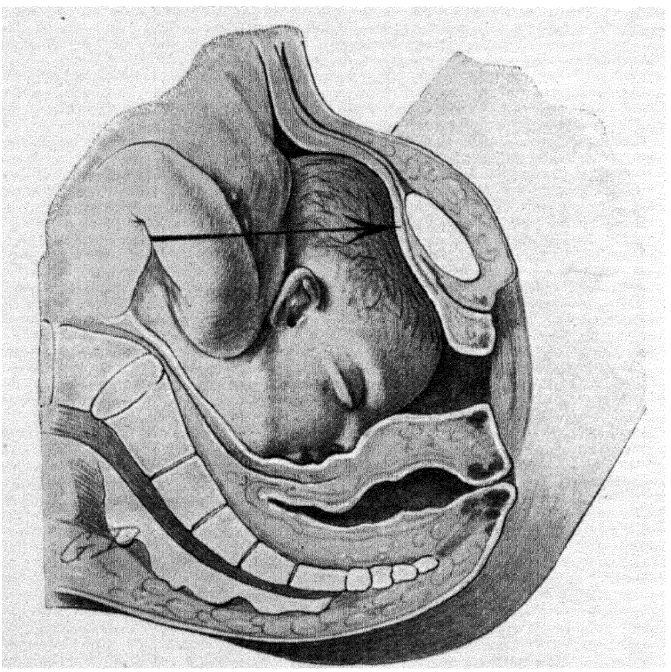


FIG. 113.—PERSISTENT MENTO-POSTERIOR POSITION.

As the face sinks deeply into the pelvis, the shoulders enter the brim with the vertex, thus wedging the head in the pelvis and preventing advance.

made no interference is necessary, but if after full dilatation there is delay in the descent of the face and the chin is anterior, forceps-delivery will be indicated for exactly the same reasons as in vertex presentations. If the chin is posterior and forward rotation does not occur, an attempt should be made to produce rotation manually as in posterior positions of the vertex. Under anæsthesia the left hand is passed into the vagina, the face grasped across the temples between the thumb and fingers and rotated round that side of the pelvis to which the chin points, while the right hand on the abdomen pushes the anterior shoulder over to the opposite side of the abdomen (Fig. 114). If this manœuvre effects the forward

rotation of the chin and the rotation of the body, the head should be delivered by the forceps. If forward rotation is not effected an attempt may be made to deliver with axis-traction forceps even with the chin backwards, as if the child is small it may succeed. If the forceps fails, it is best to wait till there are definite indications that the mother must be delivered, and then, if a further attempt at rotation is unsuccessful, or if the child is dead, the only resource is perforation and craniotomy. Those cases in which the face is delayed at the brim must be treated in accordance with the con-

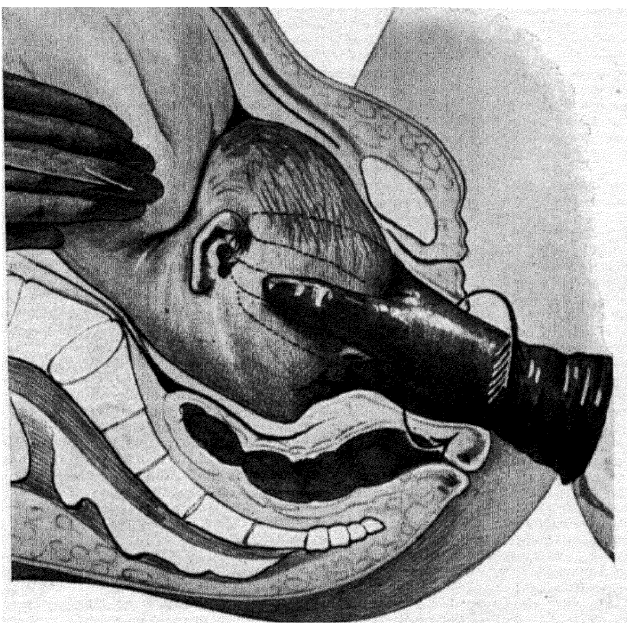


FIG. 114.—PERSISTENT MENTO-POSTERIOR POSITION.

Manual rotation of the face to bring the chin forwards with rotation of the body by pushing over the anterior shoulder. Before attempting this the head is pushed up so as to undo any impaction, such as is shown in the preceding figure, and allow of free movement of the face.

dition causing delay. In a flattened pelvis, which is not too small for the head to pass, version will be the best treatment; in a multipara with a pendulous abdomen there may be some delay in engagement, but the face nearly always descends after rupture of the membranes. If there is prolapse of the umbilical cord or a limb, version is again the best treatment. In accordance with the rule stated elsewhere, in all cases in which definite evidence of fœtal death is obtained the head of the child shall be perforated instead of attempting any of the manipulations for the delivery of a living child (see Chapters on Forceps, Version, Contracted Pelvis, Perforation, etc.).

The management of delayed face presentation will, therefore, depend on whether the head is arrested above the brim or in the pelvic cavity. In the former, if conversion to a vertex is impossible, and there is no serious degree of pelvic contraction, podalic version should be performed. In the major degrees of pelvic contraction with the child presenting by the face, the birth of a living child is scarcely to be expected unless by Cæsarean section. In the event of arrest of the head in the pelvic cavity delivery should be attempted by the axis-traction forceps, preceded by manual rotation of the head if the chin is posterior, and if this fails, perforation is the last resource.

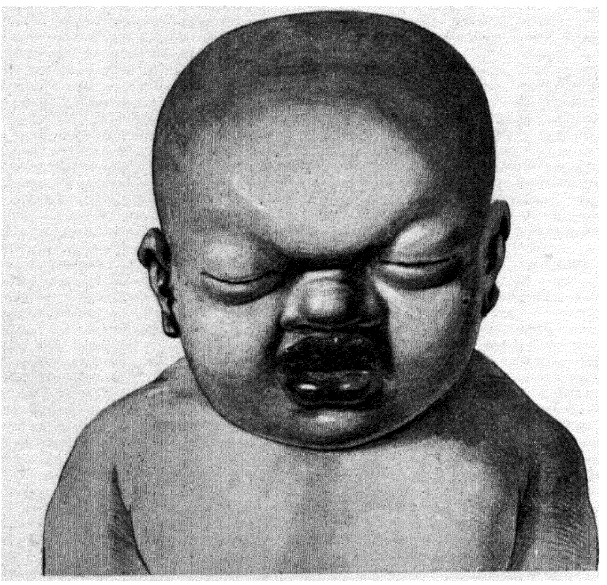


FIG. 115.—APPEARANCE OF THE FACE AFTER DELIVERY IN A FACE PRESENTATION.

The face is always much swollen, and often there is considerable bruising and subcutaneous hæmorrhage. The lips, eyes, and cheeks especially are swollen and turgid, and the infant unsightly, and hence should not be shown to the mother earlier than can be helped. Also the swelling of the nostrils, tongue, and lips may interfere with breathing, and therefore the child ought to be watched carefully for a day or so for fear of suffocation occurring (Fig. 115).

BROW PRESENTATION

As a rare occurrence the head may try to enter the brim midway between extension and flexion, so that some part of the forehead

presents. Except the rare primary face cases, all face presentations must pass through this stage, but, as it is an unstable attitude of the head, few presentations remain in it after labour has commenced. As in face presentations, the most common causes are contracted pelvis and uterine obliquity, but all the conditions mentioned as favouring malpresentation may be operative.

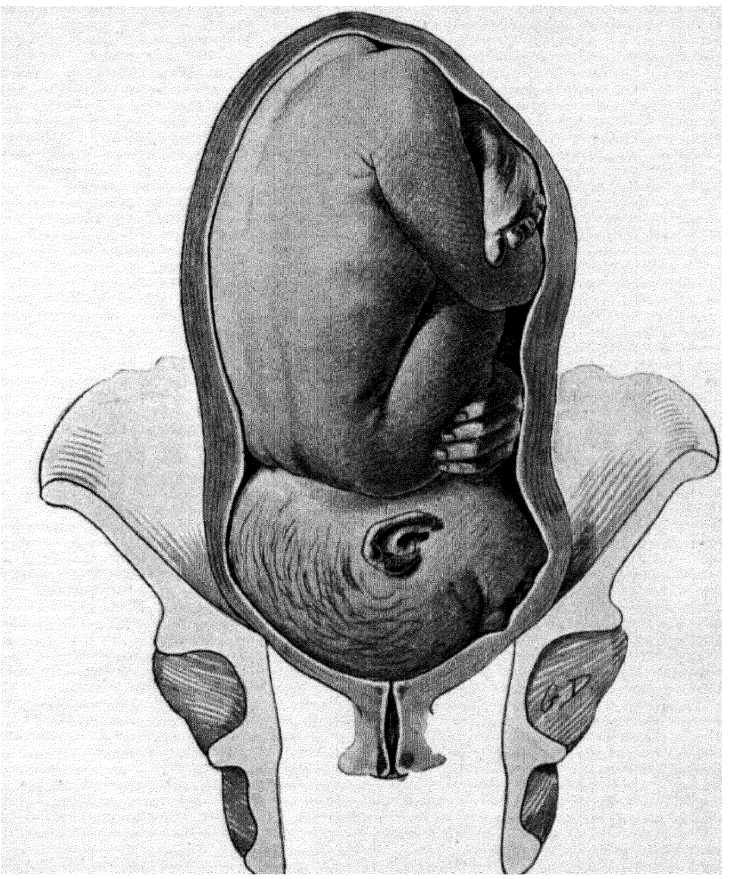


FIG. 116.—BROW PRESENTATION.

Head above the brim and not engaged. The vertico-mental diameter of the head is trying to engage the transverse at the brim (compare Fig. 63B, in which moulding has occurred).

Persistent brow presentation is happily rare, 1 in 1000 to 1500 cases; the head lies with its longest diameter, the vertico-mental (5½ inches), across the pelvis, and the passage of an average-sized head through an average-sized pelvis is impossible should the presentation persist (Fig. 116).

The positions of the brow are not usually differentiated. Sometimes the forehead is taken as denominator, and a first or left fronto-anterior, a second or right fronto-anterior, a third or right

fronto-posterior, and a fourth or left fronto-posterior, position described. Such distinctions are of no importance.

There is ordinarily no mechanism in this presentation, but with small or premature children, a roomy pelvis, and strong uterine action the head may be born, especially if the frontal bones are anterior. The head is driven down into the pelvis, the vertex against one wall and the face against the other. Extreme moulding occurs, the vertico-

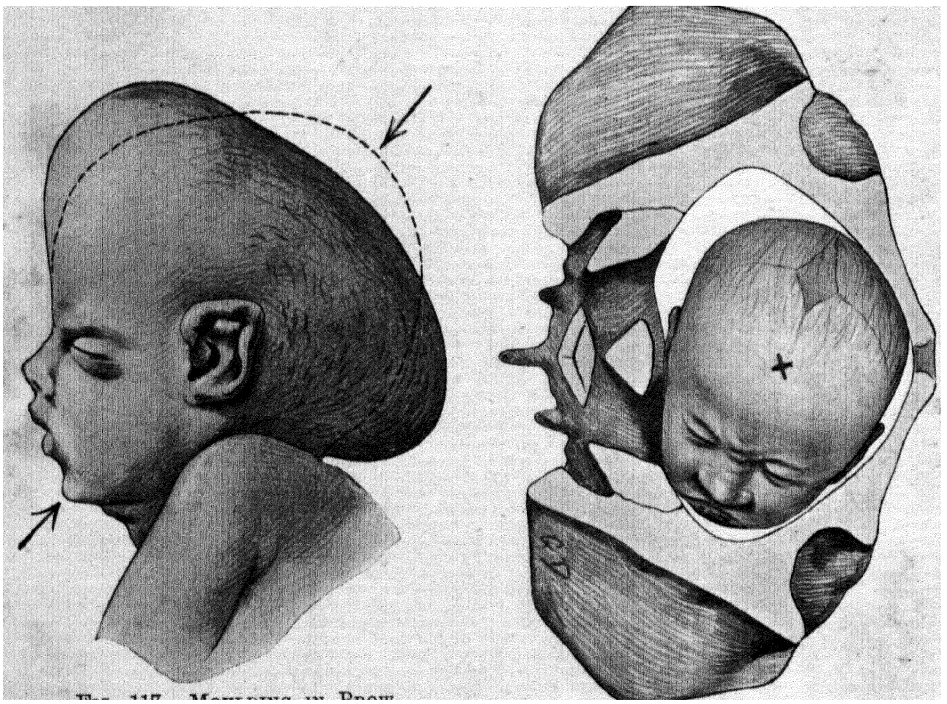


FIG. 117.—MOULDING IN BROW PRESENTATION.

Shortening of the vertico-mental and lengthening of occipito-frontal diameters. The forehead is markedly bulged forward and the occiput backwards to a lesser degree, with flattening of the vertex.

FIG. 118.—BROW PRESENTATION.

On vaginal examination the finger usually touches the middle of the frontal suture marked ×. Followed in one direction the anterior fontanelle will be recognized, in the other the face will be discovered.

mental diameter being shortened, and the occipito-frontal lengthened, causing marked forward bulging of the forehead, and flattening of the vertex (Fig. 117). The head with extreme moulding descends, the frontal region undergoes internal rotation to below the pubic arch, the face is flattened out against the back of the symphysis pubis, while the occipital region occupies the sacral hollow. The forehead first appears at the vulva, followed by the vertex and occiput over the perineum, and then the face slips down from behind the symphysis pubis, the lengthened occipito-frontal diameter occupying the

outlet. In fronto-posterior cases delivery is more difficult, but forward rotation of the forehead may occur, and the labour may end as described above; delivery may also occur with a small and soft head when the face remains posterior. The vertex is greatly flattened out behind the symphysis pubis; the nose, mouth, and chin in turn slip out over the perineum, followed by the vertex and occiput from under the pubes, the outlet being distended by the vertico-mental diameter (see Fig. 68B).

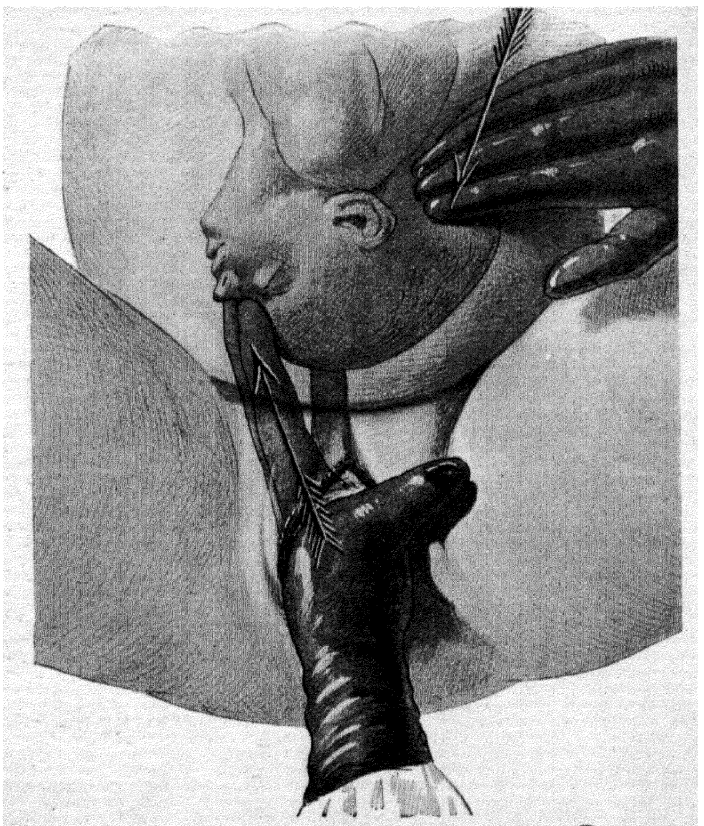


FIG. 119.—METHOD OF ATTEMPTING THE CONVERSION OF A BROW INTO A VERTEX PRESENTATION.

The internal fingers push up the forehead while the external fingers push down the occiput.

DIAGNOSIS

Abdominal examination is generally of little assistance in brow presentation. The lie will be found to be longitudinal, with the head at the pelvic brim, and probably high up and not engaged. The long axis of the head may be found lying transversely, and it may be possible to recognize both occiput and chin. *Per vaginam* the frontal bones will be identified. The finger generally touches the middle of the frontal suture; if this is followed in one direction

the anterior fontanelle is reached, if in the other the root of the nose and the orbital ridges (Fig. 118).

Prognosis

The prognosis is bad for the child, and the risks of sepsis and injury are naturally greater for the mother in view of the internal manipulation necessary to effect delivery.

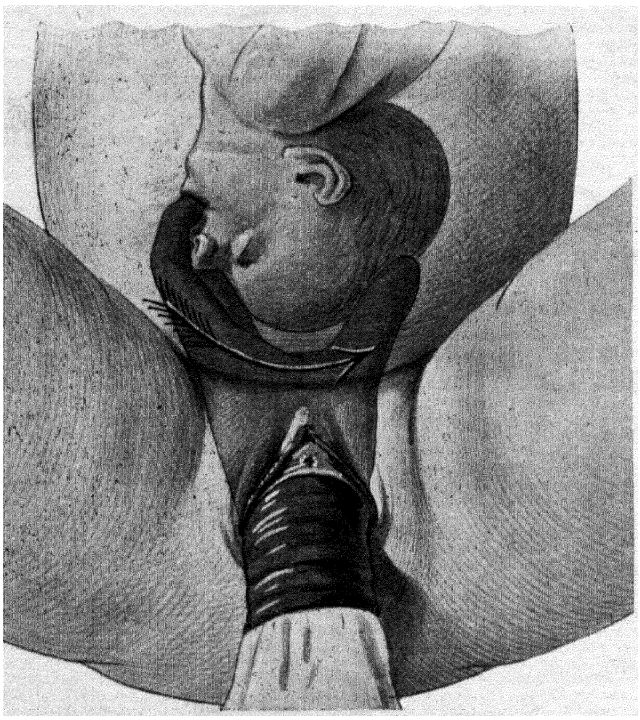


Fig. 120.—Method of attempting the Conversion of a Brow into a Face Presentation.

The whole hand is passed into the vagina and the face brought down by a finger in the mouth, while the forehead and vertex are pushed up by the thumb. Once the face has been brought down, the finger can be put over the point of the chin to hook that down.

Treatment

A careful investigation should be made to determine the cause leading to extension of the head, and especially to decide whether there is any considerable degree of pelvic contraction. With so unfavourable a presentation as a brow, even a minor degree of pelvic contraction may make Cæsarean section a justifiable method of treatment, if the child is alive and the other conditions favourable. If a marked degree of uterine obliquity is present it should be corrected.

If the head is not engaged and the pelvis not too markedly contracted, version and bringing down a foot is the best treatment. The condition will rarely be recognized with certainty before the rupture of the membranes, but if so, bipolar version should be performed. In the majority of cases the membranes will rupture early, and if the presenting part has not descended careful investigation under anæsthesia should be made, if necessary the whole hand being passed into the vagina. As soon as a diagnosis has been arrived at, the os should be dilated sufficiently to allow of internal version being performed.

After engagement of the head, unless the uterus will so far relax under the anæsthetic as to allow of the head being pushed up and version being performed without danger of rupture, an attempt should be made to convert the brow into either a vertex or a face presentation by pushing up the forehead or occiput (Fig. 119). The former is to be preferred, but usually it is easier to change the presentation into a face, as after the occiput has been pushed up a finger may be got into the mouth and the chin hooked down (Fig. 120). As a posterior position of the chin, if this change were effected, would also complicate the delivery, it is inadvisable to attempt conversion to a face unless the chin can be brought down to the front. Should a mento-posterior position result, it must be managed as described under Face presentation, p. 346. If, as often happens, conversion fails, the next procedure will depend on the position of the head. If it is high up, perforation will probably be the only possibility. If, however, the head is arrested in the cavity of the pelvis, it is probably of small size, and a living child may be born with some help. The head ought to be left as long as possible for extreme moulding to occur, and to allow the natural powers to do all they can. When symptoms on the part of the mother or child call for delivery the forceps should be tried, and if it fails, craniotomy must be done. If the child is known to be dead, perforation ought to be performed at once without attempting the other methods of delivery.

CHAPTER XXXII

ABNORMAL PRESENTATIONS (*continued*)

BREECH PRESENTATIONS

BREECH, or pelvic, presentations, which occur about once in forty labours, are divided into two classes :—

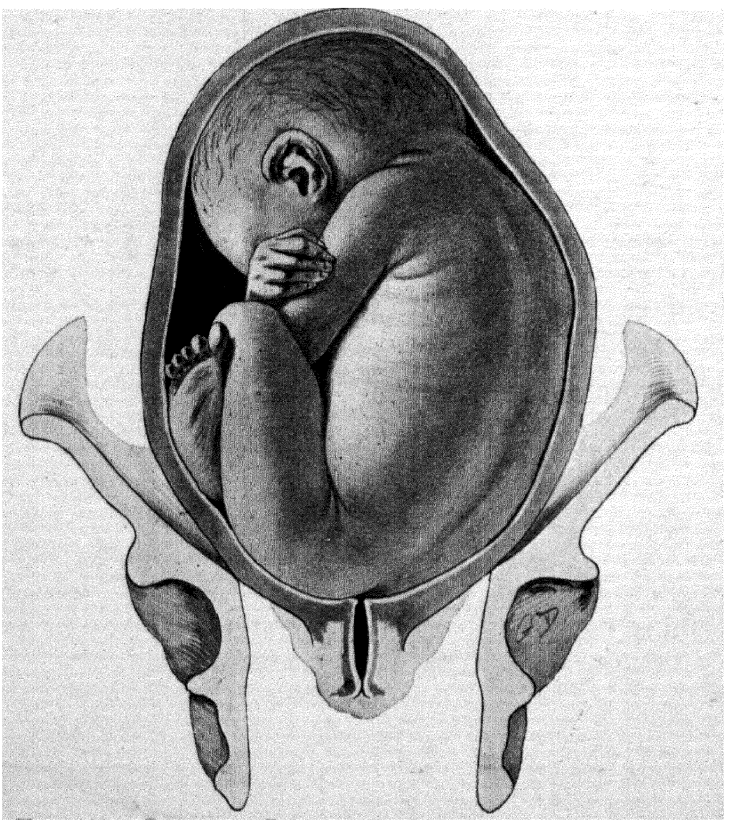


FIG. 121.—COMPLETE BREECH PRESENTATION. ATTITUDE OF GENERAL FLEXION.

1. Complete breech presentations, when the breech presents with the legs and thighs flexed, so that the feet are near the buttocks (Fig. 121).

2. Incomplete breech presentations—

(*a*) With the legs extended, the feet being somewhere near the shoulders (Fig. 122).
(*b*) Knee presentations, when a knee presents.
(*c*) Footling presentations, when a foot presents.

Cause

See p. 330 for causes of malpresentations.

In many cases it is impossible to explain why the breech presents rather than the head.

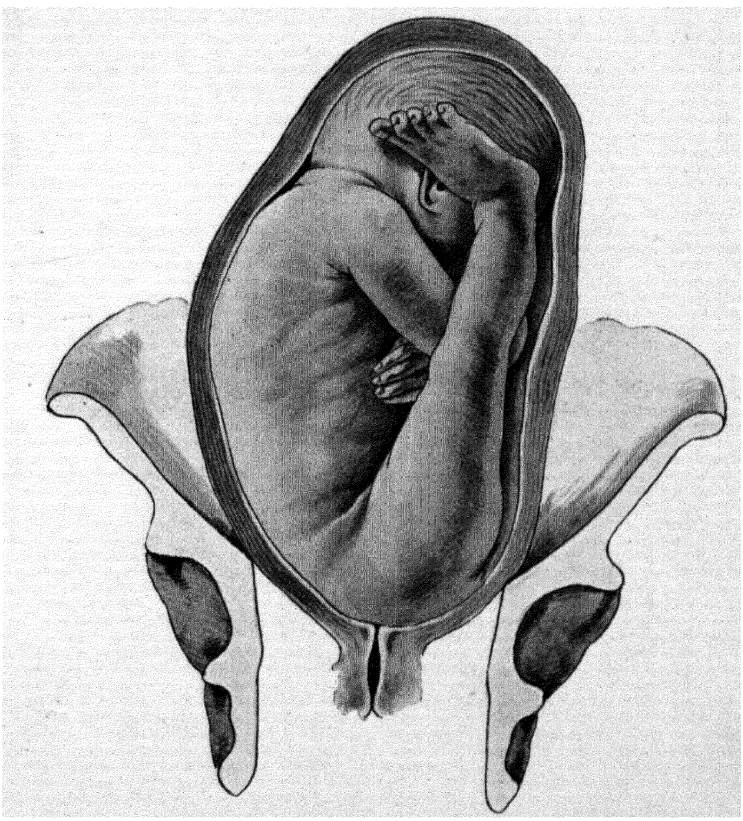


Fig. 122.—Incomplete Breech: Extended Legs.

Conditions specially likely to cause breech presentations rather than other malpresentations are:—

Prematurity.—The head of a premature child is comparatively larger than the head of a full-time child, and is more likely to occupy the larger end of the uterus, *i.e.* the fundus.

Hydrocephalus.—The large head occupies the larger end of the uterus.

Second child of twins.

Prognosis in Breech Presentation

Many children presenting by the breech are small. If the child is of full size, labour is likely to be rather longer than in vertex presentation, particularly in the second stage in primiparæ. As the breech does not fit the lower uterine segment so well as does the head, premature rupture of the membranes is likely to occur, with consequent prolongation of the first stage.

Uncomplicated breech presentations do not bring with them any special danger to the mother. If, however, the attendant's hand has to be inserted to bring down the extended arms, there is danger of rupture of the perineum in a primipara, and increased risk of sepsis from internal manipulations. If the head is delivered rapidly through an incompletely dilated os, the cervix may be torn. Extension of arms and delay in delivery of the after-coming head are often due to unnecessary interference on the part of the attendant.

The danger to the child, however, is much greater in breech presentation than in vertex presentation, the mortality of full time infants being 1 in 10.

There are three special causes of still-birth in children born breech first:—

1. *Pressure on the Umbilical Cord by the After-coming Head.*—In vertex presentations the hardest and largest part of the child, the head, comes first and dilates the passage thoroughly. The comparatively soft and small body of the child is usually born quickly after the head, and so does not cause dangerous pressure on the cord. When the breech comes first, however, the umbilical cord must be in the pelvis at the same time as the head, and if the head is not born quickly, the cord becomes squeezed between the head and the pelvic bones and the circulation through it is stopped. If the squeeze is prolonged for many minutes, the child will be born dead from asphyxia.

2. *Premature Inspiration.*—When the head comes first, the child does not breathe until the mouth and nose are outside the vulva. When the head comes last, however, the stimulus of the comparatively cold air on the body of the child may cause it to inspire when the head is still in the uterus or vagina, especially if the child is partially asphyxiated by pressure on the umbilical cord. It may then be drowned by drawing liquor amnii or mucus into its lungs.

3. *Premature Separation of the Placenta.*—This does not happen often, but occasionally the diminution in size of the uterus causes

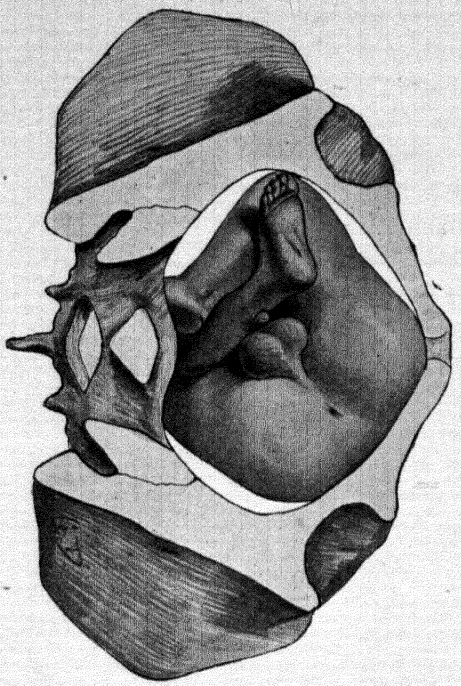


FIG. 123.—BREECH PRESENTATION: FIRST POSITION.

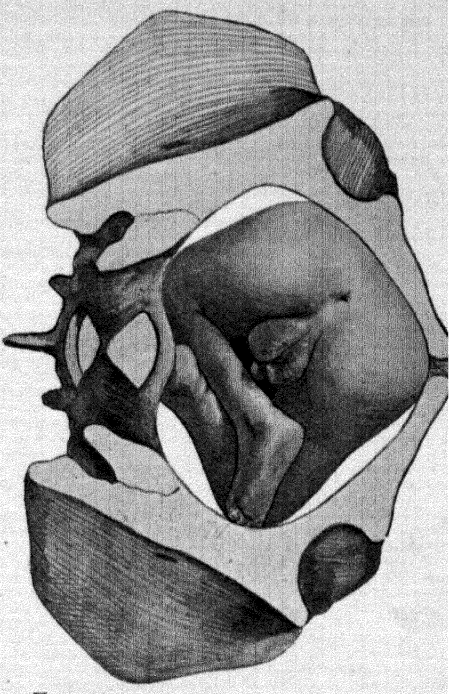


FIG. 124.—BREECH PRESENTATION: SECOND POSITION.

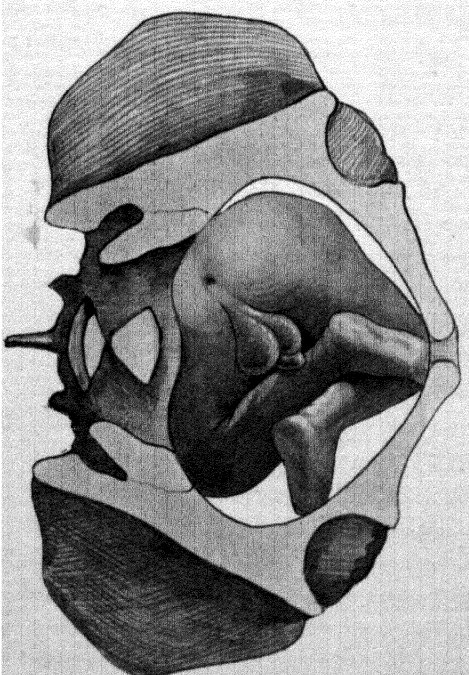


FIG. 125.—BREECH PRESENTATION: THIRD POSITION.

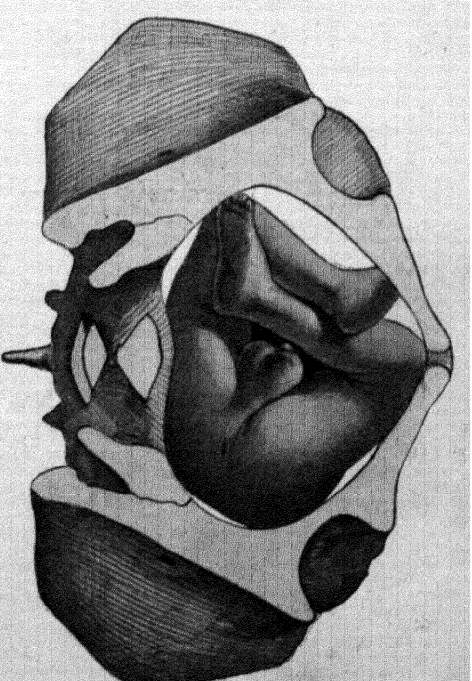


FIG. 126.—BREECH PRESENTATION: FOURTH POSITION.

separation of the placenta before the after-coming head is born. The child is then deprived of oxygen and, if not delivered quickly, is asphyxiated.

The child may also suffer various injuries during extraction, as will be described later (see p. 615).

Positions of the Breech.—The four positions of the breech are :—

1. *Left Sacro-anterior* (*L.S.A.*).—The sacrum looks to the left and in front; the bisiliac diameter lies almost in the left oblique diameter of the pelvis (Fig. 123).
2. *Right Sacro-anterior* (*R.S.A.*).—The sacrum looks to the right and in front; the bisiliac diameter lies almost in the right oblique diameter of the pelvis (Fig. 124).
3. *Right Sacro-posterior* (*R.S.P.*).—The sacrum looks to the right and behind; the bisiliac diameter lies almost in the left oblique diameter of the pelvis (Fig. 125).
4. *Left Sacro-posterior* (*L.S.P.*).—The sacrum looks to the left and behind; the bisiliac diameter lies almost in the right oblique diameter of the pelvis (Fig. 126).

The first position is the most common, just as it is in the case of vertex presentations, and for the same reasons, the child accommodating itself best to the shape of the uterine cavity when the back is to the left and in front.

Diagnosis—First Position, L.S.A.

Abdominal Examination.—Unless the legs are extended, the fundus of the uterus will be narrower, and the lower part of the uterus broader than in vertex presentations. The hard, round, smooth head will be felt in the fundus. It can be moved a little on the trunk, probably the anterior shoulder can be felt, and no small part can be detected close to it corresponding to the knee or foot which is usually felt close to the large mass when the breech occupies the fundus. The back will be felt to the left and in front, and the breech will be felt below. The fœtal heart, if the breech is at the brim, will be heard at a point higher than in a vertex presentation, usually at the level of, and a little to the left of, the umbilicus. The reason why the fœtal heart is heard higher up in the case of a breech presentation than it is in a vertex presentation is that the breech usually sits *on* rather than *in* the brim of the pelvis at the beginning of labour. In the rare event of the legs being extended before the beginning of labour, the heart may be

head lower down, because the incomplete breech, being smaller than the full breech, is able to sink lower into the brim.

Vaginal Examination.—Before rupture of the membranes, diagnosis by vaginal examination may be difficult. The breech does not engage in the brim as early as does the vertex, and consequently the presenting part is high up at the beginning of labour. The rounded buttocks, the cleft between them, the prominences on the sacrum, and sometimes a foot or both feet may be felt. The bag of membranes is likely to project in an elongated shape, because the breech does not fill up the lower uterine segment so well as the vertex. After rupture of the membranes, the soft buttocks, the genital organs, the anus, and the fold of the groin can be felt, and three bony points—*viz.* the two tuberosities of the ischia and the coccyx—can be distinguished. The sacrum is felt to the left and in front, the genital organs and feet to the right and behind.

The breech is sometimes mistaken for the face. The anus, however, can be differentiated from the mouth by the facts that it grips the finger, that no gums can be felt, and that the finger becomes soiled by meconium. Again, the nose, the supra-orbital ridges, and chin are absent.

To confuse the breech with the face is the traditional mistake, but a more likely mistake is that of diagnosing the presenting part as the breech when it is really the shoulder. If the shoulder is swollen this mistake can easily be made, but a systematic search will reveal the axilla, and, most important and most easily identified, the ribs.

When the legs are extended, the sacrum felt through a small os is sometimes mistaken for the head. The absence of sutures, fontanelles, and hair, if the membranes are ruptured, ought to make this mistake impossible.

A knee must be diagnosed from an elbow. This is sometimes rather difficult when it is high up. The point of the elbow is much sharper than the knee-cap.

A foot is often mistaken for a hand. This is usually due to carelessness, or to the extraordinary habit that some beginners have of withdrawing their finger immediately if it encounters anything unusual. The most important points are that the hand does not possess any part that can be mistaken for the heel, that the fingers are longer than the toes, and that the thumb can be abducted from the palm, and then bent on to it, while no such movement of a toe is possible.

The difficulty of early diagnosis by vaginal examination should impress on the student the importance of careful abdominal examination.

Mechanism

The movements in the mechanism are besides descent:—

1. Internal rotation;
2. Lateral flexion;
3. External rotation.

First Position, L.S.A.

Birth of Trunk.

Internal Rotation.—As the breech descends, the left buttock, being in advance, first meets the resistance of the pelvic floor, and

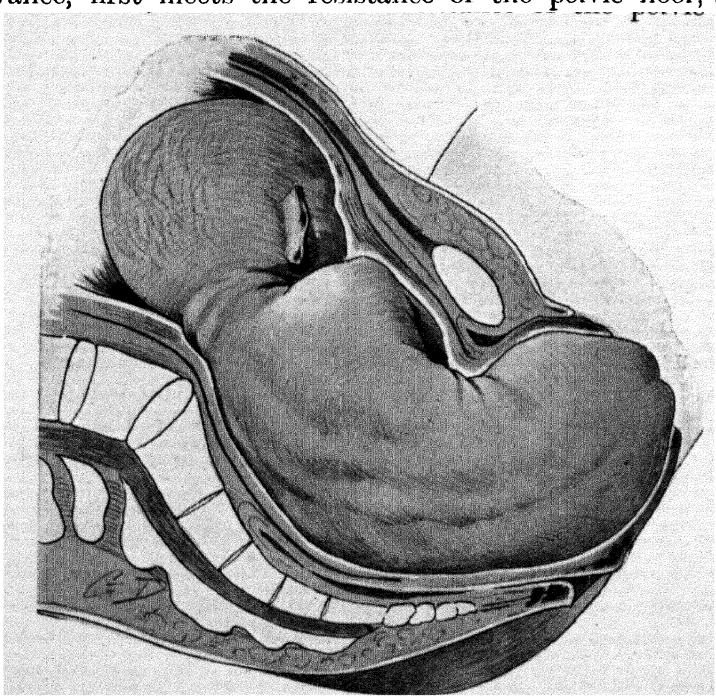


Fig. 127.—Lateral Flexion of the Body in the Third Position of the Breech.

The anterior (right) buttock is under the pubic arch, and the posterior (left) is escaping over the perineum. The child's sacrum looks directly to the mother's right side, and the body is flexed round the symphysis. The shoulders are entering the pelvis in the same oblique diameter as that previously occupied by the buttocks, so that there is also a slight twist on the body.

therefore rotates away from the resistance to the free space under the pubic arch. The bisiliac diameter, which was occupying the left oblique diameter of the pelvis, now comes to occupy the antero-posterior diameter.

Lateral Flexion.—The breech cannot be flexed and extended on the trunk as can the head, but a lateral flexion of the trunk takes place to enable the child to travel along the curved pelvic canal. By further descent the buttocks are born. If the perineum is intact the anterior buttock, the left, emerges first; if the perineum is lax, or has been torn, both buttocks are born together (Fig. 127).

External Rotation.—As the buttocks emerge, the shoulders enter the pelvis in the left oblique diameter, the buttocks rotating back

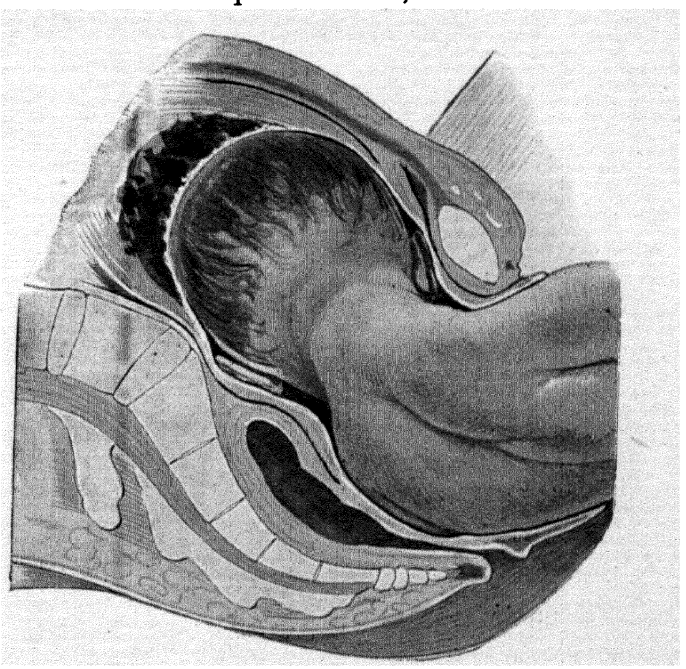


FIG. 128.—ROTATION OF THE SHOULDERS IN THE SECOND POSITION OF THE BREECH.

The anterior shoulder is escaping under the pubic arch, the posterior is on the perineum, and there is still lateral flexion of the body. The occiput points to the mother's right side, so that there is some twist of the head on the trunk.

to the oblique position which they occupied originally. This movement is not so marked as it is in vertex presentations (Fig. 128).

The feet escape soon after the buttocks.

The abdomen is then born.

As the shoulders descend, the anterior one, the left, rotates to the front, and the chest and shoulders are born.

Birth of the Head.—The head now enters the pelvis, well flexed, the suboccipito-frontal diameter lying between the transverse and right oblique diameters of the pelvis, the occiput toward the left and in front. The occiput is the most prominent part of the head, and so rotates to the front, away from the resistance of the

pelvic floor. The head is born flexed, the chin and face being born first, the occiput last (Fig. 129).

The after-coming head, when in the vagina, is beyond the control of the uterus, and must be expelled by the action of the abdominal muscles and pelvic floor.

Second Position, R.S.A.

The mechanism in the second position is just the same as in the first, right being substituted for left, and *vice versâ*.

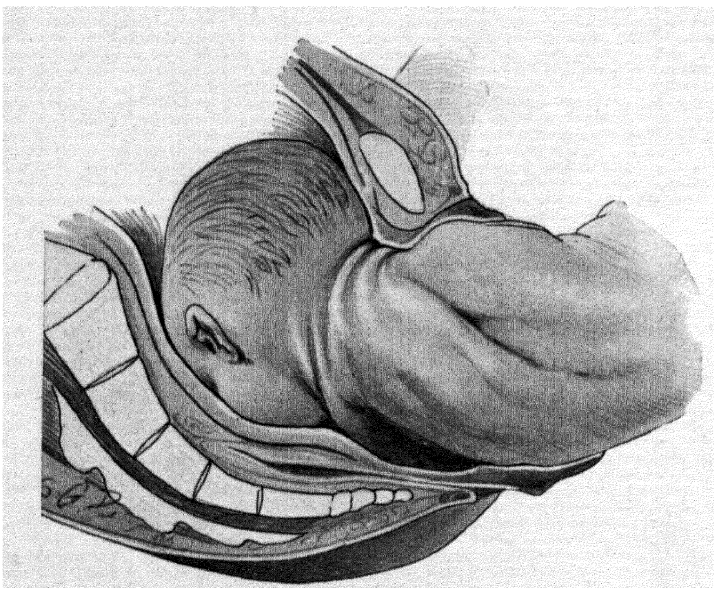


FIG. 129.—ROTATION FORWARDS OF THE OCCIPUT IN THE THIRD POSITION OF THE BREECH.

The anterior shoulder is born, the posterior is on the perineum. Lateral flexion of the body is still present. Rotation of the after-coming head so as to bring the nape of the neck under the pubic arch and the occiput behind the symphysis is occurring.

Third, R.S.P., and Fourth Positions, L.S.P.

Two different mechanisms may occur here.

1. In the third and fourth positions of the breech the external rotation of the buttocks is usually in the same direction as the internal rotation, the shoulders entering the pelvis in the opposite oblique diameter of the pelvis to that in which the bisiliac diameter entered. The reason for this is that the convexity of the child's spine rotates away from the convexity of the mother's spine. By this mechanism the occiput enters the pelvis rather to the front of the transverse diameter just as it does in sacro-anterior positions,

and then rotates away from the resistance of the pelvic floor to the free space in front.

2. If the shoulders enter the pelvis in the same oblique diameter as that in which the bisiliac diameter entered, the occiput enters the pelvis behind the transverse diameter. If, however, the head is well flexed, the occiput is still the most prominent part of the head, and rotates to the front on meeting the resistance of the pelvic floor, making a long rotation through three-eighths of a circle. In the rarer cases, in which there is deficient flexion, the occiput may make a short rotation into the hollow of the sacrum.

Treatment of Breech Cases Discovered During Pregnancy.—The fœtal death-rate in breech labours in primigravidæ is nearly three times greater than that in presentations by the vertex. External version should be performed whenever a breech is discovered during pregnancy. The most favourable time to attempt conversion is about a month before term, as then the size of the fœtus, relative to the liquor amnii, allows of its easy movement, and the breech is not then sunk into the pelvis. Observation must, however, be maintained up to term in order to know that the vertex presentation persists. Should a return to the breech occur, external version must be repeated. In cases of difficulty an anæsthetic is required with the high Trendelenburg position in order to aid in the disengagement of the breech. The unfavourable cases are those of extension of the legs and those in which the breech has sunk deep into the pelvis. A certain number of breech presentations discovered some weeks before term will undergo spontaneous version before term is reached, but that is no reason for not attempting conversion by external manipulation.

Management of Labour with the Breech in Advance.—When a breech presentation has been diagnosed the attendant should have the midwifery forceps ready for use, and should make arrangements for the treatment of asphyxia neonatorum.

First Stage.—An endeavour should be made to keep the membranes unruptured until the os is fully dilated—*i.e.* the patient should be kept in bed and not allowed to bear down, and care should be exercised not to rupture the membranes while making a vaginal examination. Full dilatation of the cervix is of great importance in breech presentation. One of the disadvantages of breech presentation is that the smaller softer end of the fœtal ovoid comes through the cervix before the larger harder end. There is a tendency for the membranes to rupture too early when the breech is in advance, as the breech does not fit the lower uterine segment

so accurately as the head. If the membranes rupture too soon the breech will easily complete the dilatation sufficiently for the buttocks, legs, and body to slip through, but this dilatation may not be sufficient for the head to pass through readily, and extension of the arms and head is likely to occur if the breech comes through an incompletely dilated os.

Second Stage.—A vaginal examination should be made when the membranes rupture, as the cord may be prolapsed.

The birth must be left to nature as long as possible, and traction

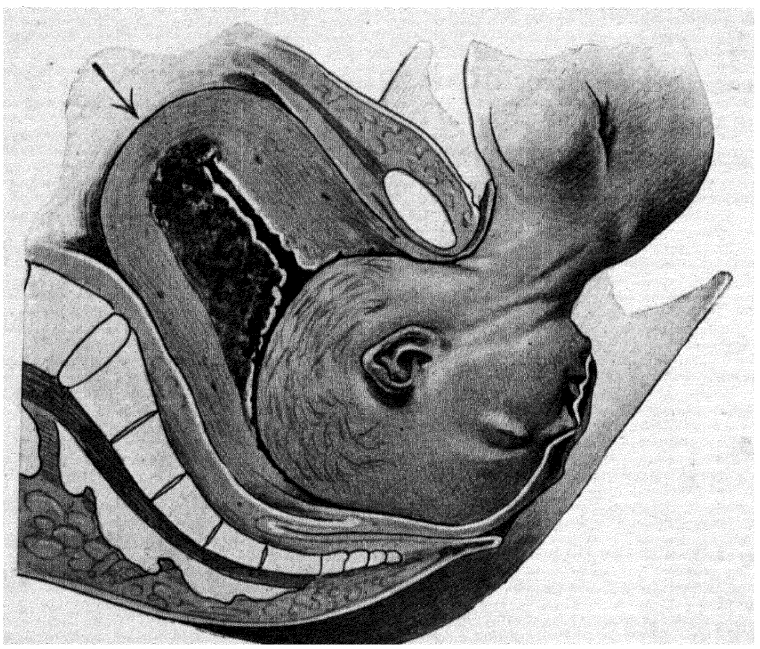


FIG. 130.—BIRTH OF THE AFTER-COMING HEAD.

The nape of the neck is under the symphysis, the chin is escaping over the perineum. In delivery the child's body is carried upwards with its back towards the mother's abdomen, whilst the hand on the abdomen assists the expulsion of the head by pressure on the fundus in the direction of the arrow.

must not be exercised. The student will have to school himself to do no more than stand by in uncomplicated cases. He must not try to hurry on the labour if all is going well and the fœtal heart showing no sign of distress. Pulling on the fœtus is only too likely to cause extension of the arms and head, an accident which may possibly cause a fatal delay at the most critical time. His active duties begin as soon as the buttocks appear. He should cover the buttocks with a sterilized towel, so that the contact with the cold air should not induce premature inspiration. When the feet slip out he must examine to find out where the arms are. They should

be folded on the chest. If they are not, no time should be wasted, but treatment must be adopted as described on p. 369. He next should draw down a loop of the umbilical cord, so that he can tell, by feeling its pulsations, whether there is any need for hastening delivery. If the umbilical cord is found to be lying in the middle line behind, over the sacral promontory, it should be moved to one side so as to lessen its chance of being pressed upon. When the shoulders are born, the patient should be encouraged to bear down, so as to expel the head. The body of the child should be supported and carried gently forwards, while the left hand assists in the expulsion of the head by pressure on the fundus (Fig. 130).

In a primipara care must be taken to prevent rupture of the perineum. The head must be born fairly rapidly. Pressure on each side behind the anus will keep the head well forward and aid in its expulsion.

Difficulties in Breech Delivery

First Stage. **Rupture of Membranes.**—In the first stage early rupture of the membranes may give rise to difficulty in the birth of the head by causing extension of the arms and head, especially if traction is made on the foot. This is due to the fact that the trunk can come through the incompletely dilated os, and the rim of the cervix embracing the trunk closely may catch the elbows and so cause the arms to be drawn up by the side of the head: similarly the rim of the cervix may embrace the base of the skull, and so produce extension of the head.

Should the membranes rupture early it is best to leave the breech to complete the dilatation; if it does not descend with good pains this can only be due to some disparity in size between the breech and the pelvis. If the pelvis is contracted it will be best to bring down a leg; if there is no contraction of the pelvis so that the non-descent appears to be due to the large size of the child, the bringing down of a leg so that the smaller half breech may complete the dilatation will again be the best practice. Before this is done careful investigation ought to be made to exclude delay due to weak uterine action; if this is the cause—and it is much the most frequent cause of delay—there should be no interference with the presentation. A Champetier de Ribes's bag (see p. 736) may be adopted as an alternative to bringing down a leg if the presenting part has not sunk too low into the pelvis. If a large enough bag is used it has the advantage of producing fuller dilatation and so diminishing the risk of extension of the arms and head during their passage through an incompletely dilated os.

Second Stage. **Sluggish Uterus.**—More commonly delay in the descent of the breech will call for interference after the os is retracted up over the breech, and generally will be due to weakness of the pains. There ought, however, to be very definite indications either on the part of the mother or child. A long second stage with draining away of the liquor amnii, slowing of the fœtal heart-beat, and prolapse of the umbilical cord are the chief indications for interference.

In such cases there are several alternatives. When a little help to the pains is all that is required traction by a finger in the groin or the fingers of both hands in both groins will suffice. This is very tiring to the fingers and does not give much power, but if exerted during the pains will be effectual when slight assistance only is needed. A fillet, *i.e.* a sterile bandage or roll of gauze placed over the groins, is rarely used nowadays and is not always easy to get in position. The breech hook, though a very powerful instrument, is too liable to damage the fœtus to be used except in the case of dead children. Hence, if traction with the fingers is ineffective and the breech not too low down, it is best to bring down a leg and apply traction by it. Provided the os is fully dilated and the waters have not drained away so that the child is tightly grasped by the uterus, this procedure will be without danger to the mother and the danger to the child will not be increased. The application of the forceps to the breech has been suggested and is practised by some, but it is not a satisfactory method of delivery and may do serious injury to the child.

Extension of the Legs.—Apart from uterine inertia, delay in the descent of the breech may be caused by extension of the legs. Extension of the legs is generally present before rupture of the membranes as an abnormal attitude of the child, but it may possibly result from some difficulty in the complete breech entering the pelvis.

The effect of extended legs varies greatly. In many cases this complication will cause no trouble whatsoever; many cases of breech delivery take place without delay or difficulty with the legs extended. This is especially common with the small premature infants which are found in a considerable proportion of breech labours. On the other hand, with a large well-developed infant extension of the legs may give rise to very grave difficulty. It is rare for the breech to be delayed at the brim by this complication; when delay does occur it is more probably due to the small size of the pelvis or the large size of the breech rather than to the extended legs. The legs lying along the

trunk increase the rigidity of the body by acting as splints, and the delay generally occurs at the time when lateral flexion should occur, *i.e.* when the breech is low down in the pelvic cavity. The rigid trunk enters in the axis of the inlet and tends to keep in an axis as near this as possible, so that progress becomes difficult when the lower part of the trunk has to bend round the symphysis to allow the breech to be born. That is why, with small premature children, the rigidity is insufficient to cause delay (Fig. 131).



FIG. 131.—BREECH WITH EXTENDED LEGS: PROGRESS ARRESTED OWING TO WANT OF LATERAL FLEXION OF TRUNK.

The breech is smaller than the complete breech and than the head. It enters the brim easily, but having descended deeply into the pelvis is arrested because the movement illustrated in Fig. 127 cannot take place.

Extension of the legs is easily recognized on vaginal examination by noticing the absence of the feet from their usual position alongside the buttocks. Hence, in any case of delay investigation should be made to decide this point, and if the feet are missing from their usual position the fingers should be passed up along the back of the thigh till the back of the knee is felt, when the diagnosis will be confirmed.

The best plan in such cases is at once to bring down a leg. The method of doing this is to press into the bend of the knee with the

fingers—towards the child's abdomen and flank, *i.e.* backwards and outwards in relation to the child, and at the same time press down with the other hand on the abdomen. This produces flexion at the knee-joint, and it is then easy to pass the fingers a little further up, seize the ankle, and draw down the foot. It is important that the leg is flexed before it is brought down, otherwise the risk of fracture of the femur is greatly increased. The anterior leg is the better one to bring down.

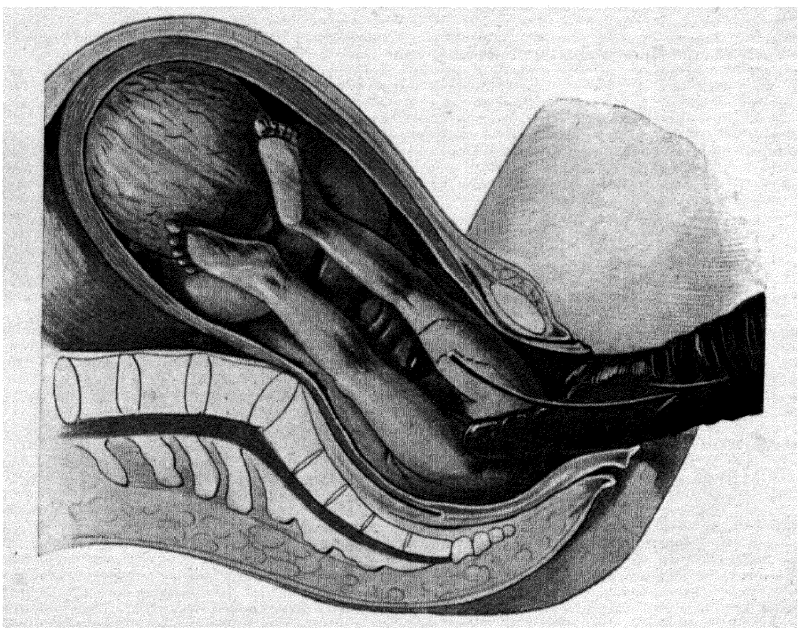


FIG. 132.—TRACTION OF THE ANTERIOR GROIN IN A SACRO-POSTERIOR POSITION OF THE BREECH WITH EXTENDED LEGS.

The breech has descended so deeply into the pelvis that it cannot be disengaged sufficiently to allow a leg to be brought down, so traction with a finger in the groin is attempted.

Impaction of Breech.—Impaction of the breech in the pelvic cavity may result from extension of the legs. The rigidity of the trunk together with the flexion of the lumbar spine which accompanies extended legs increases the antero-posterior diameter of the breech, and may cause the breech to become tightly wedged in the pelvis, more especially in sacro-posterior positions. In such cases the breech may be so low down that the swollen genital organs of the infant protrude at the vulva, and yet the breech cannot escape over the perineum because the rigid trunk will not permit of that bending of the body round the symphysis pubis which normally

occurs before delivery. Impaction may also result from large size of the child or small size of the pelvis.

The treatment of impacted breech may be extremely difficult. The first thing is to get the patient fully under an anæsthetic so as to obtain the maximum relaxation possible. A preliminary hypodermic injection of morphia is of assistance. An attempt must then be made to push the breech up out of the pelvic cavity, and, if this is successful, to bring down a leg in the way already described, and thus break up the impacting wedge. Even if the impaction can be undone it may be found that the leg cannot be reached owing to the size of the breech, or that the child is so tightly grasped by the uterus that it is impossible to bring down a leg with safety. If sufficient relaxation cannot be obtained to allow the breech to be pushed out of the pelvis, traction must be applied directly to the buttocks. Unless the breech is right down at the outlet the traction should first be applied to the anterior groin, and when the buttock has been brought down low enough to appear under the symphysis pubis the traction should be transferred to the posterior groin, as that buttock has to make the wider sweep round the symphysis (Fig. 132). The fingers are generally quite useless in these cases of tight impaction, and the fillet also very often fails, though a length of strong rubber tubing, if it can be passed over the groins or round the pelvis of the child, occasionally succeeds. Generally no course except traction with the breech-hook will be of any avail, and even with every care the use of this instrument may result in fracture or dislocation of the hip or injury to the soft parts of the child. In exceptional cases the extreme measure of embryotomy may be called for. The hip should be cut through by a sharp hook over the groin or with embryotomy scissors, and the separated limb removed; sufficient room will then be available to bring down the other leg and extract.

Extension of the Arms.—After the birth of the buttocks an examination should be made to see that the arms are flexed on the chest. If not they will be displaced upwards, generally extended at the sides of the head.

As the shoulders lie in one or other oblique diameter, one arm is anterior and the other posterior. As the body is bending round the symphysis the anterior arm is tightly wedged between the child's body and the anterior pelvic wall, while behind there is the extra space of the sacral hollow therefore the posterior arm is the easier to bring down first. To do this it is important that the child's body

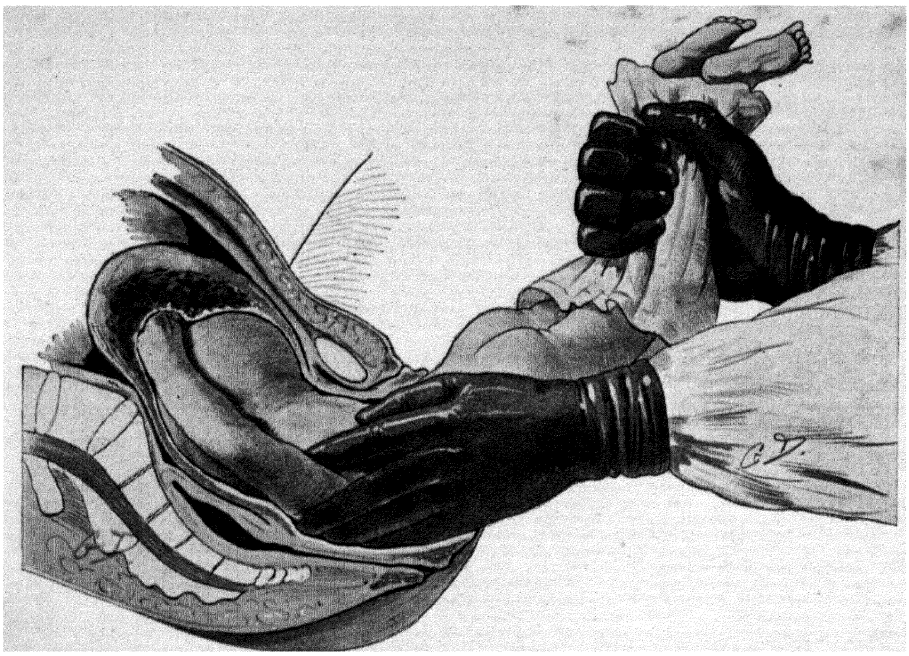


FIG. 133.—EXTENDED ARMS: BRINGING DOWN THE POSTERIOR ARM.

The child's body is swung up towards the mother's abdomen. Two fingers of the left hand are being passed up to the bend of the elbow to flex the arm and bring it down with a wide sweep across the child's face.

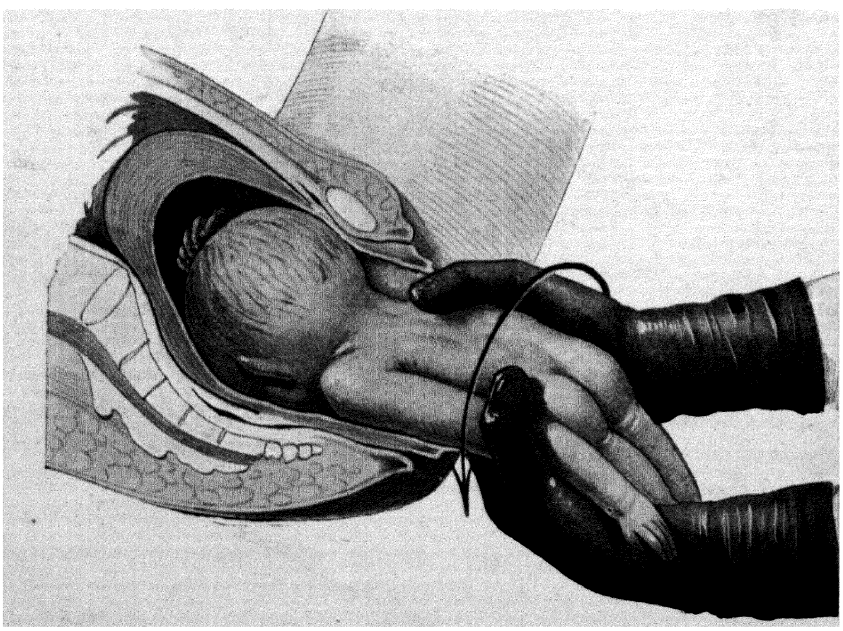


FIG. 134.—EXTENDED ARMS: ROTATION OF THE BODY TO DISENGAGE THE ANTERIOR ARM.

The anterior arm is tightly wedged behind the symphysis. The child's body is rotated in the direction which will bring the arm across the face.

should first be drawn downwards so as to bring the arms as easily as possible within reach, otherwise it may be difficult to get to the elbow. The body is grasped round the legs or round the pelvic girdle to avoid injury to the liver and other abdominal viscera, and carried upwards towards the mother's abdomen so as to be out of the way, and, at the same time, to swing the posterior shoulder downwards. Pass up the left hand along the child's back till the upper arm is reached, then with the first and second fingers along the humerus press into the bend of the elbow. This produces flexion of the arm, and if an assistant can press on the uterus at the same time it helps to bring the forearm down within reach of the fingers. The forearm is generally easily reached with the tips of the fingers, and can then be pressed down over the child's face with a wide sweep, thus bringing the hand down to the outlet. The hand is then seized, and by gentle traction it may be found possible to get the point of the shoulder to slip out over the perineum. If this is done, the delivery of the anterior arm is easy. All that is necessary is to swing the child's body backwards towards the perineum, pass the right hand as before along the child's back till the fingers can press into the bend of the elbow, and push the forearm down across the face (Figs. 133, 134).

If the point of the posterior shoulder cannot be delivered first, the bringing down of the anterior arm may be very difficult, as the additional breadth (from the tip of the shoulder to the junction of the neck with the shoulder) causes the anterior arm to be tightly pressed against the symphysis. Should it be found that the anterior arm is tightly wedged against the anterior pelvic wall, the best plan is to rotate the child's body so as to bring the shoulders into an oblique diameter or even so far as to make the anterior shoulder posterior. This rotation must be done in the direction which turns the face towards the extended arm. This manœuvre often results in bringing the retained arm across the chest, so that it can easily be reached and drawn down.

Dorsal Displacement of the Arm.—A rare condition, known as dorsal displacement of the arm, may occur in which the upper arm is extended while the forearm is flexed and lies along the nape of the neck. This displacement may be produced by attempts to rotate the body forcibly, or by rotating the face away from the retained arm in the manipulation described above (Fig. 135).

In order to undo the displacement the body must be rotated in the opposite direction to that which produced, or might have produced, the displacement, *i.e.* so as to make the face look towards the displaced arm.

In all manipulations for bringing down the arms the greatest gentleness must be exercised, as separated epiphyses, fractures, dislocations and injuries to the nerves of the brachial plexus are easily produced by rough methods.

Delay in the After-coming Head (*a*) Above the brim; (*b*) In the cavity.

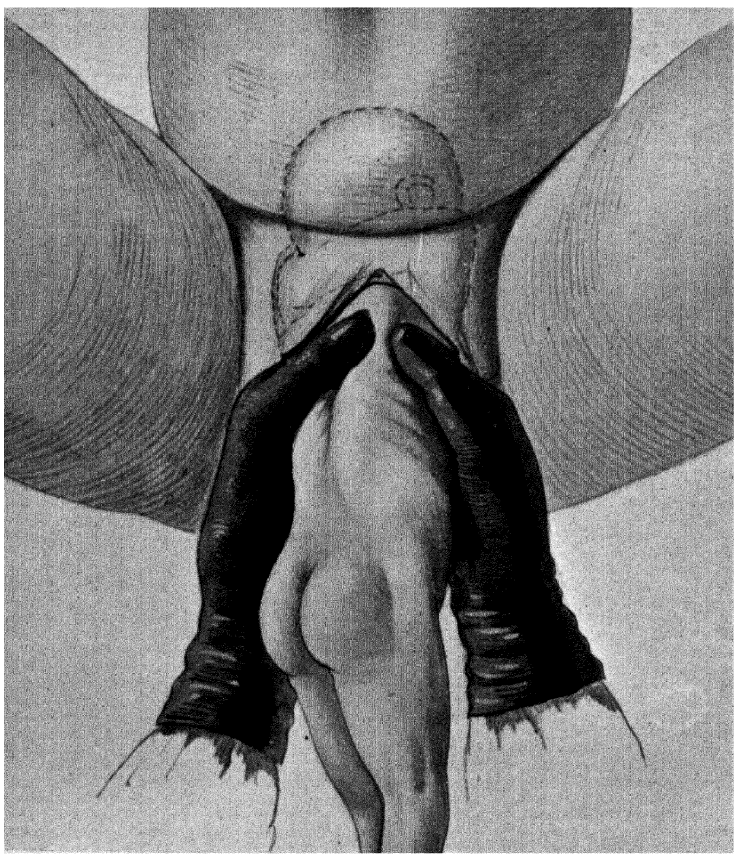


FIG. 135.—DORSAL DISPLACEMENT OF THE ARM.

To undo this displacement the body is rotated so as to make the face look towards the displaced arm. The fingers grasp the child by the thorax, not the abdomen.

(*a*) *Delay above the Brim.*—The chief difficulty with the after-coming head will occur in those cases in which the head is arrested above the pelvic brim. The base of the skull will have passed the inlet, but the wider part of the vault—generally a little below the biparietal diameter—will be arrested. This may be due to a contracted pelvis or to a large head or to extension of the head.

Treatment

Delivery of the head detained above the brim is best effected by traction from below assisted by suprapubic pressure. Traction may be applied either directly or by means of the forceps, but the former is generally effective and is more rapid, and, every moment being of importance if a living child is to be obtained, ought to be attempted first. Various methods have been described, but none is as efficient as the one known as "jaw flexion and shoulder traction," and that, therefore, is alone worthy of adoption. It is carried out as follows :—

The child's body, wrapped up in a warm cloth, is placed straddlewise along the flexor surface of the left arm so that the legs and arms hang over the sides of the arm. The fore and middle fingers are inserted into the vagina and passed up far enough to enable the index finger to be passed into the child's mouth and well back on to its lower jaw. As the head will pass the brim most easily in the transverse diameter, if not already in it it should be rotated into that diameter, especially in cases of flattened pelvis. The head should then be pressed firmly down from above—when possible by an assistant, or if not, with a clean towel over the abdominal wall to avoid soiling the hand—most pressure being exercised on the forehead end of the head, so as to flex it and bring the jaw as low down as possible. The fingers passed into the mouth must exercise only sufficient pressure to keep the head from becoming extended. Traction is not applied to the jaw, but to the shoulder. The index and middle fingers of the right hand are placed over the shoulders, one on each side of the child's neck. These fingers, when there is marked extension, may aid in flexing the head by pressing the occiput upwards while the finger in the jaw draws the face downwards. As soon as the head is flexed the fingers on the shoulders apply traction, first of all in a direction as far back as the perineum will allow, and as the head descends the line of traction is gradually carried more forward by raising the left arm on which the child is riding. When the nape of the neck is under the pubic arch and the face in the hollow of the sacrum, the fingers can be removed from the shoulders and assist the expulsion of the head by suprapubic pressure (Figs. 136, 137).

In carrying out jaw and shoulder traction care must be taken not to damage the child's mouth or jaw by too forcible pressure. To avoid this danger Smellie suggested placing two fingers on the upper jaw on each side of the nose instead of into the mouth, but this gives too insecure a hold to be of service. The chief merit of this method over traction by the forceps applied to the after-coming head is that it can be adopted at once; instruments and special preparations are not

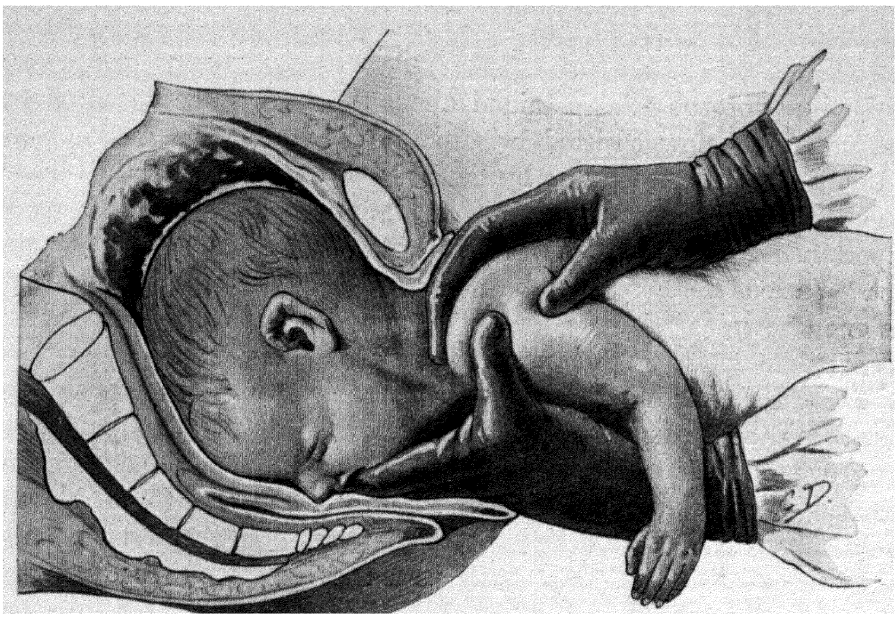


FIG. 136.—EXTENSION OF THE AFTER-COMING HEAD. DELAY IN THE PELVIC CAVITY. JAW AND SHOULDER TRACTION.

The child's body rides on the left arm. A finger passed into the mouth keeps the head flexed, while traction is applied to the shoulders by the fore and middle fingers over the clavicles.

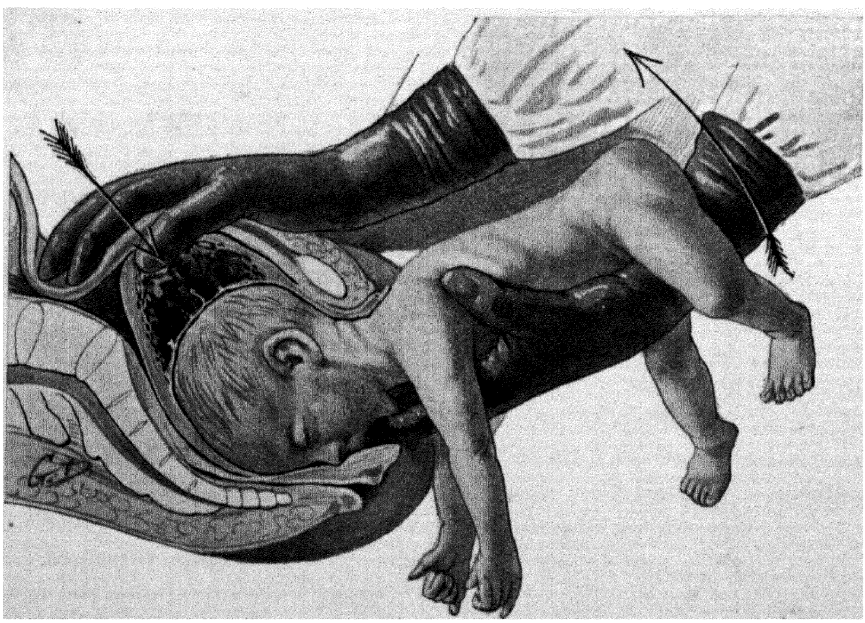


FIG. 137.—EXTENSION OF THE AFTER-COMING HEAD. DELAY IN THE PELVIC CAVITY.

The child's body lies straddle-wise along the left arm, with the fore and middle fingers in the child's mouth. The right hand, over a sterile towel, presses down the head, and as it descends, the left arm is raised in the direction of the arrow.

necessary. In cases of difficult breech delivery the forceps ought to be boiled and ready at hand. If ready and applied quickly the forceps is a very good means of delivery. The child's body is held up towards the mother's abdomen and the blades applied to the head below the body. If the forceps fails to deliver the head, or if the pulsation in the cord has ceased for some minutes, it is best to perforate the head so as to inflict as little damage on the mother as possible. It may be well to note here that the method of delivery by swinging the child's body up towards the mother's abdomen and at the same time expressing the head by fundal pressure as described for cases in which the head is detained in the cavity, is quite inapplicable to "above the brim" cases.

(*b*) *Delay in the Cavity.*—When the head has descended into the pelvic cavity it is out of the grasp of the uterus, and its further progress depends on the retracted upper segment being forced down on it by the bearing-down efforts of the mother. If these efforts are feeble and the resistance of the muscles at the outlet considerable, the delay may be fatal to the child. Extension of the head by presenting a larger diameter to the pelvic cavity is a frequent cause of delay (see Fig. 64c).

In such cases the best treatment is to press firmly on the fundus through the abdominal wall so as to push the head as low down in the pelvis as possible, and then by swinging the child's body up towards the mother's abdomen, the head will be expressed. This method is quite inapplicable until the head is entirely through the brim. Should it be found impossible to press the head down to the outlet, jaw and shoulder traction as described above should be adopted at once, as the nape of the neck must be behind the symphysis and the face in the sacral hollow before swinging the body upwards will be of any avail. It is also the best method of delivery if extension of the head is present and cannot be corrected by suprapubic pressure alone. A simpler method than jaw flexion and shoulder traction when the head is in the pelvic cavity is to apply traction by two fingers over the shoulders while the body is swung towards the mother's abdomen. In the rare cases in which the face comes down anteriorly, rotation of the body externally with manual rotation of the head internally should be practised, the hand being passed up alongside of the child's face and then rotated.

When the umbilical cord is pulseless and there is any difficulty in delivery of the after-coming head, perforation through the occipital bone ought to be done at once, rather than risk any injury to the mother.

Serious injuries to the child may result in pulling the head through

the brim, and indeed frequently cannot be helped because the head must be delivered quickly to obtain a living child. It is better to pull hard in the right direction and to risk these injuries, for a living though injured child is better than a dead child even if undamaged. The most likely injury is paralysis of the arm from injury to the brachial plexus. Rupture of the sterno-mastoid and other muscles of the neck, and hæmorrhage into the cellular tissue of the neck may

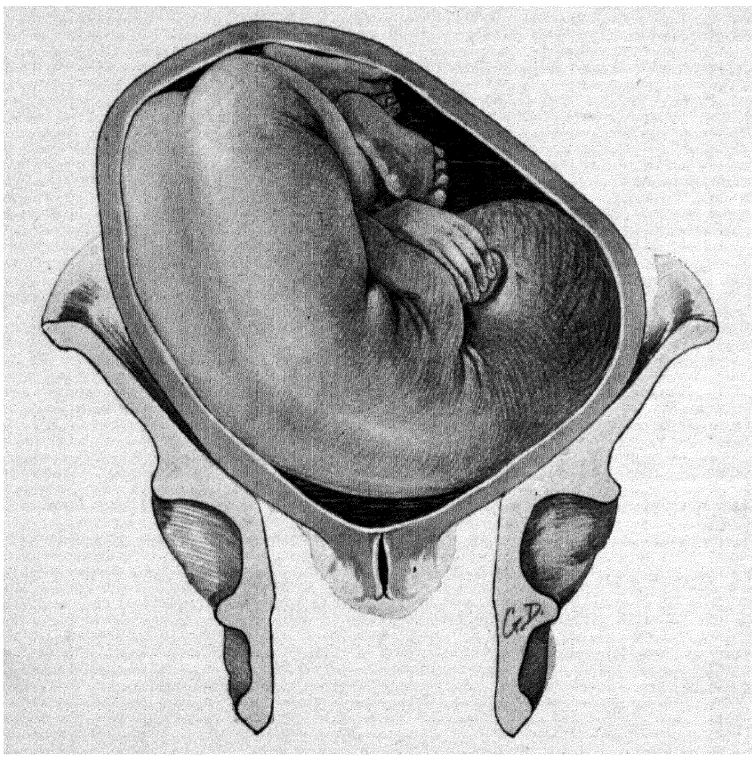


FIG. 138.—SHOULDER PRESENTATION: DORSO-ANTERIOR POSITION.
The head is in the left iliac fossa, the back lies obliquely, and the breech is on the right above the iliac fossa.

also occur. As the child is often born asphyxiated, preparations for its resuscitation should be made before delivery is completed.

Tearing of the tentorium cerebelli, or falx cerebri, is an extremely common form of injury in the fœtus. Eardley Holland found these tears in 48 per cent. of fresh viable fœtuses, associated almost invariably with subdural cerebral hæmorrhage. Most of the fatalities were the result of breech or forceps deliveries, but a few resulted from apparently normal labour. Tearing is especially liable to occur during rapid extraction of the after-coming head; tears were found by Holland in 75 per cent. of fœtuses born dead with the breech in advance.

CHAPTER XXXIII

ABNORMAL PRESENTATIONS (*continued*)

OBLIQUE LIE. SHOULDER PRESENTATION

CASES in which the long axis of the fœtus does not lie in the long axis of the uterus are described as "transverse" or "oblique" lies. It is very rare to find the long axis of the fœtus at right angles to that of the uterus—such a condition would be possible only with very small and premature children. Generally the fœtal axis is oblique to the uterine axis and the degree of obliquity varies greatly, but all such cases are usually included under "transverse" lie. The point of the shoulder is usually the presenting part, and hence the term "shoulder presentation" is used as synonymous with "transverse lie".

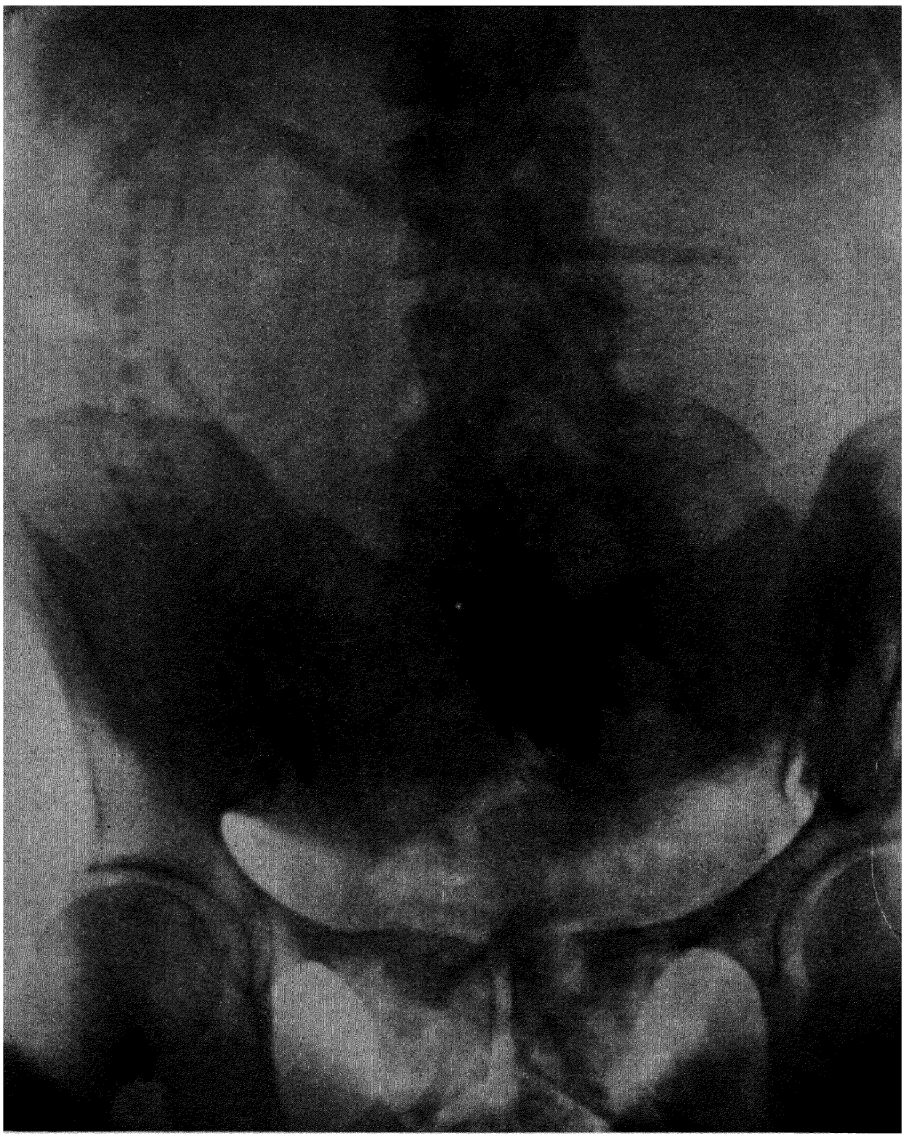
Causation.—All the conditions mentioned on p. 330 as liable to produce mal-presentation may cause a shoulder presentation. It is particularly frequent with premature children and the second of twins. Contracted pelvis and uterine obliquity are also common causes. In many cases no cause can be discovered.

Frequency.—The frequency of shoulder presentations varies greatly in different statistics, but about 1 in 200 may be taken as near the mark. They are six or seven times more frequent in multiparæ than in primigravidæ, no doubt owing to the laxity of the abdominal wall in the former resulting in a greater degree of uterine obliquity, though the fact that many more births will occur among multiparæ must not be forgotten.

Positions.—The child commonly lies with the head in one iliac fossa, the body sloping obliquely across the pelvis and the breech occupying a somewhat higher position than the head on the opposite side of the abdomen. The production of such a lie can be readily understood if the head, owing to difficulty in engagement, is imagined to slide up into the iliac fossa. Much more rarely the breech may slip into the iliac fossa and the head occupy the higher position on the opposite side of the abdomen, in which case some part of the trunk may present.

In shoulder presentation the acromion process is sometimes taken

as the denominator, but generally two positions only are designated, dorso-anterior and dorso-posterior. Of these the first is much the commoner and for the same reason as in vertex presentations, *viz.* that the child accommodates itself better to the shape of the uterine



[*From the Radiological Department of St. Thomas's Hospital.*

SKIAGRAM OF A SHOULDER PRESENTATION. THIRTY-SIXTH WEEK OF PREGNANCY.

cavity with its back to the front (see p. 288). Indeed, as might be expected from the preponderance of L.O.A. positions of the vertex and from the common obliquity of the uterus being one with the fundus to the right, the head in the left iliac fossa with the right

shoulder presenting and the back to the front is the most frequent position in transverse lies (Figs. 138, 139).

Mechanism and Course of Labour.—As the child, if lying transversely, cannot be born naturally unless in exceptional circumstances, it would be quite correct to say that there is no true mechanism of delivery. Delivery by the natural powers may, however, take place under certain conditions.

1. The transverse lie may be altered into a longitudinal one at the commencement of labour as the result of uterine action, and

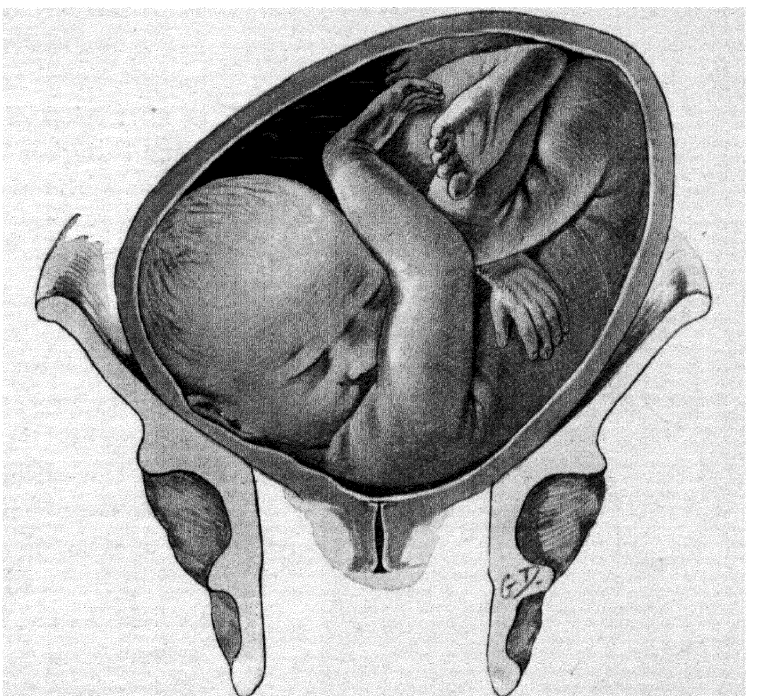


FIG. 139.—SHOULDER PRESENTATION: DORSO-POSTERIOR POSITION.

The head is in the right iliac fossa with the small parts in front, and the breech on the left above the iliac fossa.

spontaneous rectification by which a head presentation occurs, or *spontaneous version*, by which a breech presentation occurs, may be brought about.

2. With a small child, a roomy pelvis, and strong uterine action, the child may be born by the mechanism proper to a shoulder presentation. This is known as *spontaneous evolution.*

3. With a dead and macerated or small, soft fœtus the body may double up and be born in this way through a roomy pelvis. This is known as *spontaneous expulsion.*

Spontaneous Rectification.—Many cases, diagnosed as transverse before the commencement of labour, are found to be lying longitudinally after labour has begun. The uterine contractions press on the two poles of the fœtus and tend to bring them into the long axis of the uterus. That this must frequently occur in cases of slightly oblique lie is clear. With a freely movable fœtus and strong uterine contractions there is no reason why the same thing should not occur with a nearly transverse position of the child. If rectification does occur it will probably do so early in labour, certainly before any part of the child is driven into the brim. It may occur immediately after the membranes have ruptured, as then the direct action of the uterine contraction on the two poles of the child will be increased, but it will not take place when the waters have drained away to any considerable degree, or if any part of the child has prolapsed.

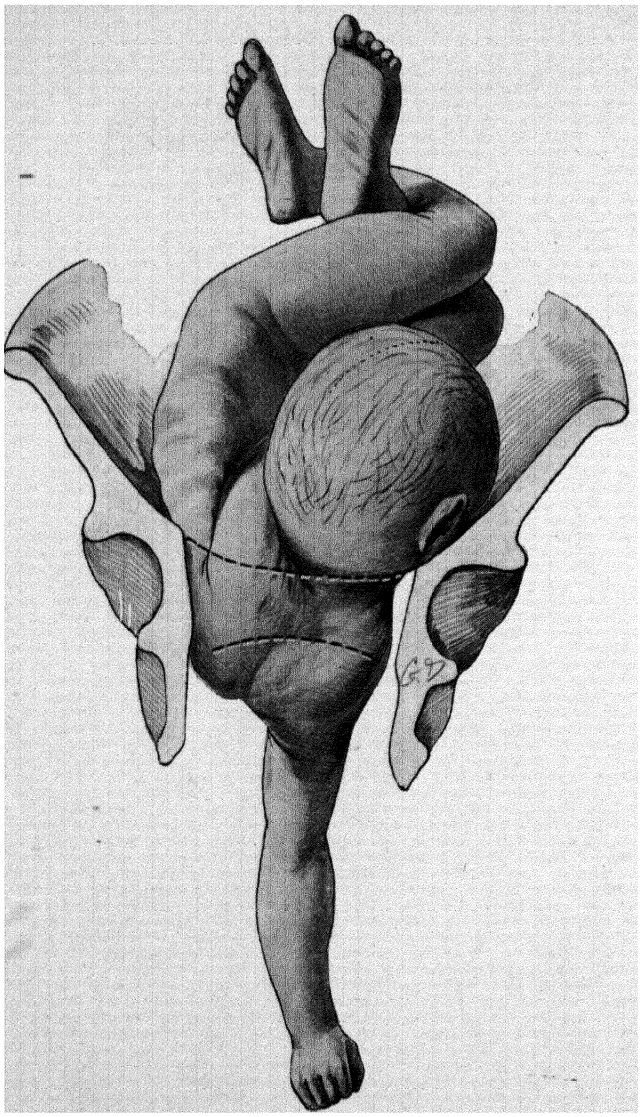


FIG. 140.—SHOULDER PRESENTATION: SPONTANEOUS EVOLUTION (1).

The shoulder with the prolapsed arm has rotated under the pubic arch. The head is above the brim, and the body is being squeezed past it with extreme flexion of the dorsal spine.

Spontaneous Version.—This is very rare, but occurs occasionally at the time of rupture of the membranes. Some of the cases may be those in which the breech was originally lower than the

head, but it may also occur in the usual variety of oblique lie when the head is the lower pole. Little is known of the mechanism by which it is produced. Possibly it is due to strong irregular uterine contractions, chiefly fundal, pushing down the breech, while the part of the uterus over the head is sufficiently relaxed to allow the head to rise.

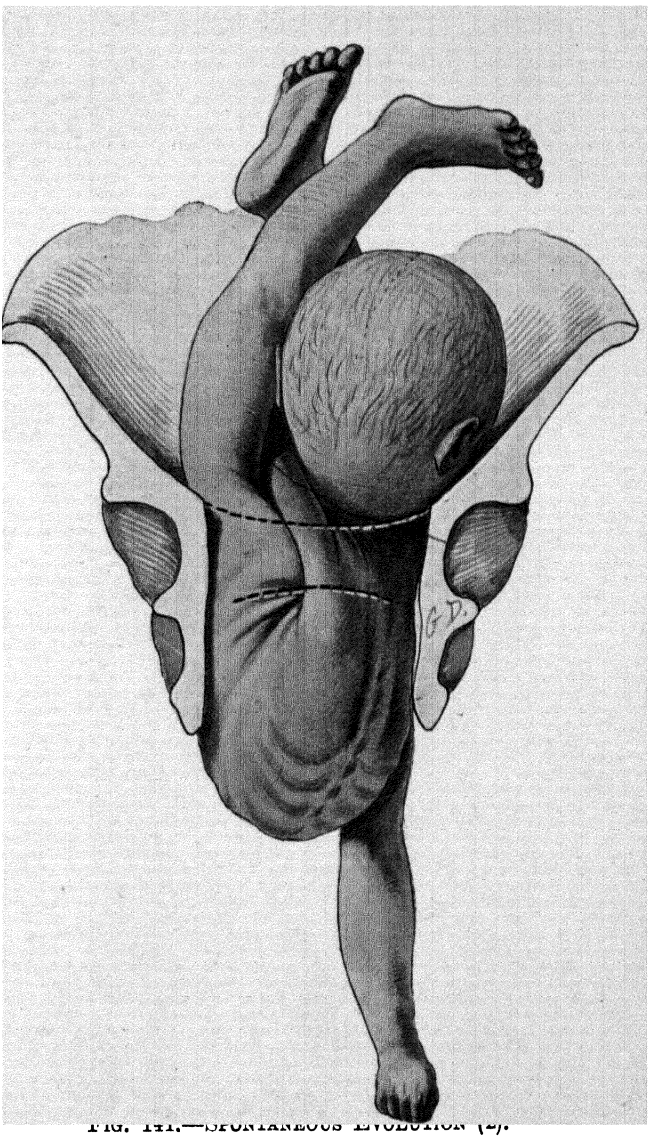


FIG. 141.—SPONTANEOUS EVOLUTION (2).

The body is squeezed past the head by extreme flexion; the ribs distend the perineum, whilst the breech occupies the sacral hollow.

Spontaneous Evolution. — This, being the natural mechanism of a shoulder presentation, deserves somewhat fuller consideration. If the fœtus is small and soft, the pelvis capacious and uterine action strong, the child may be born naturally. The shoulder is forced down into the pelvic cavity, the arm generally being prolapsed. The shoulder, following the usual rule, is rotated under the symphysis pubis and is forced down to the outlet so as to be visible externally. The clavicle and neck of the child are tightly pressed against the back of the symphysis. The head, which is lying above the brim, is squeezed against the trunk with extreme lateral flexion of the cervical and upper dorsal spine. Strong uterine contractions drive the trunk past the head so that the ribs distend the perineum, while the breech is forced into the hollow of the sacrum. The part

of the thorax below the shoulder already born now escapes, followed by the breech and legs. The posterior shoulder and arm and then the after-coming head are born in that order. The extreme compression and the excessive lateral flexion of the fœtus make it unlikely that the child will be born alive. Cases, however, have been recorded

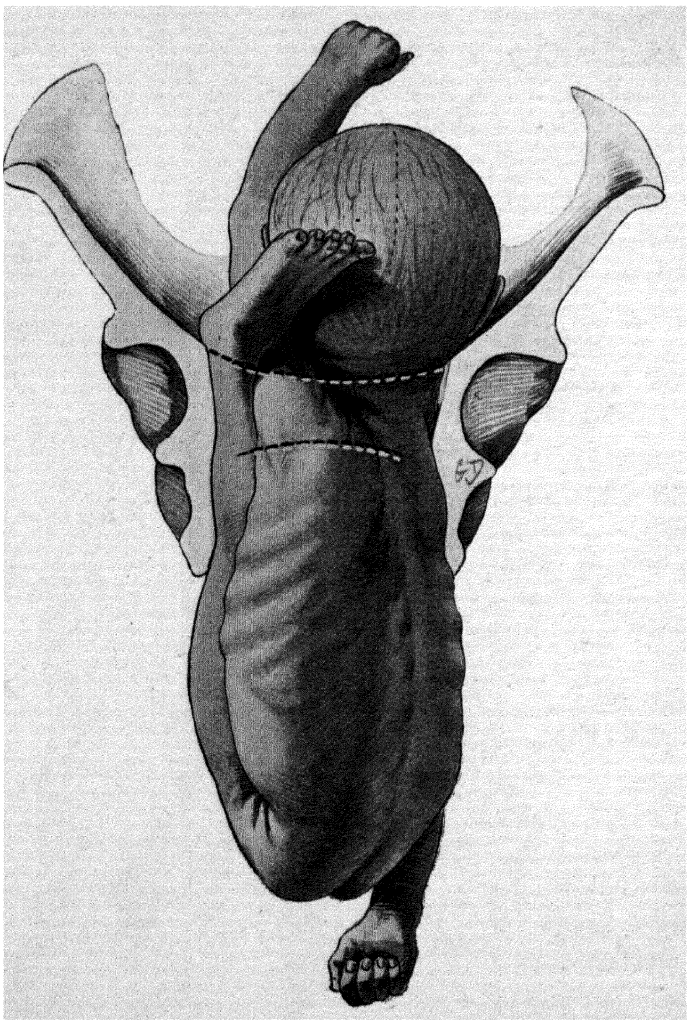


FIG. 142.—SPONTANEOUS EVOLUTION (3).

Escape of the thorax, followed by the breech and legs.

in which a living child has been delivered by this mechanism. It is most likely to occur with the second of twins when the uterus is acting strongly, the small size of the child and well-dilated maternal passages providing favourable conditions for its occurrence (Figs. 140, 141, 142, 143).

Spontaneous Expulsion.—This is the name given to the delivery when the child is expelled doubled up with the chest and pelvis pressed together, and the head and feet coming last. Only in

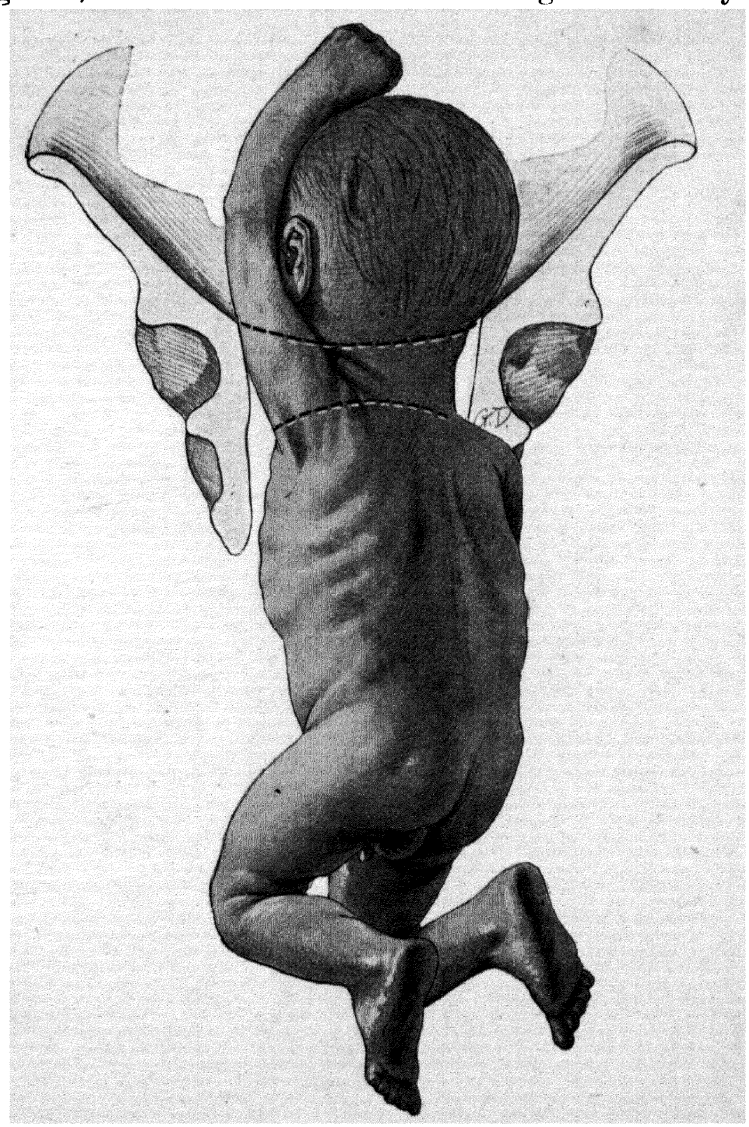


FIG. 143.—SPONTANEOUS EVOLUTION (4).

The trunk and legs have escaped, and the posterior arm and after-coming head only are left.

premature and macerated fœtuses will the body be soft enough to double up and undergo the compression necessary for this mode of delivery, and hence spontaneous expulsion is not often seen. Further, it is not always easy to distinguish this mode of delivery from the

preceding one, and no great stress can be laid on the exact mechanism by which birth takes place when small and softened fœtuses are compressed and forced through the pelvis by a strongly acting uterus. Considerable variations from the classical descriptions will occur, and several cases of deliveries of this kind have been accurately recorded which have some of the characteristics of both spontaneous evolution and expulsion (Fig. 144).

The point to be kept in mind is that a natural termination in any of these four ways is infrequent, and in the case of an average-

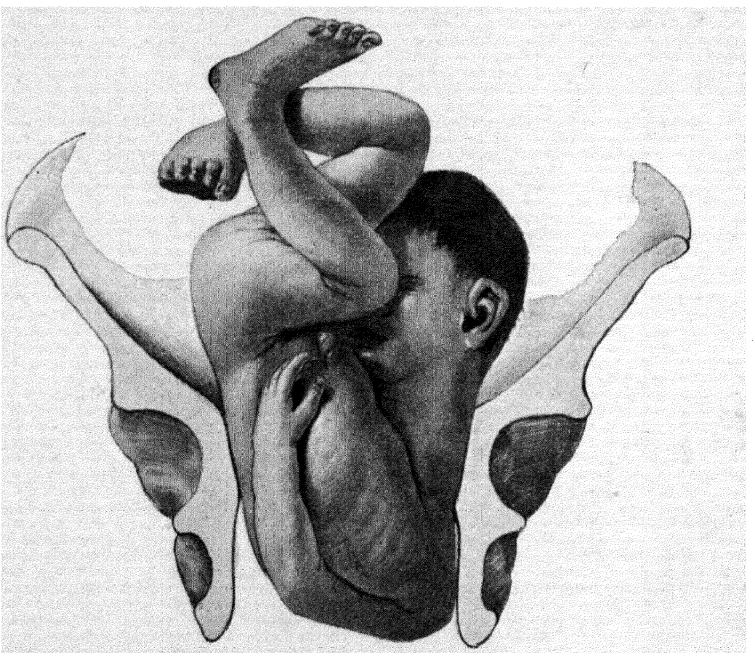


FIG. 144.—SPONTANEOUS EXPULSION.

Delivery of a premature or macerated fœtus by doubling and compression of the body.

sized child is very unlikely to occur after the labour has been in progress some time, especially after rupture of the membranes. Hence no reliance can be placed on the natural forces effecting delivery, and the lie of the child must be altered into a longitudinal one as early in labour as possible.

DIAGNOSIS

Great reliance must be placed on the abdominal examination, as these cases are most easily diagnosed by this method. This is fortunate, because it enables the oblique lie of the child to be discovered before the end of pregnancy, or early in labour before

the membranes have ruptured, or before any part of the child has descended into the pelvis.

On inspection the uterus may appear asymmetrical, being broader below and not as high in the abdomen as would be expected for the term of pregnancy reached. The degree of asymmetry will naturally depend on the degree of obliquity of the lie of the child—the more nearly it approaches the transverse, the more marked will be the change in the shape of the uterus. On palpation the head will be missed from the pelvic brim and will be found in one or other iliac fossa; the trunk will be discovered running obliquely from the head upwards and across to the opposite side to end in the softer breech, which forms a rounded end to the trunk on the opposite side to, and at a somewhat higher level than, the head (see Fig. 81). Most commonly the firm back will be made out to the front with the small parts of the fœtus above, but occasionally below, it. The lower pole of the uterus at the pelvic brim may be empty and not reveal any presenting part to the examining fingers; the fundus may similarly appear empty or to contain nothing but small parts.

Auscultation does not give any distinctive evidence. On vaginal examination during pregnancy, or at the beginning of labour, the presenting part will be too high up to be felt, no part of the fœtus having entered the pelvis. During the labour the membranes may be noticed to bulge in the elongated sausage-like shape which they assume when the presenting part does not come down into the lower uterine segment to keep the general intra-uterine pressure from the forewaters. Sometimes the arm or the cord may be felt presenting in the bag. The membranes generally rupture early, and this is often accompanied by prolapse of an arm, which may be taken to settle the diagnosis. If an arm does not come down the point of the shoulder may be felt, and the axillary fold, the scapula, and the ribs recognized. After the membranes have ruptured and the uterus has retracted down on the child, abdominal palpation is difficult, as the various parts of the child are squeezed together and the uterine wall has become thick and hard and moulded round the child.

Some doubt as to the diagnosis may arise if the lie of the child is only very slightly oblique. The head, if movable above the brim, may be considerably to one side, and yet, after labour has begun, come down readily into the pelvis. In breech presentations especially, the presenting part may be found in one iliac fossa and the small parts in the other, and yet after labour has been in progress some time the breech will be found deep in the pelvic cavity. The

difficulty in diagnosis that most commonly arises is to distinguish a transverse lie from a breech presentation. This will be more likely to occur when the case has not been seen early enough to allow of the position of the head being defined with certainty by abdominal examination, so that the vaginal examination has chiefly to be depended on for a diagnosis. If the shoulder presents and sufficient time has elapsed for an œdematous swelling (caput succedaneum) to have formed on it, it may simulate a buttock, and the acromion process the ischial tuberosity, while the fold of the axilla is very like the groin. In a shoulder presentation the ribs and scapula are the characteristic features to be sought for; if meconium is passed or the anus and genital organs recognized with certainty, the diagnosis of a breech presentation is decided. Should the arm have prolapsed it must be distinguished from a leg, the hand from the foot, and the knee from the elbow.

The projecting heel and malleoli, and the fact that the foot is at right angles to the limb and does not admit of complete extension in a line with the limb, serve to distinguish the leg, while the greater length and mobility of the fingers as compared with the toes, and the fact that the thumb can be abducted from, and opposed to, the palm, characterize the hand. A good plan is to place two fingers in what is taken to be the hand, and to try and "shake hands with it". The feel of the hand, which sometimes grasps the fingers, is often sufficiently characteristic to decide the diagnosis. The elbow is more sharply pointed and not so broad as the knee; it is said that the mobility of the patella on the knee may serve to distinguish it from the olecranon, but this is not a reliable sign, as the leg is so tightly flexed on the thigh when the knee presents that no movement of the patella is obtainable. The olecranon, however, projects more markedly, is more pointed, and has a decided depression on each side of it. When there is any difficulty the best plan is to extend the limb and bring down the foot or hand for examination. In any case of difficulty the patient must be anæsthetized and a full exploration of the pelvis made, the whole hand if necessary being passed into the vagina. The importance of this advice cannot be exaggerated, as it is no unusual thing for a shoulder to be mistaken for a breech presentation with grave risk to mother and child.

Prognosis

In shoulder presentations the outlook for the mother is graver than in any other presentation, but the earlier the condition is recognized and the earlier the lie is remedied the better the prognosis.

As in all malpresentations, the condition producing it may add to the difficulty of delivery; complications are frequent, and internal manipulation, with its increased risks of infection and damage to the maternal soft parts, is required in a considerable proportion of cases. Neglected shoulder presentations are always serious. All the risks of obstructed labour will be present, including rupture of the uterus from over-distension of the lower uterine segment, and, in the case of the child, death from pressure and diminution of the maternal circulation to the placenta is the usual occurrence. Hence the outlook for the child is serious, and a very large proportion of the children will be still-born. Prolapse of the umbilical cord, prematurity and delay in the birth of the after-coming head after version, are the common causes of fœtal death in transverse lies.

Treatment

As under ordinary conditions natural delivery cannot be looked for, the transverse lie of the child must be changed into a longitudinal one. If the case is seen early enough it may be possible to do this by external version (Fig. 145). If the os is dilated sufficiently to admit two fingers, no part of the child is prolapsed, and there is sufficient liquor amnii, bipolar podalic version may be performed (see p. 681); if labour has advanced sufficiently to allow of a hand being passed into the cervix to complete dilatation and not so far that the uterus is closely retracted on the child, internal version (see p. 683) must be done, a leg brought down, and the delivery completed as a breech. If the case is too advanced for version to be done with safety, decapitation (see p. 715) is the only means available for breaking up the wedge formed by the head and trunk with the shoulder in advance, being tightly jammed into the pelvic brim.

If the condition is recognized during pregnancy, an attempt should be made to correct the lie, so as to produce a vertex presentation. This can be done without risk to mother or child and usually without difficulty. The trouble is that the malposition is liable to recur. Hence careful investigation should be made for uterine obliquity, contracted pelvis, or other cause, and an effort made to counteract it when possible, or, as in the case of contracted pelvis, the treatment should be modified to meet the complication, *e.g.* by the induction of premature labour or Cæsarean section at term. In any case in which a transverse lie has been rectified, frequent examination of the patient will be necessary up to the onset of labour to ascertain that there is no recurrence of the malpresentation. When the head has been manipulated over the pelvic brim, careful padding in the iliac

fossæ and along the sides of the uterus with a tight binder over it may help to keep the lie longitudinal till labour begins.

Even if external cephalic version should fail, or the condition recur, another attempt should be made as soon as labour commences. The uterine contractions will then assist in maintaining the long axis of the child in the long axis of the uterus. Should this not be so, if the bag of membranes is still intact it is better to await dilatation sufficient to admit two fingers, before attempting any internal manipulation. The bag of membranes is so valuable as a dilator when

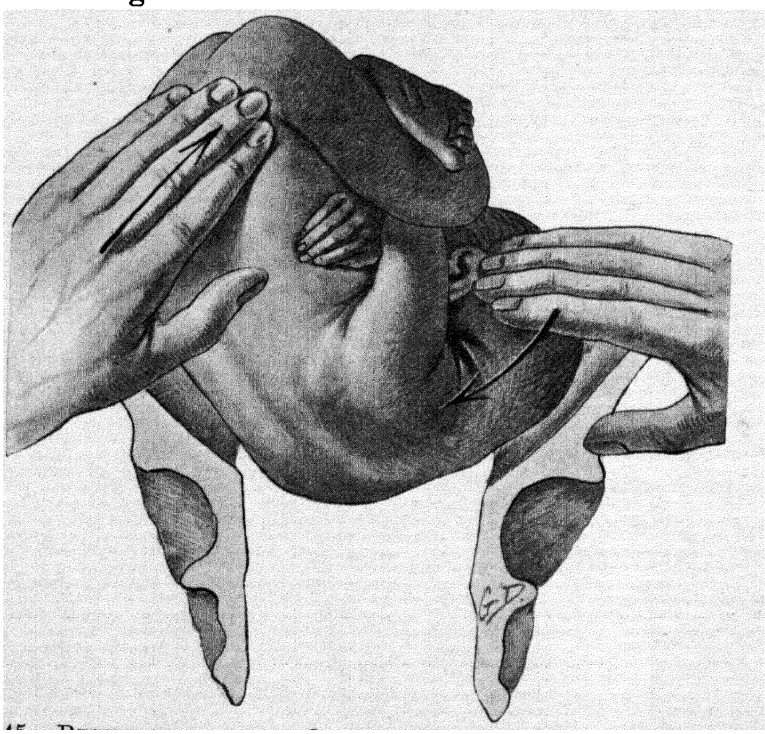


FIG. 145.—RECTIFICATION OF AN OBLIQUE LIE BY EXTERNAL MANIPULATION.

The body of the child is raised and the breech pushed towards the fundus by the left hand whilst the right hand presses the head down into the pelvic brim.

there is no efficient substitute in the presenting part and the danger of prolapse of the umbilical cord is so serious to the child, that it is better not to risk premature rupture by internal manipulation. If, however, there is sufficient dilatation to admit two fingers, there is the alternative of either proceeding at once to perform bipolar podalic version, or of waiting till the os is sufficiently dilated to allow internal version to be carried out. The latter alternative is to be preferred if the attendant can remain near at hand so as to be ready to interfere at once if the membranes rupture. If this occurs early bipolar version may still be possible, if an attempt be made immediately after rupture

of the membranes. If, on the other hand, the bag remains intact long enough to allow internal version to be done an advantage will be gained in the greater ease of turning the child and in the avoidance of complications. Should the membranes rupture before there is sufficient dilatation to allow the hand to be passed into the uterus

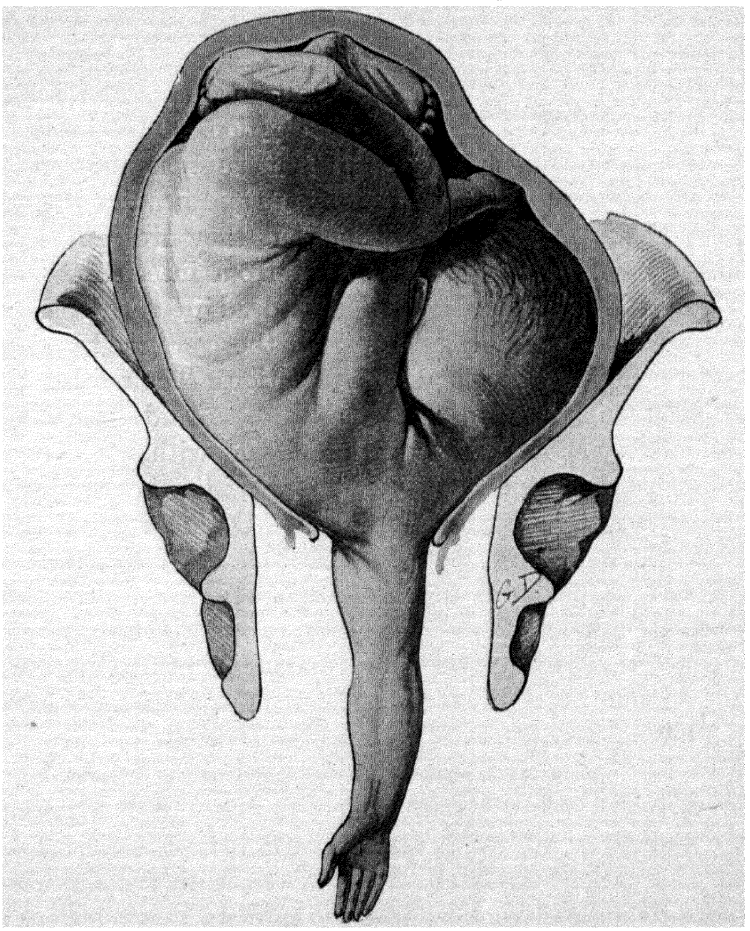


FIG. 146.—NEGLECTED SHOULDER PRESENTATION: IMPACTION.

The shoulder and arm, forming the apex of the wedge, are driven into the brim; the head and neck on the one side and the trunk on the other form the sides of the wedge. The liquor amnii drains away and the upper uterine segment becomes moulded on to the child, while the lower segment becomes thinned.

or to dilate the cervix sufficiently to admit the hand, a Champetier de Ribes's bag should be inserted to dilate the os, and version performed immediately the bag is expelled. If the os is partially dilated and soft, it may be possible to increase the dilatation by stretching with the fingers sufficiently to allow the hand to be passed cautiously into the uterus and to bring down a foot. If an arm has

prolapsed, there is generally sufficient dilatation to allow the hand to be passed into the uterus and version to be done; if not, the prolapsed arm should be replaced, and a Champetier de Ribes's bag put into the uterus and internal version performed as soon as the bag is expelled.

Neglected shoulder presentations with impaction render decapitation necessary. Happily such cases are nowadays rare. The liquor amnii drains away; the upper segment of the uterus becomes firmly retracted on to the child and cannot be felt to relax; the fœtal parts are not recognizable on abdominal palpation. The lower uterine segment is dangerously thinned, so that rupture may readily be caused by efforts at version. The shoulders and head of the fœtus are so firmly wedged into the pelvic brim that they are immovable, and the prolapsed hand is dusky and swollen from interference with the venous return. The child is invariably dead in such cases; if not from prolapse of the umbilical cord, from the continued pressure and from interference with the placental circulation. The mother is, therefore, the only consideration, and the simplest and least dangerous method of delivery should be adopted, and that without delay, because of the risk of rupture due to overstretching of the lower uterine segment. In these circumstances decapitate the tear with the sharp hook, scissors, or a wire écraseur (see p. 715), to break up the impacting wedge; push up the head, apply traction to the arm so as to deliver the trunk, and then deliver the decapitated head (see p. 716).

Owing to the risk of causing uterine rupture by injudicious efforts at version in neglected shoulder presentation, teachers and text-books have perhaps tended to lay undue stress on this condition, and to give the student a somewhat exaggerated impression of the danger of version in any case in which the patient has been long in labour. Candidates at an examination, for instance, if asked the treatment of a patient twelve hours in labour with the arm prolapsed, will hesitate to suggest version and recommend decapitation because of the emphasis which has been laid by their teachers on the risk of rupturing the uterus. The chances are that after twelve hours version could be easily performed, and without danger if done carefully. If the uterus had been in strong contraction, and the labour had advanced very rapidly in that period of time, the shoulder might already be too firmly impacted in the pelvic brim for version to be employed with safety, but in the vast majority of cases this would not be the case. Version properly performed is a simple operation without the difficulty there is in decapitation in dividing the neck when the shoulder is high up and the child's head tightly compressed against it, and without the risk of injury to the bladder

and other maternal soft parts. It is therefore worth while to consider the special points which would indicate the advisability or inadvisability of attempting version.

The length of time the patient has been in labour is no criterion; from what has been said above, the activity of the uterus is the deciding factor. If on abdominal examination the uterus is found relaxed between the pains and the fœtal heart is heard, version ought to be possible. Full anæsthesia must be induced, and in these circumstances a hypodermic injection of morphia (gr. $\frac{1}{4}$ to $\frac{1}{3}$) beforehand is of assistance in procuring complete relaxation. The whole hand should then be passed into the vagina and tentative efforts made to push up the shoulder and to get the hand into the uterus to seize a leg. Should these efforts cause uterine contractions, so that the hand is gripped by the uterus when any attempt at movement is made, then it is obvious that it would be unsafe to proceed with version. If the hand can be got into the uterus, but when any attempt is made to drag down a foot the uterus is felt to contract and resist the change of position, it will again be clear that there is danger in persisting, and decapitation should be preferred. If, on the other hand, the relaxation produced by morphia and chloroform allows of the hand being passed up without resistance, and traction on the foot does not make the uterus contract and grasp the fœtus, version ought to be done quite independently of the length of time the patient has been in labour. Without exercising undue force, traction should be kept up on the foot while efforts are made to push the head upwards from the iliac fossa. The method of tying a piece of tape to the foot, by which traction can be made with one hand externally while the other pushes the shoulder up internally, as described on page 684, is a very useful method in such cases. By continuing to exercise gentle traction in this way the head will generally be felt to move upwards in the course of a few minutes. If it does not, wait a little and try again, and if still the head will not go up, then decapitate rather than try to force the child to turn. It is evidently held by the uterus, and though force might overcome the resistance, to use it would almost certainly cause rupture. When the signs of obstructed labour (see p. 463) are obvious there is no alternative but decapitation.

COMPLEX PRESENTATIONS

Prolapse of the limbs occurring with a vertex presentation is known as a "complex presentation". Commonly it is the hand which comes down, rarely the foot, and very occasionally the hand and foot.

The most usual form of complex presentation is for the arm to come down alongside the head. It will occur under much the same conditions as prolapse of the umbilical cord—with a small head and a large pelvis, in contracted pelvis with marked uterine obliquity, and in other cases in which the head does not fit the brim properly and so leaves room for the hand to come down.

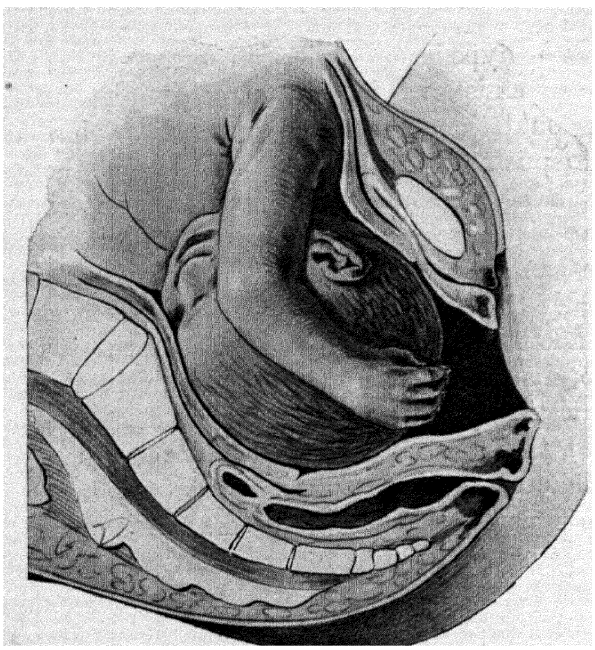


FIG. 147.—COMPLEX PRESENTATION.

Prolapse of arm with vertex presentation.

TREATMENT

The treatment in these cases is to replace the arm under anæsthesia; put the whole hand into the vagina, push the prolapsed hand over the front of the head and above its greatest diameter, and then press the head down into the brim. At the same time the cause of the prolapse should be carefully investigated and the case managed according to what is found. If the head is small and the pelvis capacious, there will be plenty of room for the head to pass even if the arm comes down with it. In such cases over-rotation of the shoulders may occur, so that the occiput may turn to the right in a first position or the left in a second position. If there is uterine obliquity, correct it, and put on a tight binder and make the patient lie on the side opposite to the fundus. If the pelvis is contracted,

the arm will probably prolapse again; in this case perform version as soon as there is sufficient dilatation and deliver as a breech.

If the prolapse is not discovered until the head has come down into the cavity of the pelvis, so that version is impossible and further progress is arrested, push the arm into that part of the pelvic cavity where there seems most room for it, and apply the forceps to

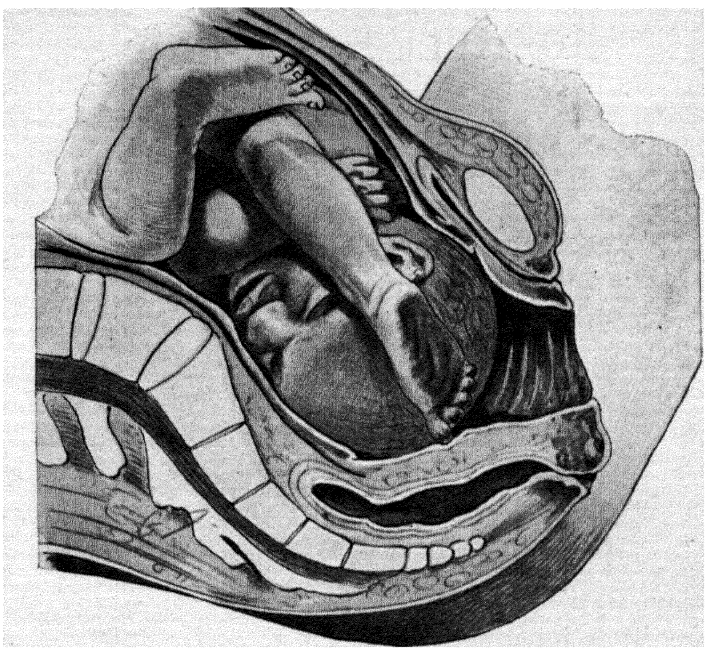


FIG. 148.—COMPLEX PRESENTATION.

Presentation of a foot with the vertex.

the head and try to keep back the arm while making traction. The fact that the arm and head were able to enter the pelvis together shows that there can be no great disparity of size between the head and the pelvis, so there is not likely to be any difficulty in delivery.

In cases of the presentation of a foot with the head, first make sure that it is a foot and not a hand; when quite certain that there is no mistake, make traction on the foot and push up the head, thus converting the presentation into a footling, and deliver as a breech. When the hands and feet come down together, bring down a leg.

CHAPTER XXXIV

MULTIPLE PREGNANCY

WHEN two or more embryos develop as a result of conception, the condition is known as multiple pregnancy. Twins, triplets, quadruplets are all known, and five at a birth has been described but is of the rarest occurrence.

Twins occur comparatively commonly, varying in different countries, but in about 1 in 80 labours on an average. As a rule, the more fertile a nation the more twin pregnancies will there be.

Triplets, on the other hand, are very rare, and only occur about once in 6000 labours. While twins and triplets are usually born alive, and in the case of the former usually survive, and may do so in the latter, quadruplets very seldom have survived in the known cases, and quintuplets have always ended in premature labour or abortion.

Causation.—There is some evidence to show that the production of twins may be an inherited tendency. It shows itself most through the females, but there is also evidence to prove that the male may have something to do with twin pregnancies. Thus there have been families in which several brothers have begotten twins; and again, a man has been known to beget twins by different wives.

Twins most commonly occur in the first pregnancy, and the tendency to produce twins in a first pregnancy increases with age in the woman.

Varieties.—Twins are termed binovular or uniovular.

Binovular twins are developed from two ova which may both be discharged from one ovary or may come one from each ovary. This has been proved by post-mortem findings, the situation of the corpora lutea showing whence the ova were discharged. The two ova must be discharged practically at the same time, and may be fertilized at a single coitus (see superfecundation, p. 398). This variety of twins is estimated as from 6 to 8 times as common as the uniovular variety. The children may be of the same or different sexes.

Anatomically, binovular twins have definite characteristics. As they are developed from separate ova, they have separate and distinct placentæ and membranes. The placentæ being quite separate, and each fœtus having its own chorion and amnion. At first, also, each embryo has its own decidua capsularis, but no trace of this can usually be found at full time when the chorionic sacs are in contact with one another. There are thus four layers of membranes to be found where they are in contact. It is said that the surfaces of the chorionic sacs may fuse and disappear, so that at

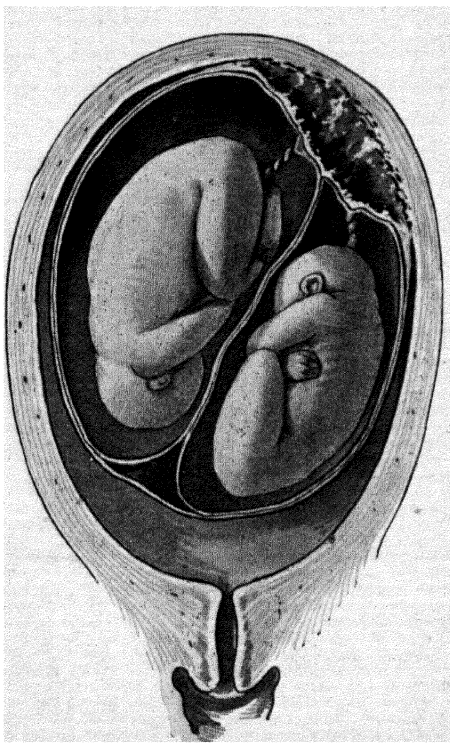


FIG. 149.—UNIOVULAR TWINS DEVELOPED FROM A SINGLE OVUM WITH TWO NUCLEI. One placenta, two amnions and one chorion.

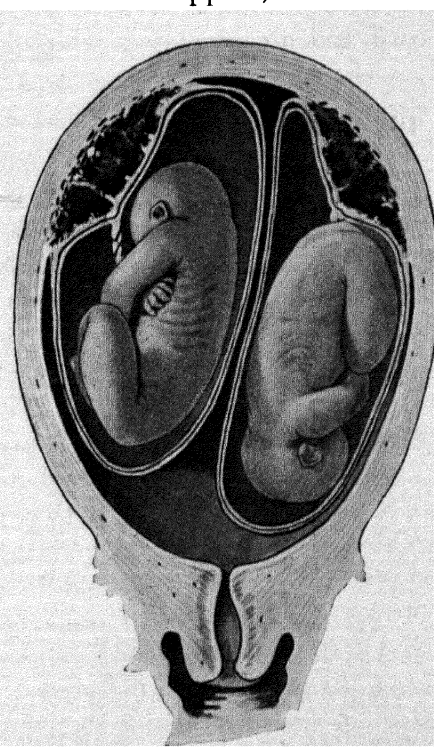


FIG. 150.—BINOVULAR TWINS. The placentæ are separate and each fœtus has its own chorion and amnion.

the end of pregnancy but one chorion can be found enveloping the two amniotic cavities, which always remain distinct (Fig. 150).

The binovular character of the twins may be seen in such a case if the placentæ are examined. They remain quite separate; there is no connection between the blood-vessels of each.

Binovular twins are usually of about the same weight and development, and are usually healthy, and more often are delivered at term than uniovular twins. The children may be of the same or different sexes.

Uniovular twins are developed from a single ovum which has either (*a*) two nuclei or (*b*) a single nucleus which after fertilization divides into two blastoderms. (This must be regarded as a pathological condition.)

(*a*) Developed from a single ovum with two nuclei, there can only be one chorion and one placenta, with two separate amniotic sacs. The placenta is at first double, but afterwards fuses to such a degree that there is always some communication between the vessels of each fœtus through the placenta. The placenta then has an area which is closely connected with each fœtus through its own umbilical cord and a central area which is common to both (Fig. 149).

The amniotic sacs are separate, because they are developed in close relation to each fœtus, while the chorion is single, being developed from the trophoblast which is continuous over both germinal areas. It occasionally happens that the amniotic sacs fuse where they touch one another, and that the septum between them eventually breaks down. Thus it comes to pass that the two fœtuses are contained in a single amniotic cavity, which, however, usually shows some remnants of the original partition. This variety of twins only occurs about 1 in 8 cases, or 12 per cent. of twin pregnancies, according to some authors. The sex of the fœtuses is always the same and the children are exactly alike.

(*b*) Developed from a single blastoderm which afterwards divides more or less completely in two, there can only be one chorion, one amnion, and one placenta from the first. Seeing that the blastoderm may be incompletely divided in this variety of twins, it is not surprising that pathological embryos may result.

All the varieties of double monsters are derived from this incomplete dichotomy of the germinal area. This incomplete separation may also affect the umbilical cord in such a manner that it is single at the placenta, but bifurcates as it approaches the embryos. Even when the embryos are quite separate there may be only one amniotic cavity, and in any case the placenta is single, with vascular communication between the halves belonging to each fœtus.

The sex of the embryos is always the same. This variety is very rare and only occurs, according to some statistics, in ·8 per cent. of all twin pregnancies. In both varieties of uniovular twins premature expulsion of the fœtus is likely to happen; they are liable to be unhealthy, small, and perhaps of unequal development.

Unequal development of the twins may occur to a variable extent; not infrequently one is twice as heavy as the other, but sometimes one actually perishes *in utero* when it has attained perhaps only four or five months' development. When this happens the dead

fœtus is retained *in utero* and becomes gradually compressed and mummified, giving rise to what is known as a fœtus papyraceus or fœtus compressus. Thus it remains until labour comes on, when it is expelled along with the healthy fœtus (Fig. 151).



FIG. 151.—FŒTUS PAPYRACEUS OR COMPRESSUS, PASSED WITH THE PLACENTA AND MEMBRANES AFTER THE BIRTH OF A NORMAL FŒTUS.

The method of destruction of the second fœtus in this case is interesting. It will be remembered that there is always a placental communication between the vessels of the two fœtuses,

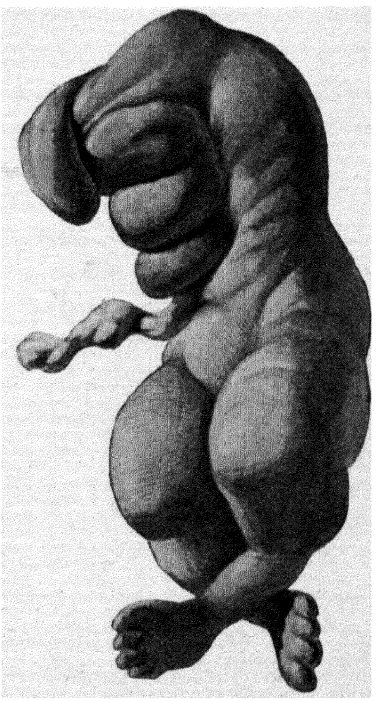


FIG. 152.—ACARDIAC ACEPHALIC MONSTER, ONE OF UNIOVULAR TWINS OF WHICH THE OTHER WAS NORMAL.

and as long as the hearts of the two fœtuses have equal pumping power, there is no great amount of mingling of the blood of one with that of the other, save in the intermediate area of the placenta which is common to both. Now, if the heart of one fœtus becomes more powerful than that of the other, the blood in the hypogastric arteries of the one umbilical cord will be forced up the arteries of the weaker, thus reversing the course of the blood-stream, and causing indirectly back pressure upon the weaker heart.

The commonest result of this reversal of the blood-stream is death

of the weaker fœtus, but sometimes it occurs very early in the pregnancy and produces an *acardiac monster* instead (Fig. 152). This sometimes takes the form of an indescribable mass of tissue without head, upper extremities, or heart, but with lower extremities and some abdominal development. This comes about because the reversal of the blood-stream supplies the lower extremities with blood sufficiently pure for their needs, but no purified blood is supplied at all, and as the heart of the monster is not working, the upper part of the body never becomes differentiated.

When a single germinal area becomes incompletely divided double monsters result, which are described according to their appearance and relations to one another. Thus the commonest form is that in which the fœtuses are joined by the sternum, and are known as Thoracopagus; joined by the lower end of the body, Ischiopagus; joined by the head only, Craniopagus; double-headed monsters, Dicephalus; two-faced monsters without any division of the neck or thorax, Diprosopus; double pelvis with four lower extremities and single body and head, Dipygus; and so on. In addition to these malformations, a hydatidiform mole may develop from one germinal area in uniovular twins.

Triplets may be developed from three ova or from two ova, one of which has a double nucleus, or conceivably from a single ovum. The placenta and membranes will be arranged in the same way as in twins, according to the manner in which development has taken place.

Superfecundation.—By this term is meant the fertilization of two ova, discharged at the same ovulation period, by different sexual acts at short intervals. It is no doubt one of the ways in which binovular twins are produced, and its possibility could hardly have been recognized but for the results which have been described in connection with negresses.

Cases are known in which a negress has given birth to twins, one black and the other white, the fathers being respectively black and white. It is quite possible that this argument is fallacious, however, for it does not seem impossible that coitus between a negress and a white man might result in a twin birth, one infant being white and the other black. It would no doubt be an exceptional occurrence.

Except for the black and white theory, there is not the slightest reason to suppose that superfecundation is possible.

Superfœtation is now believed to be impossible, or to be capable of explanation on other grounds. By superfœtation is meant the fertilization of two ova belonging to different ovulation periods at

intervals of one or more months. The term was invented to attempt to explain cases in which a woman has been delivered of a fœtus at full time, and then one or more, up to four, months later has been delivered of a second apparently full-time fœtus It presupposes that a second ovum could become fertilized while an embryo was already developing *in utero.*

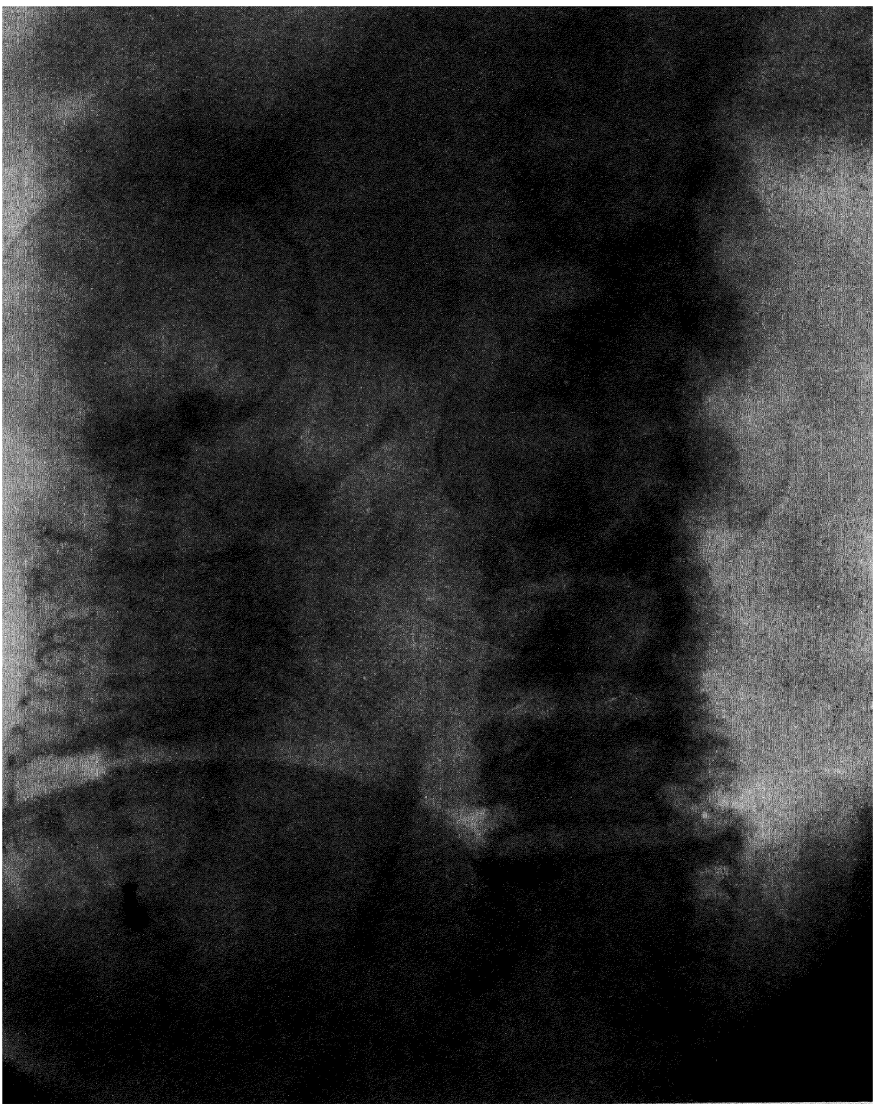
By some authorities this is theoretically reckoned to be possible, because up to the end of twelve weeks' pregnancy there is still a cavity left in the uterus between the decidua vera and decidua capsularis. At the same time, it seems hardly possible that in these circumstances the Fallopian tube entrances would be sufficiently patent to allow a second ovum to enter the uterus or for spermatozoa to pass through them. The growth of the embryo, the dilatation of the uterine cavity, and the decidual development all seem to be against any such possibility.

In consequence of these doubts, the consensus of opinion at present is that superfœtation is impossible, and that all the supposed cases of it can be explained on other grounds.

It has been shown, for instance, that in some apparent cases of superfœtation the patient has really had a double uterus, and that pregnancy has occurred in each half at different times, leading to the delivery of fœtuses with a considerable interval between. In other cases it has been shown that one fœtus has been intra-uterine and the other extra-uterine, the second having found its way into the uterine cavity by a process of breaking down of the cavity (perhaps interstitial) in which it originally developed.

Finally, the question arises whether ovulation occurs or can occur during pregnancy. It has always been believed that ovulation, like menstruation, is suspended during pregnancy, and if this is true the whole possibility of superfœtation breaks down.

Pregnancy with twins does not differ greatly from a single pregnancy. The uterus is by no means always more distended, twin children being usually decidedly smaller than in single births, their conjoint weight being generally somewhere about 10 lbs. Hydramnios is distinctly more frequent, however, especially in the sac of the larger of uniovular twins. The distension of the uterus depends more on the amount of liquor amnii than on the mere fact of there being twins present. Naturally, when there is undue uterine enlargement, pressure symptoms such as œdema of the lower limbs and abdominal wall, varicose veins, and hæmorrhoids, will be marked. Labour is frequently premature, but usually not by more than a



[*From the Radiological Department of St. Thomas's Hospital.*

SKIAGRAM OF TWINS *IN UTERO* BETWEEN THE TWENTY-SIXTH AND TWENTY-EIGHTH WEEKS OF PREGNANCY.

Each fœtus is presenting by the breech. Such a skiagram is of diagnostic value in the case of excessive abdominal enlargement in connection with pregnancy and its possible association with a tumour.

*

week or two. Malpresentation is common with twins. In about half the cases both present by the head; in about a third, one presents by the head and one by the breech; in about 10 per cent., both by the breech; in about 8 per cent., by the shoulder and head or breech, or both by the shoulder.

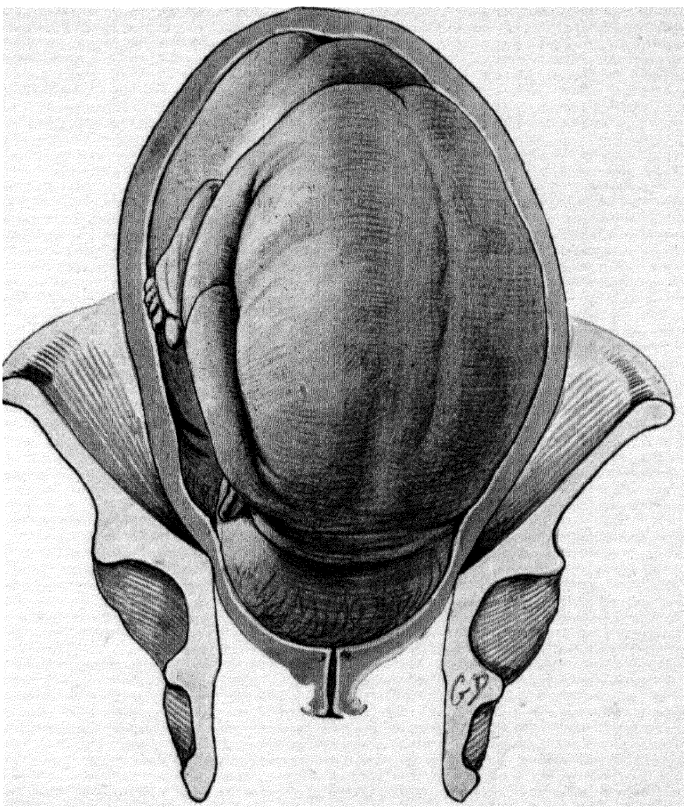


FIG. 153.—TWIN PREGNANCY.

Both fœtuses presenting by the vertex, one lying in front of the other, thus making accurate diagnosis impossible till after the birth of the first.

DIAGNOSIS

If the fœtuses lie alongside one another *in utero*, the diagnosis may be easy; if one twin lies in front of the other, it may be impossible until after the birth of the first child. The twins very rarely lie one above the other, but in such a case early diagnosis would be easy (Figs. 153, 154, 155).

Unusual enlargement of the uterus, *e.g.* a girth at the umbilicus of 40 inches or over, instead of the usual 36 to 38 inches, would lead to a suspicion of the presence of twins, but, as has already been mentioned, excess of liquor amnii may be the cause, and, on

the other hand, the enlargement of the uterus may not be sufficient to attract attention if the twins are small, as is frequently the case.

If the fœtuses are so placed that two heads and two backs with an unusual number of small parts can be discovered on abdominal examination, the diagnosis is simple. Two heads may be found at the pelvic brim, or a head at the brim and another in the fundus, and it may be possible to trace the back of each to end in the rounded

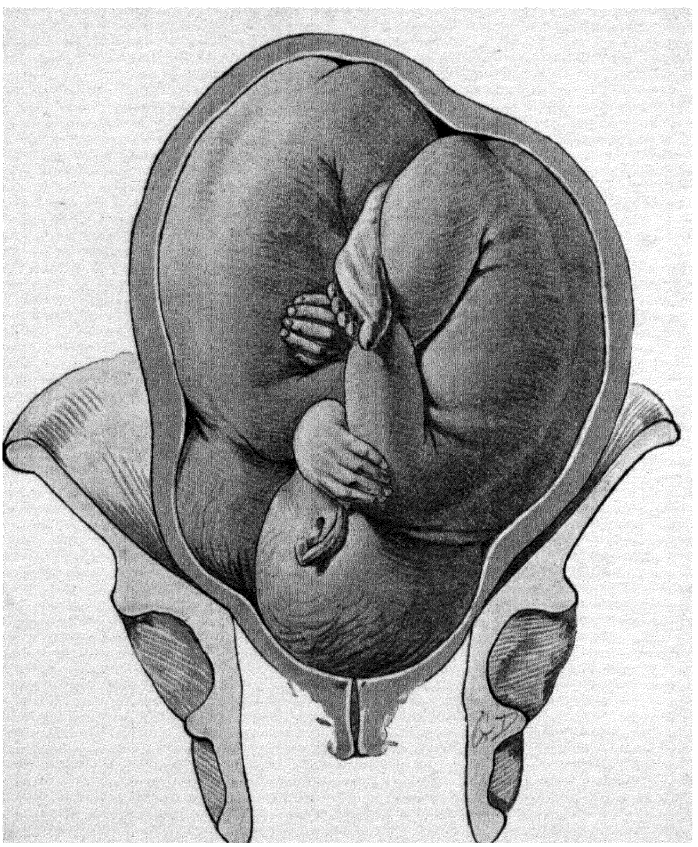


FIG. 154.—TWIN PREGNANCY.

Fœtuses lying alongside one another, and both presenting by vertex, thus making diagnosis easy. The two heads may be palpated and two backs with small parts in groove between them. The two points of maximum intensity of the fœtal heart ought also to be readily located.

breech, with a definite groove between the two fœtal trunks. The diagnosis is confirmed by hearing two fœtal hearts, recognized by their points of maximum intensity being at different positions at some little distance from one another, and the sounds being lost between them. It is usually stated that definite confirmation of the auscultation of two heart-beats can only be made by counting the two and finding the rates different, but the chances of error are so

great that this observation is rarely of practical value unless found to be constant after frequent observation and by different observers. The rates of the two fœtal hearts may not differ by more than 10 or 12 beats per minute, and the error of observation is such that if one heart is credited with five extra beats and the other deprived of five of its just due, the difference will disappear.

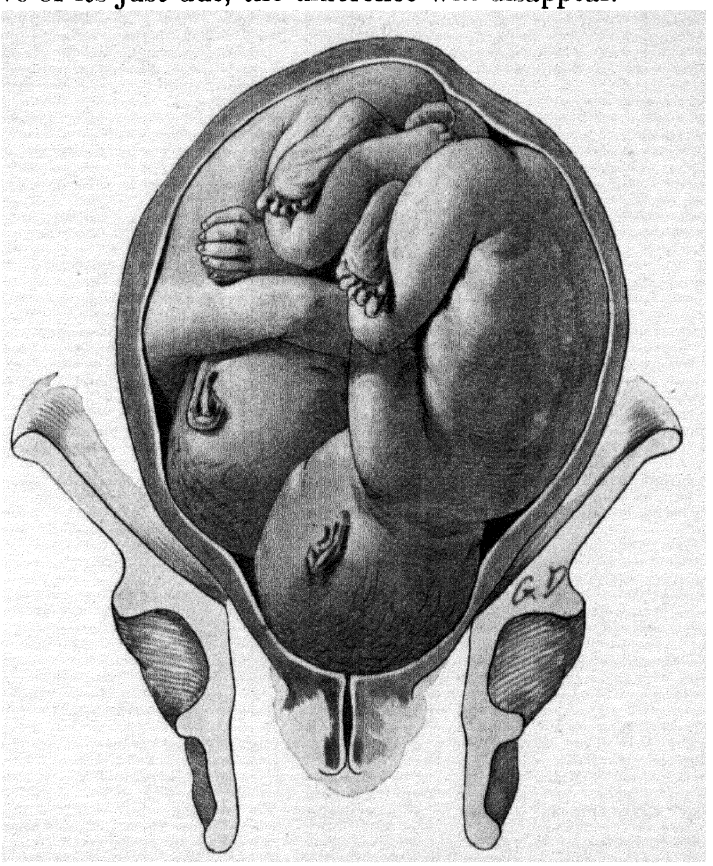


FIG. 155.—TWIN PREGNANCY. BOTH PRESENTING BY THE VERTEX.

Fœtuses lying alongside one another. Both heads could probably be felt, one at the brim and the other above it in the iliac fossa. One back and an unusual number of small fœtal parts would be recognized and possibly two breeches in the fundus.

Vaginal examination is rarely of assistance, as two fœtal parts do not present together, and it is difficult to recognize two bags of membranes. Large size of the uterus after rupture of the membranes and small size of the presenting part should raise a suspicion of twins.

With the birth of the first twin, the high position of the fundus uteri, the palpation of a second fœtus, and the presence of a second bag of membranes and presenting part make the condition clear.

Prognosis

Labour may be prolonged from inertia due to over-distension of the uterus and from malpresentations and the possibility of one twin interfering with the descent of the other. On the other hand, owing to the children being under the average size, the labour is generally easier. So far as the mother is concerned there is a trifling

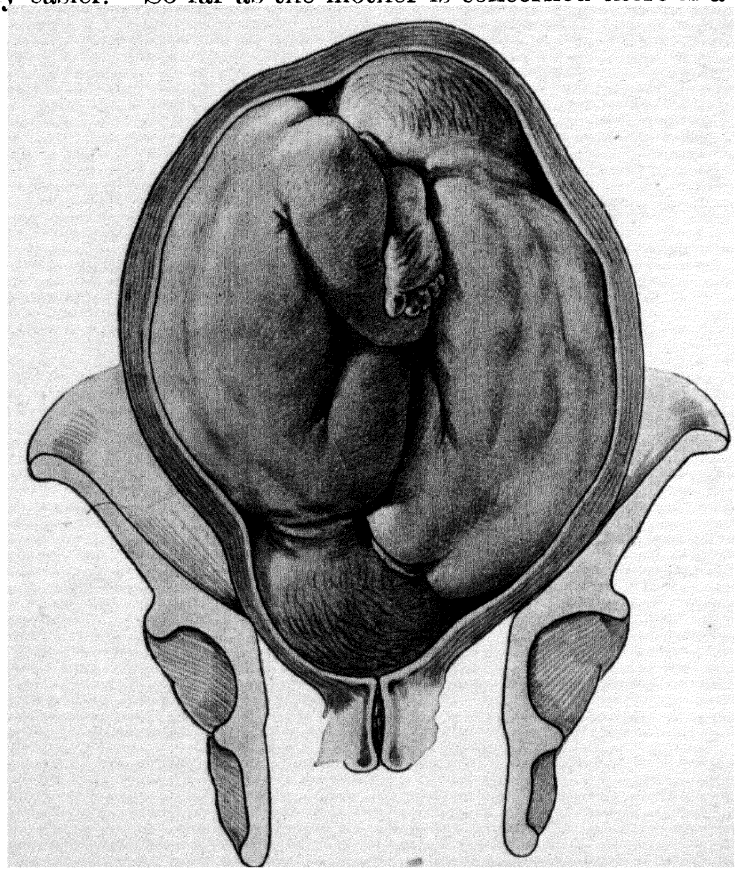


Fig. 156.—Twin Pregnancy.

First presenting by the vertex, second by the breech : fœtuses lying alongside one another. This offers the easiest diagnosis. One head would be felt at the brim and one at the fundus; two backs with the small parts in the groove between would be palpable and two points of maximum intensity of the fœtal heart could be made out, one on the right and below the umbilicus and the other on the left and above.

increase of risk in labour—principally due to the greater danger of postpartum hæmorrhage, owing to the larger placental area and the diminished power of contraction and retraction resulting from over-distension of the uterus. There is a slightly increased risk from sepsis, owing to the more prolonged labour and greater frequency of internal manipulation, as well as the double placental site with its

greater area for infection and absorption and greater opportunity of retained placental fragments. There is also said to be a greater tendency to eclampsia and renal complications.

The prognosis for the children is decidedly worse than in single births. Premature, small, and feeble children occur with greater frequency in twin deliveries, and breech, shoulder, and other malpresentations are common.

Labour with Twins.—The first stage is liable to be prolonged from inertia of the over-distended uterus; the second stage up to the delivery of the first twin may also be long for the same reason, but very often the small size of the fœtus more than compensates for the less efficient uterine action. After the birth of the first child there is cessation of uterine activity for ten or fifteen minutes, and then the second child generally descends quickly through the dilated passages. The placenta or placentæ do not usually come away till after the birth of the second child, but occasionally the placenta and membranes may follow each child, and in very rare cases the birth of the second twin may not take place till days, or even weeks, after that of the first.

Management of Labour

In many cases the diagnosis of twins will not be made until the birth of the first child, so that special instructions would be useless before then; in cases in which the presence of twins is known or suspected, the only precaution to be taken would be to leave the birth to nature as far as possible, and avoid the use of the forceps unless the indications were very decided. There may be some degree of uterine inertia and a slow delivery, but plenty of time should be given, and the children frequently being small and premature, serious injury is easily inflicted during instrumental delivery. After the birth of the first child the placental end of the umbilical cord should be tied securely, as it is possible for a second uniovular twin to bleed through the umbilical cord of the first in the event of there being a communication between the two placental circulations. A careful investigation should then be made to determine the lie and presentation of the second child. If it should be transverse, it is important that version should be done before the waters have escaped and the uterus is retracted firmly on the fœtus. Unless there is hæmorrhage from premature separation of the first placenta, or indications for speedy delivery from slowing of the fœtal heart-beat, it is best to wait for an hour for the return of pains. If the pains return and the second bag presents it should be ruptured, as it is

not required for dilatation, and the escape of the waters will stimulate the uterus. If, however, there is hæmorrhage, or slowing of the fœtal heart, the second bag should be ruptured without awaiting the return of pains, and the uterus stimulated by friction. When after waiting an hour there is no return of pains, the membranes should be ruptured, as this generally produces uterine activity. If it does not, massage to the fundus and expression may effect delivery. An injection of ½ c.c. of pituitary extract is often effectual in producing return of pains and the delivery of the second child, and is especially valuable in diminishing the risk of bleeding after delivery. As the uterus is frequently inert, and as a greater degree of retraction and contraction is required to control the bleeding from the double placental site, slow delivery and abdominal pressure on the fundus are important to lessen the risk of hæmorrhage. Hence, unless there are very strong reasons for the sake of either mother or child, delivery by the forceps should be avoided. With the passages already dilated and the child usually less than the average size, this ought generally to be possible. Prolapse of the umbilical cord and hæmorrhage from placental detachment are the only likely indications for immediate delivery of the second child. If the fœtal heart-sounds are unaffected, physical and nervous exhaustion of the mother is a definite contra-indication to delivery; she ought to be left to rest until active labour recommences.

Recognizing the greater risk of postpartum bleeding in twin deliveries, everything should be in readiness for its treatment; rubber gloves, douche-nozzles and tubes should be sterilized, and a plentiful supply of boiling water and cold sterile water prepared. Throughout the third stage the hand should be kept on the uterus ready to stimulate contraction, and after the birth of the placenta a drachm of liquid extract of ergot or an intra-muscular injection of ergotin should be given as a prophylactic measure. Pituitary extract before the birth of the second child has already been mentioned as particularly efficacious in this respect. The attendant should remain within call for longer than usual. Any abnormal presentation, prolapse of the umbilical cord, placenta prævia, or other complication must be treated as in single births. Difficulties may arise in the case of small children by two presenting parts trying to engage together. Push back the upper one and let the lower descend, unless one is a breech and one a vertex, in which case it is better to let the vertex come first, so, even if the breech is the lower, an attempt should be made to push it up.

Locked Twins.—Obstruction from locking of twins is a very rare accident which has received more than its due attention in the text-

books. The locking may occur by the head of the second child being jammed between the chin and thorax of the first child. The obstruction in this case may be difficult to detect if a diagnosis of twins has not been made, as the first head will be well down in the pelvic cavity, and the condition may not be discovered till the whole hand is passed into the vagina under anæsthesia—often for the passage of the forceps. An attempt should be made to push up the obstructing head and to deliver the first head with the forceps; if this fails, the first child, being in the greater danger from pressure on the umbilical cord and

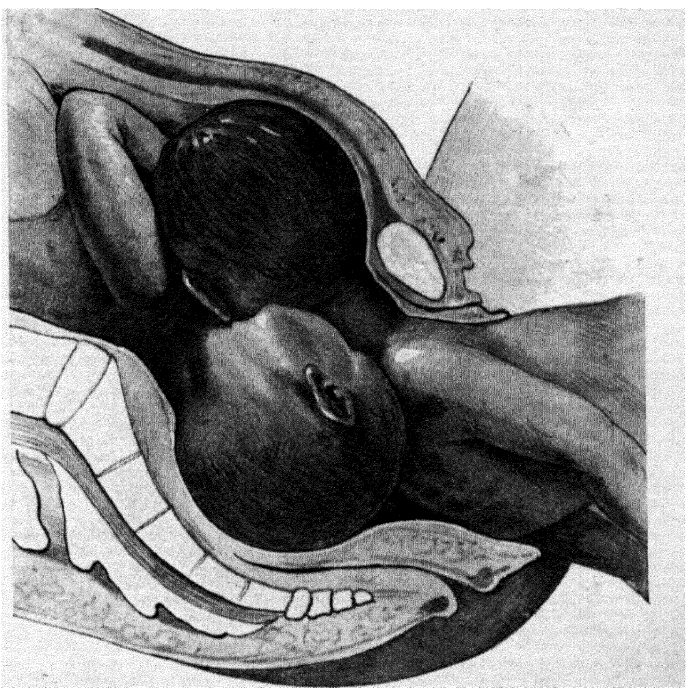


FIG. 157.—AFTER-COMING HEAD OF THE FIRST LOCKED WITH THE FORE COMING HEAD OF THE SECOND.

thorax, should be sacrificed; perforation should be done if the head is high up; decapitation if it is low down. This will generally permit of the second head being pushed up and the body of the first delivered; but if it does not, then perforation of the second head must also be done. Another form of locking may occur when the first child is born by the breech and its head is obstructed by that of the second trying to enter the brim with it, the chins being locked (Fig. 157). Delay with the after-coming head being quickly fatal, the second child is again the one to save; unless the head of the second can be disengaged and pushed up at once, the first child is certain to be stillborn. Probably decapitation of the first, pushing up the decapitated head,

and delivery of the second by the forceps will be the only possible treatment. In difficult cases, perforation and crushing of the lower or fore-coming head may also be required. Locking of the after-coming head with the shoulder or arm of the second child will

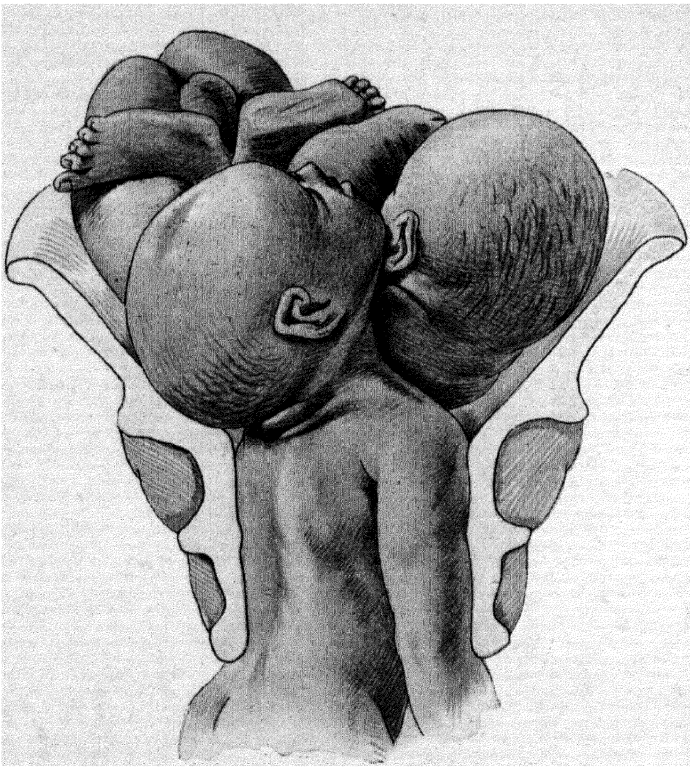


FIG. 158.—LOCKED TWINS.

Locking of the after-coming head of the first with the shoulder of the second, which is lying obliquely.

require decapitation of the first, and probably version for the second. Cæsarean section, when the conditions are favourable, will be the best treatment when the locking cannot be overcome by manipulation from below (Fig. 158).

CHAPTER XXXV

MALPOSITIONS AND ANOMALIES OF THE UMBILICAL CORD

DESCENT of the umbilical cord in front of the presenting part may result in death of the child from compression of the cord between the presenting part and pelvic brim.

Two varieties are described :—

1. *Presentation* when the umbilical cord lies below the presenting part in the intact bag of membranes (Fig. 159) ;

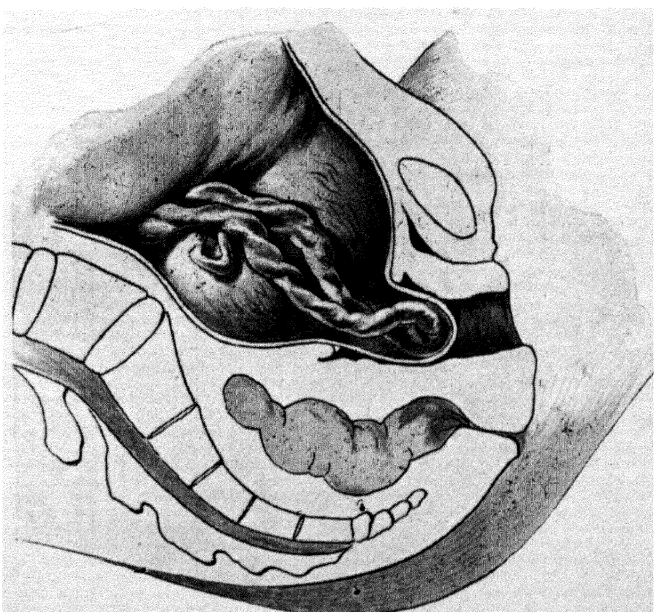


FIG. 159.—PRESENTATION OF THE CORD.

After rupture of the membranes the condition will be termed prolapse of the cord.

2. *Prolapse* when after rupture of the membranes the umbilical cord lies in the cervix or vagina below the presenting part.

A third variety is sometimes mentioned, expression of the umbilical cord, to designate the cases in which a loop of the cord is squeezed past the head or breech during delivery. The term is of no practical importance, and is scarcely worth retaining.

Causation

Descent of the umbilical cord is most often found when the presenting part does not come down and completely occupy the cervix, and so allows a loop to slip down through some unoccupied space between it and the pelvic wall. It is thus a common complication of contracted pelvis, of all malpresentations, especially shoulder-presentation, of labours with twins or small, premature, or malformed fœtuses. Pendulous belly, by interfering with the direction of the uterine axis and so directing the presenting part behind or to one side of the pelvic inlet, and thus preventing early engagement, predisposes to descent of the umbilical cord. Excess of liquor amnii, by permitting undue mobility of the fœtus, tends to produce presentation, and if rupture of the membranes results in a sudden gush of liquor amnii, it is likely to be followed by prolapse of the cord. A very long umbilical cord, and low implantation of the placenta will facilitate descent.

Diagnosis

This is generally quite simple. In presentation a loop of cord can be felt through the membranes and rolled between the fingers; pulsation when present can be recognized. In prolapse a loop of cord, into which the finger can be hooked and pulsation detected, will be felt in the vagina. There is really nothing which can be confused with the prolapsed cord, even if pulsation has ceased. Prolapsed small intestine, either maternal from rupture of the uterus or fœtal from ectopia, has been described as a possible source of error. In the unlikely event of such confusion, the fact that the finger cannot be hooked through a loop of intestine owing to the attached mesentery would serve to distinguish it.

Prognosis

In itself descent of the umbilical cord in no wise adds to the gravity of the labour so far as the mother is concerned, but it must not be forgotten that presentation and prolapse of the cord often indicate that some serious complication, such as contracted pelvis or malpresentation, is present which may add considerably to the danger of the labour. Also the interference required for treatment of the prolapse increases the risk of infection.

To the child the prognosis is extremely grave, and especially in cephalic presentations; compression between the hard head and the pelvic wall completely obstructs placental respiration, and

the child will soon die unless the cord is replaced above the head. In breech and shoulder presentations there is more chance of the cord escaping compression; if version is performed in transverse lies before the shoulder is wedged into the brim, the danger is less than in head cases. If pulsation is not detected in the cord it must not be concluded that the child is dead. If pulsation has only just ceased the fœtal heart may still be heard on auscultation, and resuscitation may be possible if pulsation has ceased for five or ten minutes the child is almost certainly incapable of resuscitation. In over half the cases of prolapsed cord the child is still-born, and naturally the prognosis is worse the earlier the cord comes down and the earlier the membranes rupture.

Treatment

In *presentation* nothing must be done to provoke rupture of the membranes, as before this occurs the child is in no danger; therefore till rupture occurs no attempts at reposition must be made, and vaginal examinations should be avoided, or if essential should be conducted with the greatest care; the patient should be kept quiet in bed, and it is better to prohibit the giving of an enema. The cause of the descent of the cord must be carefully investigated, as the treatment will necessarily be modified by the condition found. Thus Cæsarean section would be indicated if the disparity between the head and the pelvis was sufficient to make the delivery of a living child by the natural passages unlikely. So long as the membranes are intact the amniotic fluid will prevent serious compression, and if the presenting part is not engaged there is always the possibility of the cord returning if the patient is placed in such a position that the fundus is the lowest and the cervix the highest part of the uterus. This gives the presenting loop of cord the chance of sinking down into the fundus. The knee-chest position is the one which will best produce this state of affairs, so the patient should be placed in this position and kept in it as long as possible (Fig. 160). When she can remain no longer—twenty to thirty minutes is generally the limit of endurance—she ought to be turned gently on to her side, and, if it has been possible to discover on which side of the presenting part the cord comes down, on to the opposite side to this, and kept lying down. The Trendelenberg position has an effect similar to, but less decided than, the knee-chest, and has its advocates as being endurable for a longer period. It is doubtful, however, if much advantage will be gained from prolonged postural treatment, and the disadvantages in the shape

of nervous and physical exhaustion, prolongation of labour, and increased risk of rupture of the membranes in changing position are considerable.

In *prolapse*, if pulsation is present, an attempt must be made to replace the cord above the presenting part and to retain it there until delivery can be effected. These procedures will vary according to the stage of labour at which the prolapse occurs and the condition which has produced the prolapse. The simplest way to consider the treatment will be to describe first the methods of replacing and retaining the cord above the presenting part, next the stages of labour and conditions in which each is specially applicable, and then, the subsequent management of the labour. As all such manipulations are undertaken on behalf of the child, it is obvious

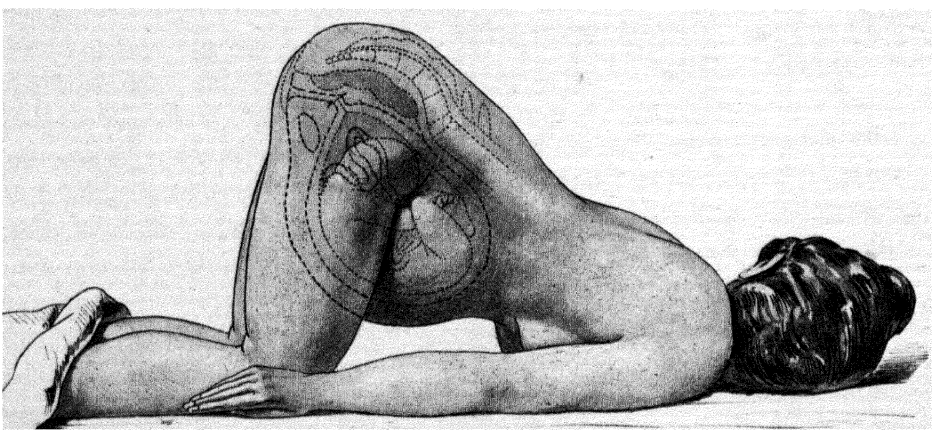


FIG. 160.—THE KNEE-CHEST POSITION IN THE TREATMENT OF PRESENTATION OF THE CORD.

In this position the cord tends to sink towards the fundus and the presenting part to leave the brim and so diminish the risk of pressure on the cord.

that the absence of pulsation in the cord, unless at a very late stage in the labour when rapid delivery without danger to the mother is possible, is a definite contra-indication to interference. The soft cord offers no obstruction to delivery, and therefore, unless there is some prospect of the child being born alive, interference on its account is needless.

Replacement of the cord may be manual or instrumental.

Manual Reposition.—Under anæsthesia the whole hand is passed into the vagina and the prolapsed loop of cord taken between two fingers and pushed up above the head. This takes some time. Generally the best plan is to push up first the part which came down last, *i.e.* the arms of the loop; if these can be got up the most

dependent part of the loop is the last part to be pushed up. If the arms of the loop as they are pushed up fall back again, it is best then to try and replace the most dependent coil, which will leave small coils on each side of it, and these in turn must be pushed up after the main coil. Wrapping the loop in sterile gauze, so as to make it into a compact mass, and then pushing the whole mass above the head, has been suggested as the easiest method of manual replacement. When once the cord has been got back, an attempt must be made to keep it up with the fingers while the head is pressed into the brim to prevent the return of the cord. A firm abdominal binder should then be applied in the hope of retaining the head in the brim. Unless this can be done the cord will come down again. Hence manual reposition is useless unless the os is fully or very nearly fully dilated and the head can enter the brim or be brought down by the forceps. In primigravidæ, also, this method may not be available if the vagina is not sufficiently roomy to allow the introduction of the hand. It may be worth trying reposition before an anæsthetic is administered; this should be attempted with the patient in the knee-elbow position. There is not the same chance of success as with the anæsthetized patient, nor does it afford the same opportunity of investigating the conditions which have favoured descent of the cord.

Instrumental Reposition.—Special repositors have been designed, but, except for their additional length, possess no special advantage over the ordinary male gum-elastic catheter generally used for this purpose. A long piece of whalebone with a hole bored through one end may be used when a catheter is not to hand. A catheter of the largest size is used with a piece of sterilized tape or string to snare the cord, and then the snared cord and catheter are passed above the presenting part and left in position till the child is born. There are several methods of snaring the cord. The catheter is perforated opposite the eye and a loop of tape threaded through the catheter as through a needle; the coil of prolapsed cord is then passed through the loop of tape, which is tightened by drawing on the loose ends through the opposite side of the catheter until the coil of cord is brought up to the eye of the catheter. It must be retained like this with just sufficient traction on the tape to keep it in position without compressing it. The catheter and cord are then passed up into the uterus till no cord is left below the presenting part. In a modification of this method the tape is carried round the coil of cord and the loop hitched over the point of the catheter. After the cord has been carried above the head, the withdrawal of the

catheter will disengage the loop from the point of the catheter without bringing down the cord. Another method is to use the metal stilette of the catheter for threading the tape; the loop of tape is passed into the eye of the catheter round the stilette and out again, and used in a precisely similar way to snare a coil of cord. When once the cord is up in the uterus, the stilette may be withdrawn, thus liberating the tape, obviating any compression of the cord, and permitting removal of the catheter. Variations on these methods will doubtless occur to the individual operator; in the event of difficulty being found in threading a double loop through the catheter, a short single piece of tape tied at the ends will form a loop into which a coil of cord may be drawn. Tape is to be pre-

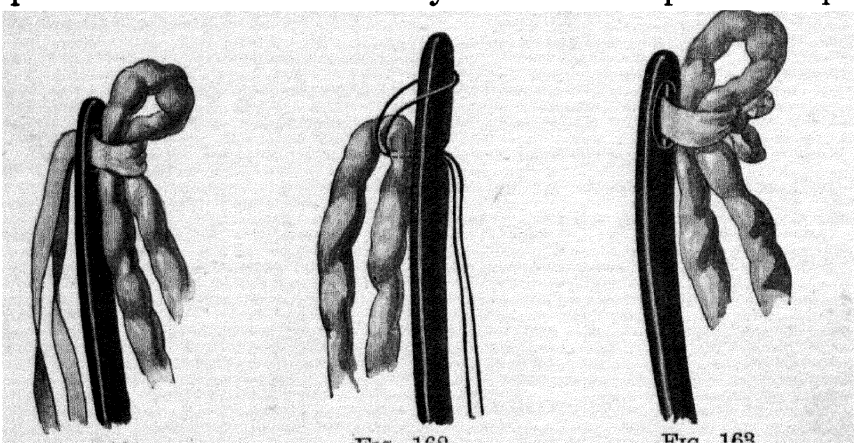


FIG. 161. FIG. 162. FIG. 163.

REPOSITION OF A PROLAPSED LOOP OF CORD BY A CATHETER.

Catheter perforated opposite the eye, a loop of tape threaded through the two openings and a coil of cord snared by the tape.

String similarly passed through double opening in catheter, coil of cord held by the loop of string being hitched over the point of the catheter.

Tape threaded round the stilette of the catheter and tied round loop of cord.

ferred to string as less likely to cause constriction of the cord. It is inadvisable to risk recurrence of the prolapse by attempting withdrawal of the catheter. Uterine polypus forceps or ring forceps can also be used to replace the cord.

The cord can only be retained in the uterus either by bringing down the presenting part to fill up the lower uterine segment, or by putting in a dilating bag, such as Champetier de Ribes's. If the head is presenting, it can only be brought down if the cervix is fully or nearly fully dilated; on the other hand, if the breech is presenting it is possible to bring down a leg, and so use the half-breech to plug the cervix, when there is much less dilatation. Hence

podalic version is often adopted in the treatment of prolapse of the cord.

The management after reposition of the cord will therefore depend first of all on the stage of labour reached.

If the os will admit two fingers and there is a sufficient quantity of liquor amnii present, do bipolar version and bring down a leg; if this fails insert a de Ribes's bag. If the os is sufficiently dilated to allow the hand to be worked through and internal version performed, do podalic version and bring down a leg. If the os is nearly fully dilated and there are signs of fœtal distress indicating rapid delivery, apply the forceps, and as soon as the cord is well above the head, draw the head gently downwards and hold it while the rim of cervix is worked above the head. As soon as all the cervix is drawn up, deliver quickly. Version should be preferred in flat pelvis, and in any case in which the position of the head is unfavourable for rapid delivery by the forceps, *e.g.* occipito-posterior positions, face and brow presentations. In breech cases, the bringing down of a leg is the obvious method of treatment, unless the breech is down near to the pelvic outlet, in which case delivery must be hastened by traction in the groins. In transverse lie, podalic version must be done in any case, and prolapse of the cord does not modify treatment, except in so far that feeble pulsation may indicate rapid completion of the labour.

Other malpositions and anomalies of the cord may affect labour (see sections dealing with abnormalities of the cord and its placental insertion, p. 33 and p. 34). The usual length of the umbilical cord has been stated to be about the same as that of the fœtus, *viz.* 20 inches (50 cm.), but considerable variations occur. Excessive length predisposes to descent and to the formation of coils and knots. An abnormally short cord may cause malpresentation, delay in labour, antepartum hæmorrhage from premature detachment of the placenta, rupture of the cord and inversion of the uterus.

Coiling of the cord round some part of the fœtus produces the same effect as an abnormally short cord, and may cause still-birth from interference with the fœtal circulation to the placenta. Most commonly the cord is round the neck, but coiling round the body or limbs may also occur.

The diagnosis of short cord or relative shortness from coiling is not easy. It may be suspected if there is delay without obvious cause, the head receding markedly between the pains, and antepartum bleeding occurs. The ordinary treatment of cord round

the neck at the birth of the head has already been described. If recognized as a cause of delay earlier in labour, an attempt to divide the cord and deliver quickly should be made.

Knots may be formed as the result of fœtal movements, the child passing through a loop which later forms into a knot. Knots are rarely tight enough to obstruct the circulation, but occasionally they may lead to intra-uterine death of the fœtus. Local protuberances of the Whartonian jelly may give an appearance of knotting and have been described as false knots. They are of no practical importance.

Shortness of the Cord.—The cord may be actually short or relatively short by being twisted round some part of the fœtus. It is very rare for obstruction to occur during the first stage of labour; it generally occurs after birth of the head. The dangers are rupture of the cord, premature separation of the placenta, or inversion of the uterus. Inversion must occur as the result of *vis a fronte*, as when the uterus is contracting the accident is unlikely to happen. The treatment is releasing the cord if wound round the neck, or clamping and dividing the cord, and then hastening the birth of the child.

CHAPTER XXXVI

CONTRACTED PELVIS

PELVIMETRY

To ascertain whether the pelvis of a patient is above or below the normal size it is necessary to take certain measurements; this is known as pelvimetry, of which there are two varieties, external and internal.

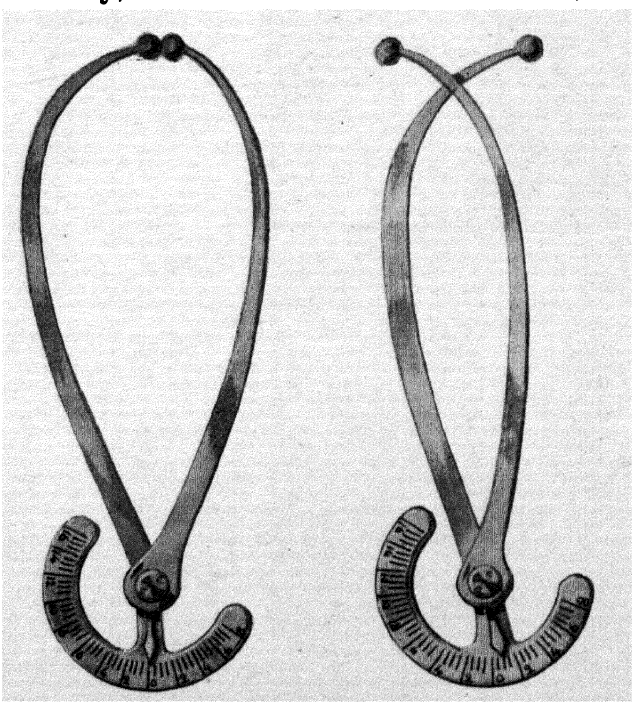


FIG. 164.—PELVIMETER.

External pelvimetry is of value because the size of the internal measurements can be more or less accurately deduced from it, generally less rather than more, but chiefly because it indicates the type of contracted pelvis that is present.

Internal pelvimetry gives more accurate results, but it is difficult to measure the pelvis thoroughly by this method without an anæsthetic.

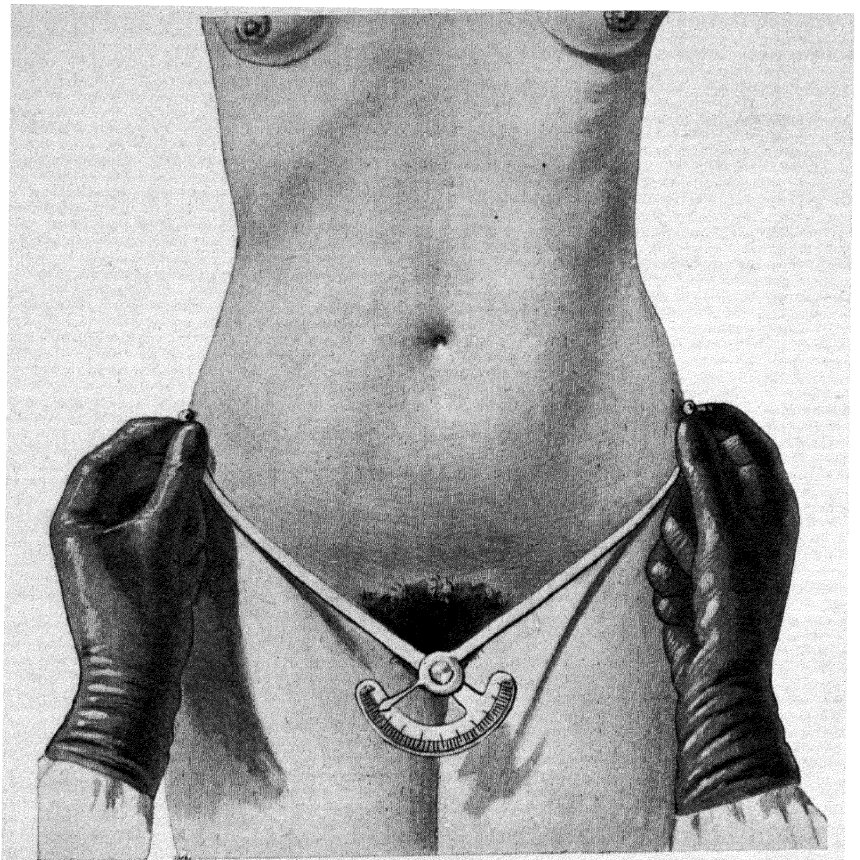


FIG. 165A.

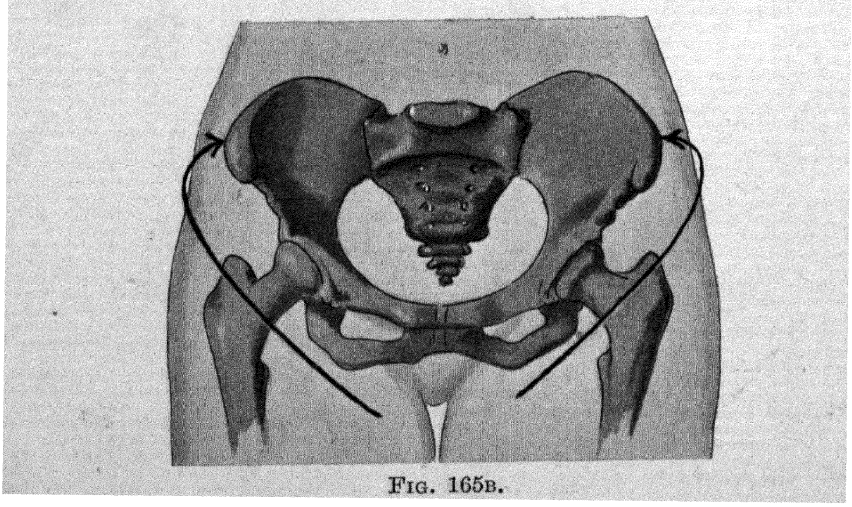


FIG. 165B.

PELVIMETRY. MEASURING THE INTERCRISTAL DIAMETER.

The smaller picture shows the points on the skeleton between which the measurement is taken.

A pelvimeter consists of a pair of calipers of a size suitable for measuring the pelvis; a useful pattern is one by which internal measurements (*e.g.* those of the pelvic outlet) can be taken by crossing the limbs instead of opening them (Fig. 164).

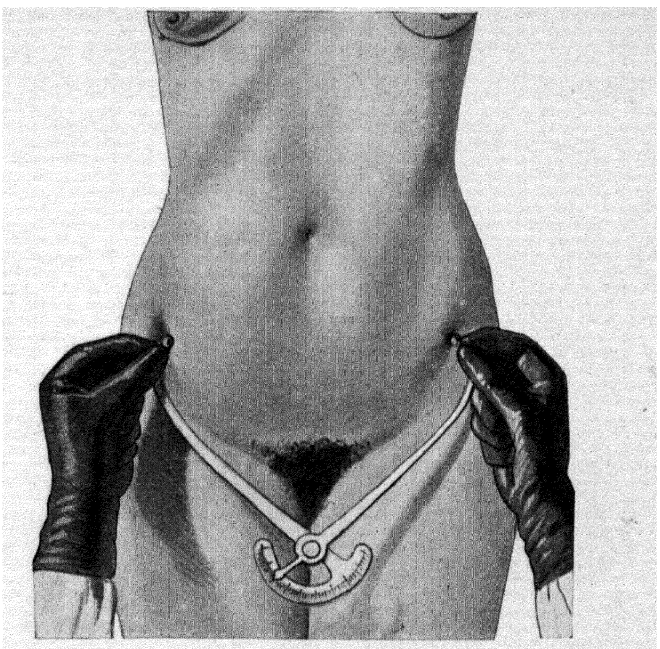


FIG. 166A.

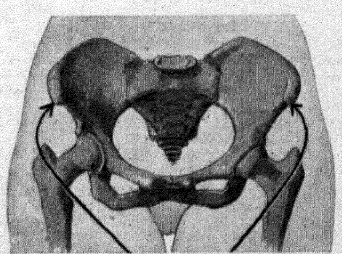


FIG. 166B.

PELVIMETRY. MEASURING THE INTERSPINOUS DIAMETER.

The smaller picture shows the points on the skeleton between which the measurement is taken.

EXTERNAL MEASUREMENTS

The Intercristal.—This is measured by putting the points of the calipers on the outer margin of the crests of the ilium and taking the widest transverse measurement. The normal measurement is 11 inches (Figs. 165A, 165B).

The Interspinous.—The points of the calipers are put on to the outside of the anterior superior iliac spines. The normal measurement is 10 inches (Figs. 166A, 166B).

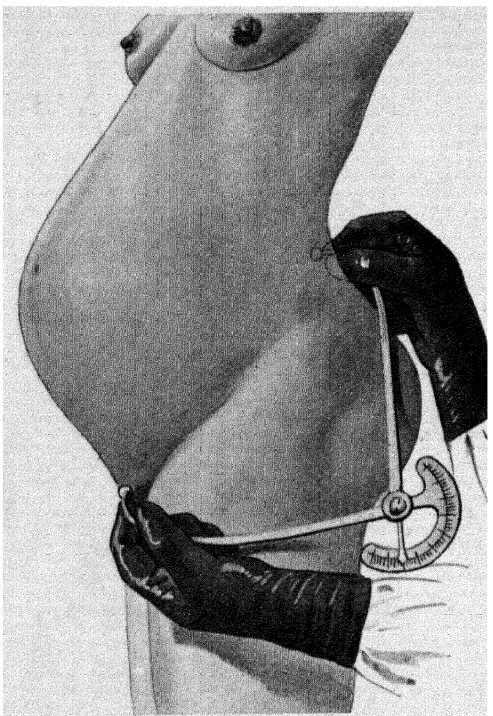


FIG. 167A.

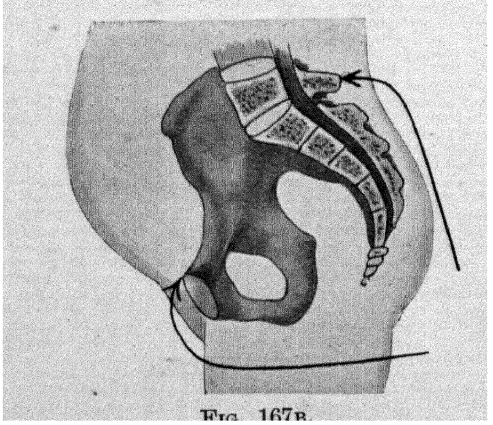


FIG. 167B.

PELVIMETRY. MEASURING THE EXTERNAL CONJUGATE.

This is most conveniently done with the patient standing. The smaller picture shows the points on the skeleton between which the measurement is taken.

If these measurements are less than usual, but the difference between them maintained or increased, the pelvis is probably a generally contracted one. If the proportion is altered so that the interspinous is as large as, or larger than, the intercristal a flat pelvis is present.

The External Conjugate.—This is taken with the patient standing. One tip of the pelvimeter is then placed on the front of the pubes and the other upon the spine of the last lumbar vertebra. The normal measurement is 7½ inches (Figs. 167A, 167B).

The space below the last lumbar vertebra is found by taking a line joining the posterior superior iliac spines. A point 1½ inches above its centre denotes the position of the last lumbar spine. The position of the posterior superior iliac spine may be indicated by a dimple in the skin (Figs. 168A, 168B).

Another method of finding the spine of the last lumbar vertebra that may be useful in a fat patient is to take a line joining the highest points of the iliac crests and then to mark a spot on the spine three fingers' breadths below it.

The external conjugate is supposed to be 3¼ inches longer than

the true conjugate, but this is not exact, as the thickness of the bones and subcutaneous tissues varies so much. Hence it is only a rough guide—if it is over 7½ inches the true conjugate is probably not shortened, if less than 7 inches the true conjugate probably is shortened.

The Antero-posterior at the Outlet.—This is taken by placing the patient in the lithotomy position and measuring from the apex of the pubic arch to the top of the coccyx (Figs. 169A, 169B).

Measurements with a Tape.—To ascertain if the pelvis is oblique, for instance Naegele's oblique pelvis or some pelves in unilateral old hip disease, measurements may be made with a tape measure from the vertebræ or from one posterior superior iliac spine round the front to the anterior superior iliac spine of the opposite side. If these two measurements are of different lengths the pelvis is not symmetrical.

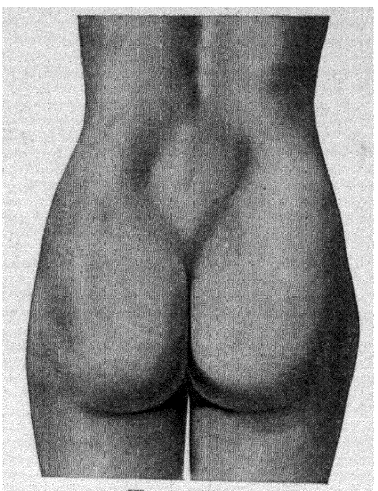


FIG. 168A.

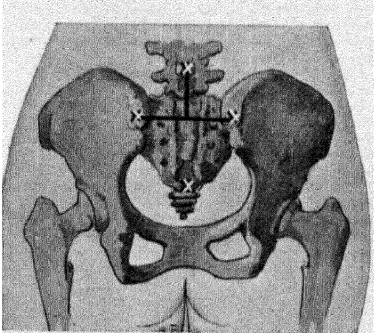


FIG. 168B.

BACK VIEW OF A THIN PATIENT, SHOWING THE "RHOMBOID OF MICHAELIS".

This is a diamond-shaped depression situated in the middle line immediately above the prominence of the buttocks. The crosses on the lower picture show the bony points corresponding to the four angles of the rhomboid. It will be seen that the upper half of the rhomboid is enclosed by lines joining the two posterior superior iliac spines with the spine of the fifth lumbar vertebra. These three points are often indicated by dimples in the skin, and are of use as a means of locating the fifth lumbar spine when measuring the external conjugate.

INTERNAL MEASUREMENTS

The diagonal conjugate is measured from the lower margin of the pubes to the promontory of the sacrum. It is just over ½ inch longer than the true conjugate. In cases in which the promontory is high (as in a generally contracted pelvis) the difference is greater, and ¾ inch or more may have to be subtracted from the diagonal to obtain the true conjugate.

To measure the diagonal conjugate place the patient on her left side or back with the knees drawn up. Insert the first and middle

fingers of the right hand into the vagina and press the tips of the fingers upwards and backwards until the tip of the middle finger meets the promontory of the sacrum. If the pelvis is larger than normal the fingers will not reach it, but if at all contracted the

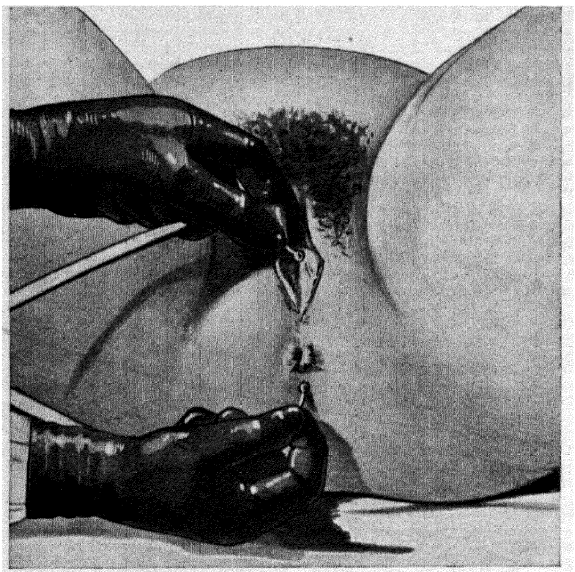


FIG. 169A.

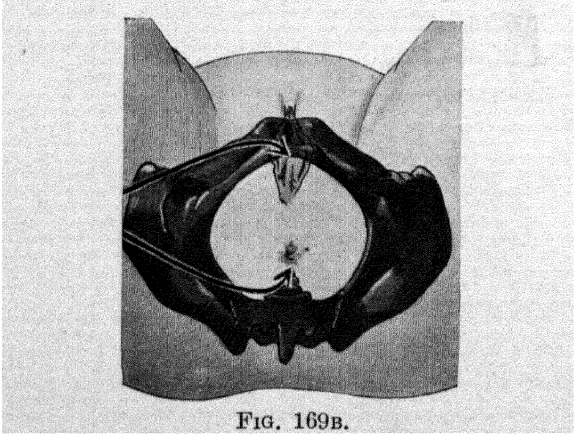


FIG. 169B.

PELVIMETRY. MEASURING THE ANTERO-POSTERIOR DIAMETER OF THE OUTLET OF THE PELVIS.

The smaller picture shows the points on the skeleton between which the measurement is taken.

promontory should be easily palpable. While the tip of the middle finger touches the promontory the radial border of the index finger touches the under surface of the symphysis pubis; this spot is marked off with a finger of the other hand. The fingers are

then withdrawn from the vagina, and the distance from the tip of the middle finger to the point on the radial border of the hand is measured by calipers or tape. The normal measurement is $4\frac{3}{4}$ inches. In some cases a *false promontory* is found caused by an undue projection of the junction of the first and second sacral vertebræ. The measurement from the lower border of the symphysis pubis to the nearer of the two promontories must be taken as the diagonal conjugate (Fig. 170).

Direct Measurement of the True Conjugate.

Immediately after labour the true conjugate can be measured by inserting the whole hand into the vagina and then finding in what attitude the hand just fills the true conjugate.

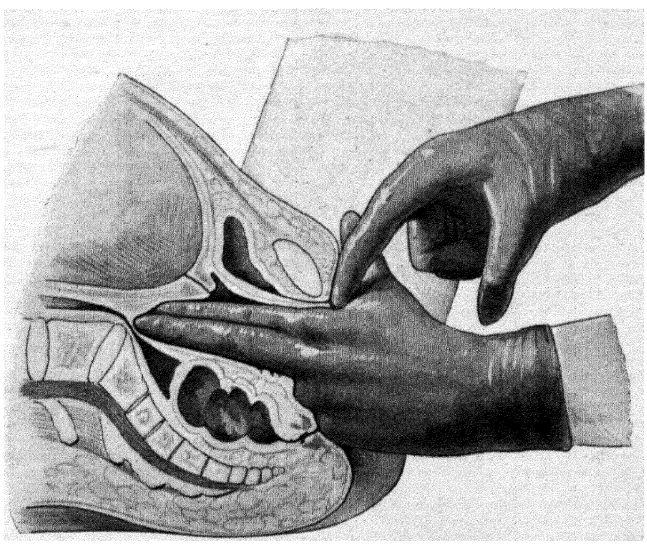


FIG. 170.

For instance, the four fingers side by side may just fill it or the four fingers with the thumb flat against them may do so, or the folded fist with the thumb out may just reach. Whatever attitude of the hand just fills the antero-posterior diameter of the brim is remembered; the hand is withdrawn and again placed in the same attitude, and then the distance between the two points where the promontory and symphysis pubis respectively were felt is measured off with calipers.

Measurement of the Distance between the Ischial Tuberosities.—This may be measured after labour by the above method or during pregnancy by placing the patient in the lithotomy position and (under anæsthesia if necessary) putting the pelvimeter with the limbs

crossed into the vagina and guiding them on to the inner surface of the tuberosities. It is of importance in a kyphotic pelvis. The normal measurement is $4\frac{1}{4}$ inches.

Instruments have been invented for taking the internal measurements of the pelvis accurately during pregnancy. They all cause



FIG. 171A.

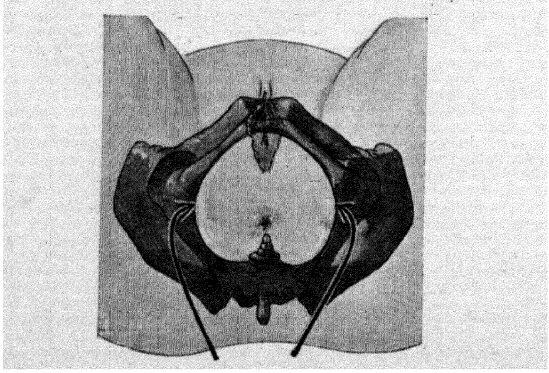


FIG. 171B.

PELVIMETRY. MEASURING THE DISTANCE BETWEEN THE ISCHIAL TUBEROSITIES.

This measurement is chiefly of importance in a patient with a kyphotic pelvis. The smaller picture shows the points on the skeleton between which the measurement is taken.

Another method of taking this measurement is described in the text.

pain to the patient, and are not in universal use in the British Isles. It is of little help putting a patient to the mental and bodily discomfort which internal pelvimetry with instruments necessitates unless the accurate measurements so obtained can be put to some

useful purpose. As the child's head cannot be measured even approximately, such accurate pelvic details cannot be used to their full advantage.

Another point to be noted is that it is not the absolute size of the pelvis that is so important as the relation which it bears to the child's head. The relation between the size of the head of the child and that of the pelvic brim can be ascertained by placing the patient on her back, and then putting two fingers of either hand on the forehead and occiput respectively and pressing the head down.

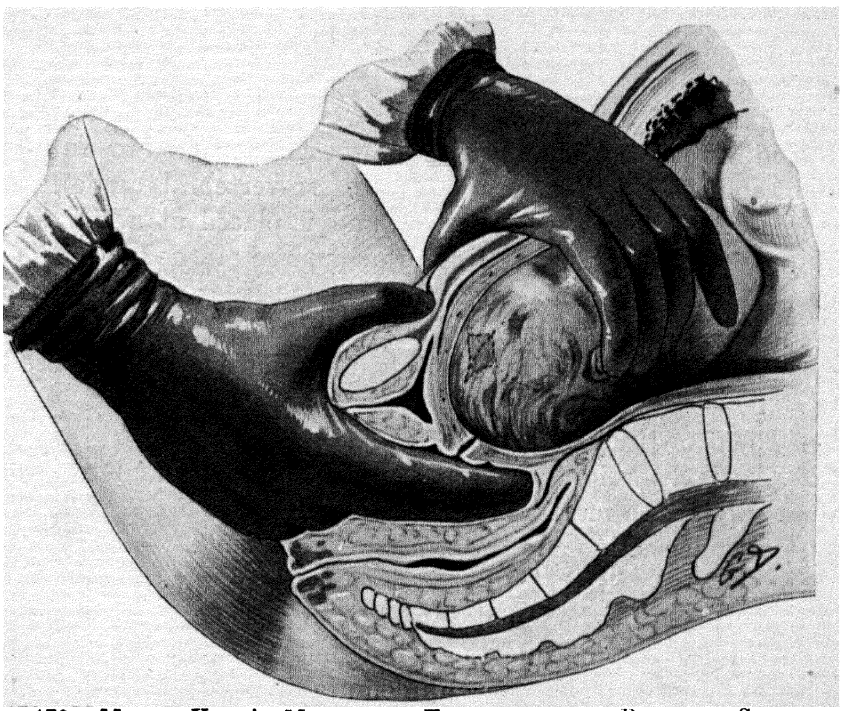


FIG. 172.—MUNRO KERR'S METHOD OF ESTIMATING THE RELATIVE SIZES OF THE MOTHER'S PELVIS AND THE CHILD'S HEAD.

As long as the head can be pushed into the pelvis in this way, the uterine contractions will be able to do so with ease (Fig. 172).

Another method is to ascertain how far one parietal eminence projects over the pubes when the other is pressed against the promontory. This is best done by Munro Kerr's method. With the patient lying on her back, two fingers of the right hand are placed in the vagina to note the level of the head, and the thumb allowed to project above the symphysis pubis. The head is then pressed down by the left hand from above, and the amount of projection of the parietal bone over the pubes is estimated by the thumb of the right hand. The amount of the projection is approximately the amount of moulding necessary to allow the head to enter the cavity.

In many cases these investigations can be satisfactorily carried out only under anæsthesia.

CONTRACTED PELVIS

Before considering the subject of contracted pelvis, it is necessary to review what are generally accepted as being the factors in the production of the normal adult pelvis, because some of these factors, by deficient or excessive action, play an important part in the production of those anomalies of shape and size which constitute "contracted pelvis".

The pelvis of an infant is small, even in proportion to the size of the child; it has an almost straight sacrum united to an almost straight spine at a slight angle (the sacro-vertebral angle), hence the promontory is not well marked, and is placed at a higher level than in an adult pelvis. The anterior surface of the sacrum is flat from above downward and also from side to side; it is also narrow, because the lateral masses are poorly developed. The iliac fossæ are shallow and look inwards. This primitive pelvis becomes altered by—

1. The growth of the bones;
2. The body-weight acting through the sacrum and resisted by the pressure of the femora on the acetabula;
3. Muscular action and the tension of ligaments.

It may be noted that the second and third causes act equally in the male and in the female, and therefore the characteristics of a female pelvis must be due to an inherent tendency on the part of the bones to develop along certain definite lines.

1. **The Growth of the Bones.**—The alæ of the sacrum grow more than the central portion, thus the sacrum becomes broader. Further, all the bones become larger, and the cartilaginous junctions of the constituent parts of the innominate bone become ossified.

2. **The Effect of the Weight of the Body.**—This is usually looked on as the most important factor at work in the formation of the adult pelvis, but some authorities think that its importance has been exaggerated, because some of the changes which it is supposed to produce have been found already present at birth in cases of intra-uterine rickets. For this reason it has been thought that muscular action is the more important factor; but this criticism is hardly a valid one, as in these cases the bones are so soft that the

effects of muscular action are accentuated. The influence of the body-weight in shaping the pelvis is shown by—

(1) The existence of those changes which theoretically should be present if the weight was the important factor.

(2) The exaggeration of these changes in rickets when the bones are soft.

(3) The fact that they also increase if in adult life the pelvic bones become softened (as is seen in slight cases of osteo-malacia).

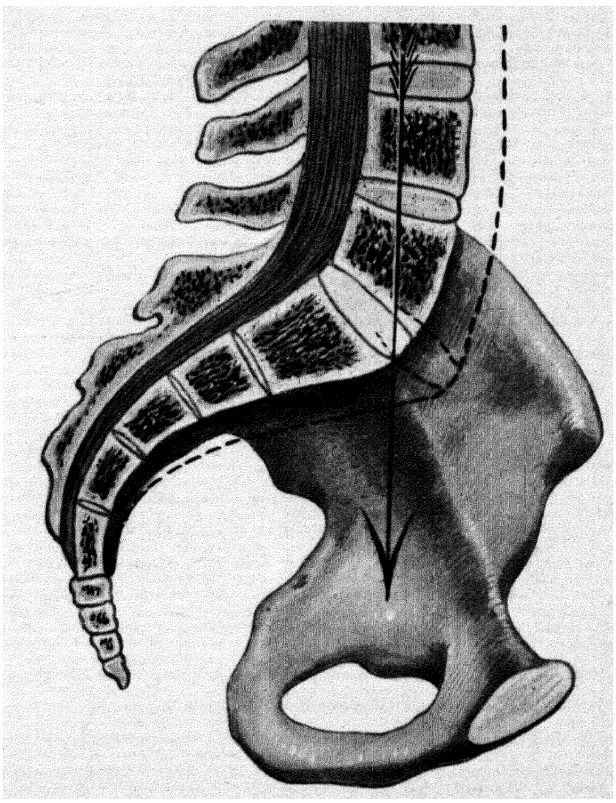


FIG. 173.—DIAGRAM TO SHOW THE ACTION OF THE BODY-WEIGHT (REPRESENTED BY THE ARROW) IN PRESSING THE PROMONTORY OF THE SACRUM DOWNWARDS.

(4) The pelvic changes found in cases of long-standing hip-disease and scoliosis in which the body-weight is unequally distributed.

Any pelvic deformity which increases the inclination of the brim of the pelvis to the horizontal (and therefore increases that portion of the body-weight which acts in the plane of the pelvic brim) will tend to diminish the conjugate, and conversely any deformity which diminishes the inclination of the pelvic brim will tend to increase the conjugate. The normal inclination of the brim is about 60° with the patient in the upright position. In this position the

anterior superior iliac spine is in the same perpendicular plane as the pubic spine.

The body-weight acting through the centre of gravity of the body passes in front of the middle of the sacro-iliac joint, therefore the sacrum tends to rotate and the promontory to come downwards and forwards and the coccyx to go back and up. But the lower end of the sacrum and coccyx is held in place by the sacro-sciatic ligaments and so cannot move, and therefore the sacrum bends and the antero-posterior curve is produced.

In spite of the upper part of the sacrum being held in position by the posterior sacro-iliac ligaments, it is forced downwards and forwards, and therefore the sacro-vertebral angle is increased and the sacral promontory becomes more prominent. At the same time the whole sacrum gets pushed bodily further in towards the centre of the brim of the pelvis. As the sacrum is held suspended on either side by the posterior sacro-iliac ligaments, and as the body-weight is continuously pushing downwards in the centre, the sacrum tends to be pushed forwards most in the middle line; if the bones are pathologically soft, this may be sufficient to make the brim kidney-shaped (reniform pelvis) (Fig. 173).

The Counter-pressure of the Femora.—The line of transmission of the body-weight from the sacrum to the feet falls inside the line of upward pressure of the femur, and therefore the pressure of the femur is partly outwards as well as upwards. This may be proved by dividing the symphysis pubis in a cadaver and then pushing the legs upwards, when the joint will gape open. But during life there are muscles passing between the femur and the middle line of the pubes which pull inwards, and the combination of their force with that of the femora from the ground is found to have a resultant which acts *up and in*. It may, therefore, be summed up by considering that practically the pressure of the femora acts *upwards* and *inwards*. It follows from this that any condition which keeps the patient from walking for prolonged periods will diminish the inward pressure of the femora, and therefore tend to widen the pelvis transversely; among such conditions are rickets and congenital dislocation of the hip-joint (Fig. 174).

Results of Sitting.—The reaction to the body-weight through the ischial tuberosities tends to increase the transverse diameter of the pelvis chiefly through the leverage action of the ilium (*q.v.*).

The Leverage Action of the Ilium.—The posterior extremity of the illum is fixed by the sacro-iliac ligaments immediately behind the

sacro-iliac joint. The sacrum may be regarded as suspended from the ends of the ilia by these ligaments. The body-weight pressing on the sacrum tends to pull the posterior end of the ilium inwards and downwards and (the joint acting as a fulcrum) the anterior extremity naturally tends to move outwards. But the anterior end cannot move outwards because it is held in position by the inter-pubic ligaments, therefore the bone becomes moulded into a curve and the transverse diameter of the pelvis is increased. For this leverage action of the ilium to take place the bones must be sufficiently hard

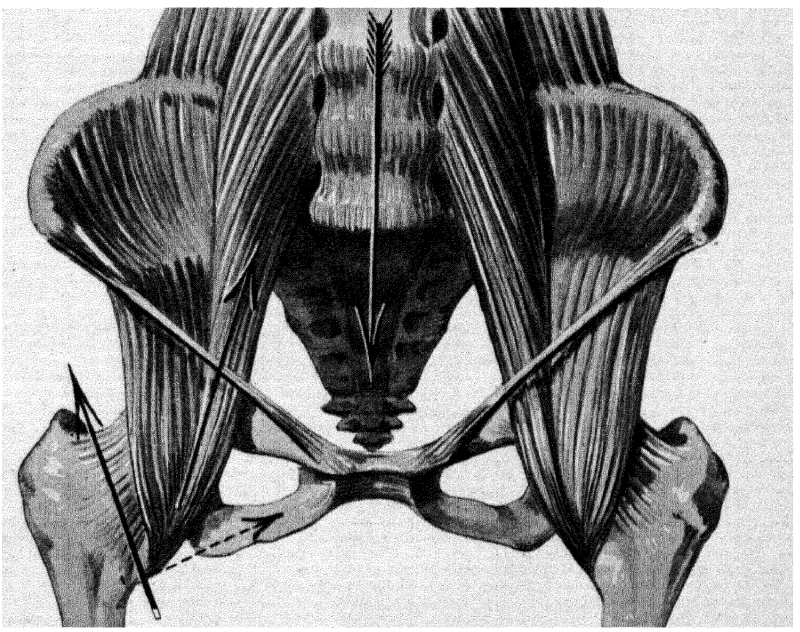


FIG. 174.—DIAGRAM TO ILLUSTRATE THE ACTION OF THE BODY-WEIGHT AND THE COUNTER-PRESSURE OF THE FEMORA.

The inward pull of the adductor muscles passing from the femur towards the middle line neutralizes the slight outward direction of the force representing the counter-pressure of the femur. The resultant of these two forces acts slightly inward as well as upwards as represented by the arrow on the psoas muscle.

and rigid to act as levers ; if they become too soft (as in osteomalacia), the leverage action of the ilium fails.

Muscular Action.—Owing to the inclination of the pelvic brim the plane of the pull of the anterior abdominal muscles, including the recti, is directed towards the vertebral column, and therefore, when those muscles contract they tend to pull the pubes backwards towards the sacrum and thus flatten the pelvis from before backwards.

In a similar manner the pull of the glutei makes the iliac fossæ look more forward by pulling the anterior portion of the crests outwards.

VARIETIES OF CONTRACTED PELVIS

Contracted pelves are those which alter the course of labour with a child of normal size and contour. The common classification into five groups is a good one:—

Class I. Due to faulty development of the pelvic bones.

Generally contracted, including dwarf, infantile, and masculine.
Funnel-shaped (male-type).
Naegele's oblique.
Robert's.
Split pelvis.

Class II. Due to disease or injury of the pelvic bones.

Rickety.
Osteomalacic.
Fracture.
New growth.
Caries.

Class III. Due to disease or faulty development of the spinal column.

Kyphotic.
Scoliotic.
Kypho-scoliotic.
Spondylolisthetic.
Assimilation-pelvis.

Class IV. Due to defects of the pelvic articulations.

Synostosis of the sacro-iliac joint.
Synostosis of the sacro-coccygeal joint.
Synostosis of the pubic joint.

Class V. Due to abnormalities of the lower limbs.

Hip-disease.
Dislocation of hip.
Club foot.
Absence of or defect of one limb which alters distribution of the body-weight.

Of the above only some are likely to be met with at all frequently and others cannot be diagnosed with certainty clinically, therefore only the commoner and more important varieties will be described here. For details regarding the rarer forms of contracted pelvis monographs must be consulted.

THE FLAT PELVIS

Pelves flattened in their antero-posterior diameter may or may not be accompanied by the usual signs of rickets, and they are accordingly called "rickety" and "simple" respectively. It is, however, rare to see a pelvis which is much flattened in a patient who does not show signs of rickets more or less marked.

The characters of a flat pelvis are those which would naturally be present if the body-weight and muscular action had greater effect than usual owing to the excessive softening of the bones, and

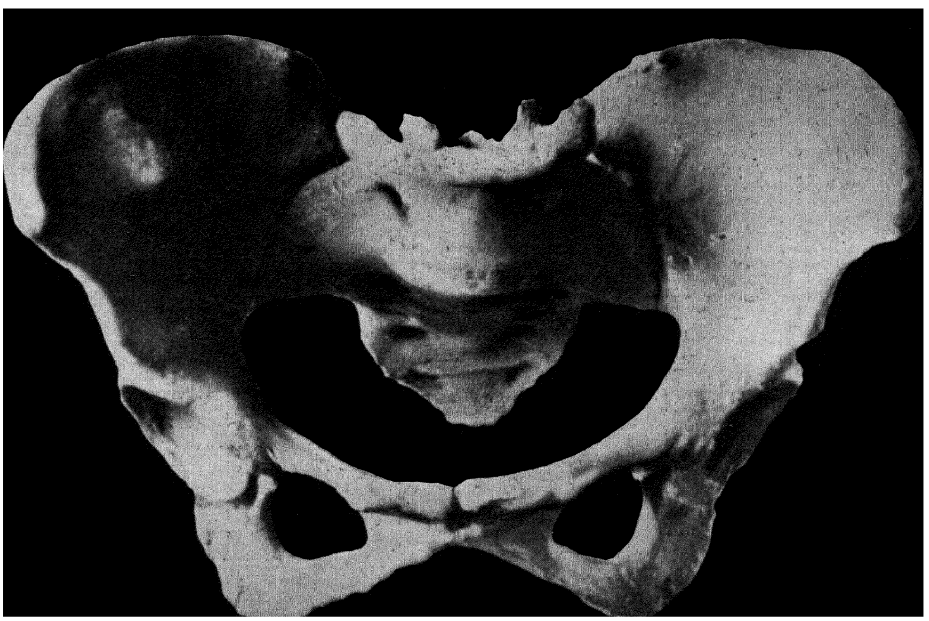


FIG. 175.—FLAT PELVIS.

Showing the contraction in the antero-posterior measurement of the brim. Contrast this with Fig. 179.

it is convenient to regard all flat pelves as having been produced by excessive bony softness. In some cases this softness is due to gross rickets, which leaves other signs by which the rachitic nature can be identified; in others only very faint signs of rickets can be demonstrated, and in the remainder no signs of rickets are present. The simple flat is rare and is apparently due to some disease of the pelvic bones of which the pathology is unknown. Carrying heavy weights during childhood has been considered a possible cause of flat pelvis, because the resulting lordosis will increase the inclination of the pelvic brim and therefore decrease the conjugate.

Softness of the bones being the underlying condition, the following

changes will occur as the result of the action of the body-weight. First the promontory will be forced more forward and the sacrum bent, antero-posteriorly; the sacrum will also be flattened from side to side and its centre may even project forward in the middle line, so as to encroach on the space of the brim and make its contour reniform.

The leverage action of the ilia (see p. 428), the pull of the recti, and the absence of the inward push of the femora (for rachitic children walk late) will all tend to make the pelvis broader transversely. Owing to the pull of the glutei, the iliac fossæ will be everted, so that the anterior superior iliac spines will project outward as far as the crests or even farther.

Although failure of development plays a minor *rôle* in the formation of this type of pelvis, it must be noted that there is shortening of the iliac portion of the innominate bone which increases the flattening; this shortening is considered by some as rachitic.

In connection with the projection of the promontory it should be noted that the lower margin of the first sacral vertebra may project so much forward that it forms a false promontory which may be nearer the pubes than the true promontory, and may therefore be of obstetric importance.

If the bony softening is so extreme that the bones can no longer act as levers and transmit forces, the pelvis takes a different shape and crumples up into a tri-radiate pelvis, but except in osteomalacia such an occurrence is almost unknown.

The characteristics of a flat pelvis are:—

The conjugate is much diminished, but the transverse is not much below and may equal or exceed the normal. Below the brim there is no contraction. The iliac fossæ are flared out so that the spines may be as wide apart as the crests. The sacrum is frequently bent antero-posteriorly at an angle. The brim may be flattened posteriorly, or in extreme cases may be reniform from the projection forward of the promontory. Typical external measurements would be: intercristal, 11 inches; interspinous, 11 inches; external conjugate, 6 inches. The distance between the posterior superior iliac spines is reduced, and as the anterior interspinous measurement is increased the normal proportions are upset. In a normal pelvis the posterior interspinous is about one-third of the anterior interspinous; in a flat pelvis it may be only a fourth or fifth (Fig. 175).

Effects during Pregnancy.—If the promontory of the sacrum is overhanging, there is a risk that during the third month of pregnancy

the uterus if retroverted may be caught under it and thus become incarcerated in the pelvis.

This is especially liable to occur if lordosis is present as a co-existing condition as the projection of the spine will also make the promontory more prominent than usual.

Towards the end of pregnancy the presenting part cannot engage, and therefore is found freely movable above the brim. As a result of this malpresentations are likely to occur, and, as the uterus sags forward, the condition known as "pendulous belly" may result.

Effects during Labour. *First Stage.*—The head cannot enter the brim because of the contraction, and if the pelvis is of the reniform type it cannot even lie over the brim, but is displaced to one side of the promontory and comes to lie in one or other iliac fossa—thus there is a tendency to oblique lies and malpresentations. Even if the head presents it cannot fill up the brim, the hind waters are not separated from the fore waters and the membranes have to bear the full force of each contraction, and therefore premature rupture of the membranes is very common. Before rupture the bag is forced down into the vagina for some distance in a shape like the finger of a glove. This "glove-finger" projection of the membranes is characteristic of either a contracted pelvis or a malpresentation.

As there is a space at one or other side of the pelvis which is not filled up by the presenting part, and as the presenting part cannot descend low enough to fill up the lower uterine segment, the cord may descend through this unoccupied space. The liquor amnii also drains away through this space, and so the fœtus loses the protection of this fluid.

If the membranes rupture prematurely and the presenting part cannot come down to stretch the cervix, there may be very considerable delay in the first stage of labour, and the cervix may get tightly nipped in front and behind unless it gets pulled up by the uterine contractions.

Second Stage.—Cephalic Presentations. Mechanism. Transverse Position of Head.—The chief characteristics of labour in a flat pelvis are that the head enters the brim in the transverse diameter and that the difficulty is limited to the inlet because there is ample space in the cavity.

The movement that the head executes and the position that it assumes in a case of flattened pelvis depend on the relative size of the head and the pelvic brim. The two chief cephalic diameters that come into play are the bi-parietal (3¾ inches) and the bi-temporal (3¼ inches), and they have to pass either through the true conjugate

or to one side of it. It should be noted that in a markedly flattened (reniform) pelvis, the promontory projects so much that there is considerably more space at the sides, in front of the sacro-iliac joints.

The transverse diameter of the child's head, from a point just below one parietal eminence to a point just above the other, measures rather less than the bi-parietal, and is sometimes called the sub-parieto-super-parietal diameter. If the posterior parietal bone is held back by the promontory so that the head is inclined towards the posterior shoulder, this sub-parieto-super-parietal diameter comes across the brim.

This oblique lie of the head is called Naegele's obliquity or asynctitism. Supposing the head to be of normal size, the mechanism will probably be as indicated in the following two classes :—

1. If the true conjugate measures just under $3\frac{3}{4}$ inches, the bi-parietal diameter will be gripped in the conjugate and delayed there till moulding occurs. During this time the uterus will force the child down, and, as there is space for the smaller bi-temporal diameter to descend, it follows that slight extension will occur while the bi-parietal diameter is delayed in the brim.

Naegele's obliquity occurs and is desirable as bringing a slightly smaller diameter than the bi-parietal across the brim. Once the head has got through the brim, the bi-parietal diameter is no longer held back, and so the head again becomes flexed in the cavity, and, as there is no contraction there or at the outlet, no further difficulty occurs in delivery.

It should be noted that if the parietal bones are held too long in the brim, a face presentation may result.

2. If the pelvis is still more flattened, and there is not space for the bi-parietal diameter even to engage in the true conjugate, the head will move, as a whole, towards the side of the pelvis, so that the parietal eminence lies opposite to the sacro-iliac joint, and the bi-temporal diameter in or near to the true conjugate. In this case the bi-parietal diameter is less likely to get gripped than the bi-temporal, and so the head remains well flexed. Some degree of Naegele's obliquity is present, and if the uterine action is efficient the head slowly moulds through the brim.

Anterior Parietal Presentation.—By this is meant that the anterior parietal bone is lower than the posterior, and so the sagittal suture is nearer the promontory than the pubes. The child thus has its head inclined toward its posterior shoulder. This condition may possibly be caused by the projecting sacrum delaying the posterior parietal bone more than the anterior, but a more important reason for its occurrence is that a smaller transverse diameter of the

head is thrown across the pelvis. This diameter is measured from just above one parietal eminence to just below the opposite one, and is called the sub-parieto-super-parietal diameter. It is found to be slightly less than the biparietal measurement; thus the anterior parietal presentation is a favourable one. The head descends into the cavity of the pelvis either by the anterior parietal bone becoming fixed against the symphysis pubis and the posterior one being squeezed past the promontory by a movement of rotation of the head on its long axis, or else by the anterior parietal bone maintaining its lower position till the largest diameter of the head is past the brim.

In addition to the above favourable obliquity of Naegele there is the opposite condition of *posterior parietal presentation*, when the posterior parietal bone is lower than the anterior, the sagittal suture is nearer the pubes than the promontory and the child's head is inclined towards its anterior shoulder. This posterior parietal presentation is unfavourable, but it is not very frequently observed.

It will thus be seen that the three main features of the second stage of labour with a flat pelvis are transverse lie of the head, tendency to extension of the head, and presentation of the anterior parietal bone.

Mechanism of Labour with the After-coming Head.—The after-coming head enters the pelvis with its long diameter lying transversely. Usually the bi-parietal diameter lies to one side or other of the promontory. If it is held back while the bi-temporal diameter advances, flexion will occur, but more frequently it is found that the diameter opposite the promontory is retarded, and so *extension* occurs. The tendency to *extension* is increased by the traction on the shoulders which is usually necessary in order to get the head through the brim. For when traction is made by a force applied below the neck, the head extends owing to the condyles being situated so far posteriorly.

Naegele's obliquity is also found to be present, so that there is a very close similarity between the mechanism of the fore-coming and that of the after-coming head.

The tendency to extension may have serious consequences as the occipito-mental diameter (4¾ inches) comes across the pelvis, and delay at this stage in the delivery of a breech case often proves fatal to the child (see Fig. 64C, and p. 375).

Third Stage.—Postpartum hæmorrhage from uterine exhaustion may occur after this as after any other prolonged labour.

Effects during Puerperium.—The maternal tissues are subjected to pressure which is chiefly distributed on the parts which lie over the promontory and over the pubes; hence sloughing is especially

liable to occur over these two points. As the uterine contractions pull the tissues upwards, it is usually the upper part of the vagina

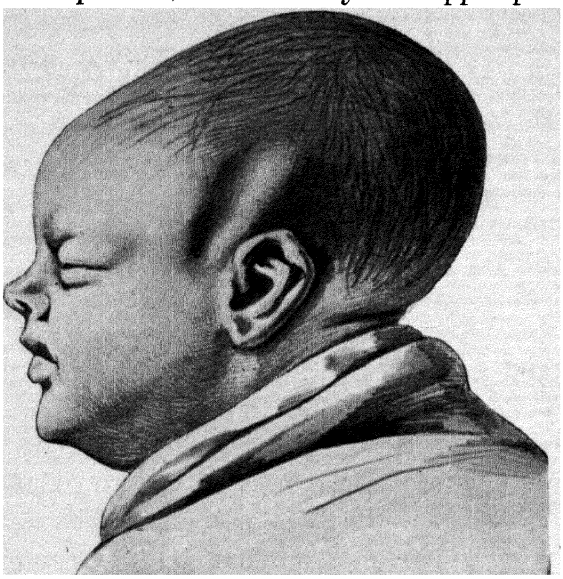


FIG. 176.—PRESSURE MARK CAUSED BY PROMONTORY OF SACRUM ON CHILD'S HEAD DURING ITS PASSING THROUGH A FLAT PELVIS.

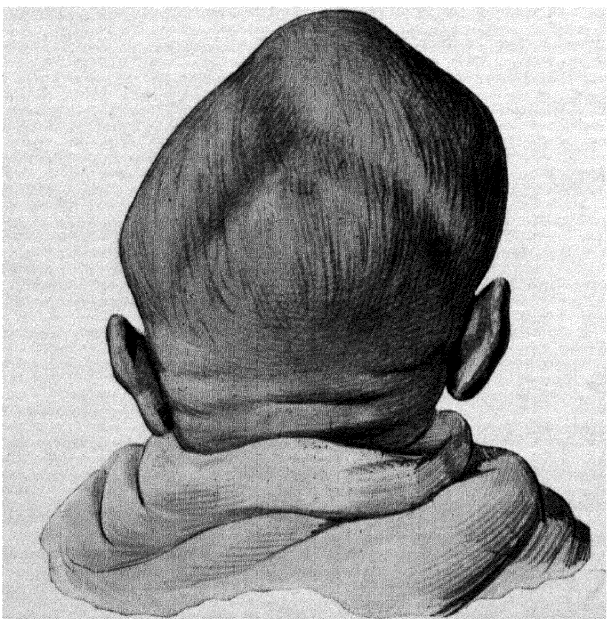


FIG. 177.—FŒTAL HEAD AFTER LONG LABOUR.

The parietal bone that was posterior has become somewhat flattened and its upper edge has been pushed under the anterior parietal bone. A caput succedaneum has formed over the latter.

which lies between the pelvic bones and the head, and thus a vesico-vaginal fistula may be formed.

The hard head causes more injury than the softer breech. The prolonged pressure while the head is moulding first renders the part anæmic and finally so lowers its vitality that gangrene occurs; this easily becomes infected by organisms, and a slough forms and separates a few days after delivery; hence the incontinence of urine is not noticed till some days after delivery.

Prognosis to the Mother (see *Treatment of Contracted Pelvis*, Chap. LIV.).

Prognosis to the Child.—This will obviously depend on the exact size of the pelvis and on the treatment adopted, but on the whole the results to the child are better than in a generally contracted

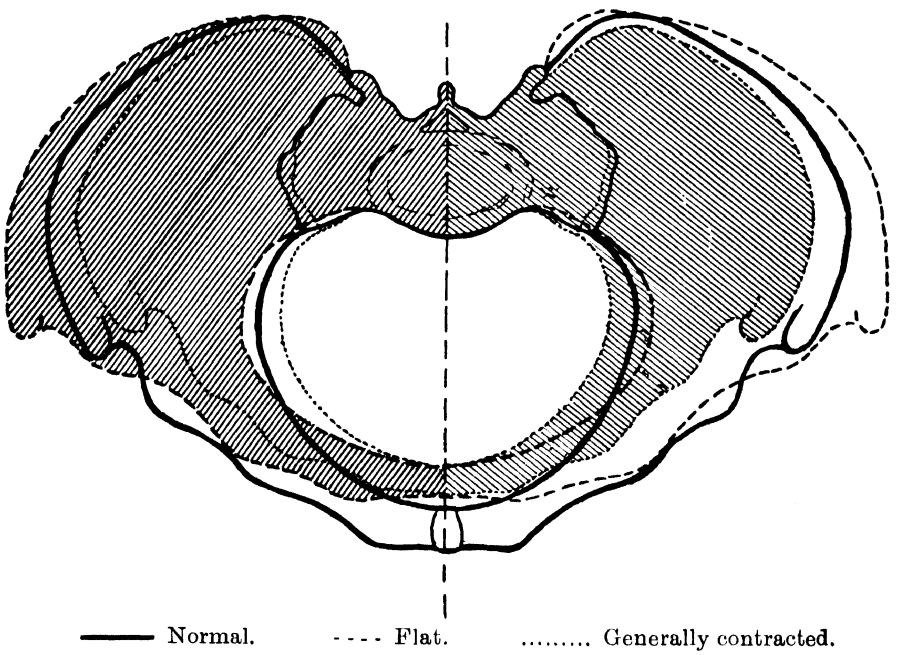


FIG. 178.—A NORMAL, A FLAT, AND A GENERALLY CONTRACTED PELVIS SUPERIMPOSED TO INDICATE THE RELATIVE PROPORTIONS.

pelvis, because once the head is through the brim there is little delay. Also, as the transverse diameter is not contracted, the total area of the brim is greater than in a generally contracted pelvis of the same conjugate, but this space at the side of the pelvis may be also a source of danger to the child from prolapse of the cord.

The child may be born alive, but with a spoon-shaped depression on the posterior parietal bone, where the promontory has dented it (Fig. 176). Or the skin may be raw where the head has squeezed past the promontory. This abrasion starts on the posterior parietal bone and runs downwards parallel to the coronal suture. If the head flexes as it reaches the cavity, this abrasion will take the

form of a curve running downwards and forwards on to the face near the malar bone.

If the pressure has not been sufficiently severe to produce such gross injuries as denting the bone, the head will show only overlapping at the sutures, with a tendency for the posterior parietal bone to be flat while the anterior one is still curved (Fig. 177).

THE GENERALLY CONTRACTED PELVIS (Pelvis æquabiliter justo minor. Small round pelvis)

This must be regarded as a normally shaped pelvis which has been built by nature on a smaller scale than usual. Nothing definite

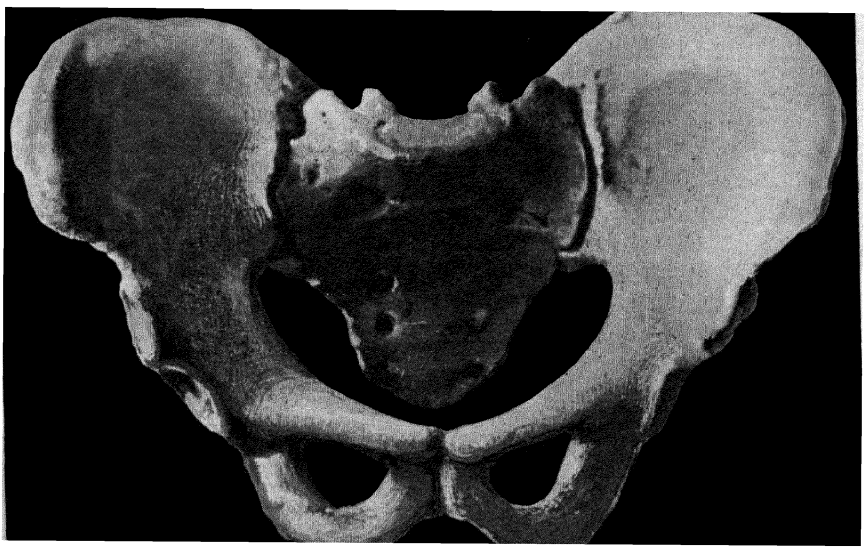


FIG. 179.—GENERALLY CONTRACTED PELVIS.

All the diameters of the brim are smaller than usual. Contrast this with Fig. 175.

is known as to its causation; it is found in dwarfs and women of small stature and in those who have been ill-nourished in childhood, but it is also found in well-developed healthy people.

This type of pelvis is much rarer in the British Isles than the flattened pelvis. It is characterized by a diminution of all its measurements with little alteration of their relative proportion to each other; thus the normal difference between the intercristal and interspinous diameters is still present and may be slightly increased. The promontory is situated higher up than usual, so that the true conjugate differs from the diagonal conjugate by more than the usual half-inch (Fig. 179).

In the case of the true dwarf pelvis the synchondroses between the pelvic bones persist, and even in adult life bony union does not occur.

The diagnosis of this type of pelvis depends on the pelvic measurements—instead of the interspinous, intercristal, and external conjugate being respectively the usual 10, 11, and 7½ inches (25, 27·5, and 19 cms.), some such figures as 8, 9½, and 6 may be found. In a normal pelvis the distance between the anterior superior iliac spines is three or three and a half times the distance between the posterior superior iliac spines, but in a generally contracted pelvis it may be reduced to only twice or two and a half times that between the posterior spines. On internal examination the promontory is high up, but nearer the pubes than usual, and, owing to the diminution in the transverse diameter, the ilio-pectineal line may be palpable over a greater length than usual. The patient is generally of small stature, and her general want of development or infantile appearance may raise suspicions that a generally contracted pelvis is present.

Effects during Pregnancy.—No effect of importance occurs.

Effects during Labour.

First Stage.—The brim may be too small to admit the head, but as the brim is regularly smaller the head is not forced out into the iliac fossæ (as in a flat pelvis), and so the lie remains longitudinal.

As the head fits into the brim of the pelvis tightly it cuts off the hind-waters from the fore-waters, and therefore premature rupture of the membranes does not occur with any great frequency, and in a similar way, the brim being filled up with the head, there is no space left for descent of the cord.

If the membranes do happen to rupture prematurely, the head may descend and (if the pains are strong) may nip the cervix against the brim. This will not only seriously delay dilatation, but, by interfering with the return of blood from the nipped portion of the cervix, will cause œdema of the parts, so that the aperture of the cervical canal may actually become smaller. For similar reasons the vagina rapidly becomes dry and swollen, and later on (usually in the second stage) the vulva becomes œdematous. This œdematous state of the vulva and vagina is very characteristic of labour obstructed by a generally contracted pelvis, and does not occur to the same extent with other types of contracted pelvis.

Second Stage.—Malpresentations occur, but not so frequently as with a flattened pelvis. The results with a vertex presentation are exactly those which would be met with if a large head were passing

through a normal pelvis. Flexion must be extreme so as to bring the smallest possible diameter across the pelvis, and this must continue all through, because in a generally contracted pelvis there is contraction right through to the outlet and not only at the brim as in a flat pelvis.

Internal rotation is influenced by the shape of the bony pelvis and occurs early. The shoulders may become impacted if the child is large. The head usually undergoes extreme moulding, and much overlapping of the sutures is present, but no denting or pressure marks.

The After-coming Head.—The head in breech presentations comes through the pelvis in extreme flexion. If the brim is only just large enough to admit the child's body, the arms easily become extended when the elbows get caught by the brim ; more frequently extension is caused by the attendant attempting to hurry labour by pulling on the legs. Extension of the head occurs for the same reasons and is a more frequent occurrence. If extension of either the head or arms does occur, the smaller space available for the necessary manipulations to bring them down makes this task more difficult than usual.

Third Stage.—As in other conditions which prolong labour the uterus tends to become exhausted, and so postpartum hæmorrhage is liable to occur.

Effects during Puerperium.—Owing to the prolonged pressure while the head is moulding through the brim, sloughing is liable to occur, and as the pressure is not localized to any one special point but is distributed all the round brim, the sloughing may occur anywhere.

Prognosis for the Mother.—See Treatment, Chap. LIV.

Prognosis for the Child.—Because all the diameters are diminished and there is no compensatory increase in the transverse diameter as in a flattened pelvis, these cases may be very difficult, and the difficulty continues all the way to the outlet. In an extreme case there will be trouble in delivering the shoulders even after the head is born. Roughly speaking, labour with a generally contracted pelvis will be as difficult as a labour with a flat pelvis with a conjugate half an inch smaller.

Owing to the extreme overlapping of the bones which occurs during moulding, cerebral hæmorrhage may occur, and in breech cases stillbirth is frequent owing to the delay in delivering the after-coming head.

The caput succedaneum is usually very large, and irregular abrasions, the result of pressure as the head is moulding through

the brim, are found chiefly over one side of the frontal bone, as, with the head engaged in an oblique diameter, the frontal bone is in contact with the sacrum.

Comparison of Flat and Generally Contracted Pelves.—It will be seen from the above that these two main types of pelvis differ markedly from each other. The differences may be given in the following tabular form (Herman):—

Flat.	*Small round pelvis.*
Incarceration of gravid uterus common.	Incarceration of gravid uterus not specially common.
Obliquity of uterus common.	Obliquity of uterus not common.
Pendulous belly common.	Pendulous belly not common.
Transverse lies and footling presentations common.	Transverse lies and footling presentations not common.
Head usually lying transversely.	Head usually in oblique diameter.
Posterior position of occiput not specially unfavourable.	Posterior position of occiput very unfavourable.
Brow and face presentations common.	Brow and face presentations uncommon.
Obliquity of Naegele the rule.	Obliquity of Naegele rare.
Obstruction at brim only.	Obstruction throughout pelvis.
Small caput succedaneum.	Great caput succedaneum.
Little œdema of vagina and vulva.	Great œdema of vagina and vulva.
Denting of cranial bones common; moulding slight.	Denting of cranial bones rare; moulding great.
Early rupture of membranes.	Less likely.
Prolapse of the cord.	Unlikely.

THE GENERALLY CONTRACTED FLAT PELVIS

A special type of pelvis will result if, as a result of rickets, there is not only softening but also stunting of growth of the bones. In these circumstances a pelvis is found which combines flattening with general contraction, and is known as the "generally contracted flat pelvis". This is a pelvis which is occasionally met with, and it is found clinically that most cases with marked flattening of the conjugate are also small in other diameters. In such a case the difficulties of delivery will be increased, as not only will there be trouble from the flattening of the brim, but there will be markedly deficient transverse measurements and contraction of the cavity.

The diagnosis of such a case will rest on the recognition of the external and internal measurements. All these will be reduced; the side wall of the pelvis is more easily palpated than usual as in a generally contracted pelvis, more commonly the conjugate is especially narrowed and the promontory projects as in a flattened pelvis.

The mechanism in such a case will depend on which type of deformity predominates, the head being flexed and also lying transversely in the brim and passing slowly through the pelvis in the fully flexed attitude.

CHAPTER XXXVII

CONTRACTED PELVIS (*continued*)

RARE FORMS OF CONTRACTED PELVIS

Kyphotic Pelvis.—This is one of the rarer forms of contracted pelvis, but is important and therefore deserves consideration.

In kyphosis the upper portion of the spine is so bent forward, if the angular curvature is high up, that a compensatory lordosis in the lower vertebræ is developed to prevent the body falling forward. In these circumstances the pelvis is not altered. This is possible when the angular curve is high up so that there are a large number of vertebræ below it, but if the kyphosis is low down, sufficient lordosis to neutralize it is unobtainable in the limited space below the disease, and so an alteration in the inclination of the pelvis takes place. In this way the inclination of the pelvis to the horizontal is diminished, and so, as already explained, the conjugate is increased and the promontory raised higher than usual.

The lessened inclination of the pelvis puts an increased strain on the ilio-femoral ligaments when standing in an easy position, and so the anterior inferior iliac spines are pulled down and outwards; thus the innominate bone is rotated on an axis passing through the sacro-iliac joint and the symphysis pubis, and the ischial tuberosities are turned inwards and the pubic arch narrowed.

The chief characters of the kyphotic pelvis will be most marked when the disease is below the mid-dorsal region, and occurs during early childhood; they are—

1. An increase of the antero-posterior measurement of the brim.

2. A diminution of the anterior-posterior measurement at the outlet.

3. A diminution in the space between the ischial tuberosities.

In rare cases the angular curve immediately above the brim may be such that the pelvis is overhung by the projecting vertebræ (the so-called "pelvis obtecta"). This may be so marked that the fœtus

is prevented from entering the brim. In some cases there is so little room between the thorax and the pelvis that the patient experiences great discomfort during the later months of pregnancy from interference with the respiratory movements.

Effects on Labour.—The lordosis pushes the uterus unduly forwards, and so pendulous belly is usual. For a similar reason the usual adaptation of the fœtus to the mother is upset, and occipito-posterior positions are very frequent. No difficulty occurs during labour till the head reaches the outlet, and then it is driven backwards owing to the narrowness of the pubic arch. If there is insufficient space between the tuberosities for the head, it may be delivered entirely behind the tuberosities instead of in front.

Diagnosis

The existence of the spinal deformity is obvious, so the difficulty that has to be faced is that of ascertaining how much (if any) effect it has had on the outlet. The diagonal conjugate and the usual pelvimetry give no help; the only measurements of any value are that between the ischial tuberosities, which normally should measure 4¼ inches and the antero-posterior diameter at the outlet.

Prognosis

This is not very good, as owing to the difficulty of judging the degree of contraction there is frequently obstruction at the outlet, and, as this is not apparent till late in the second stage, perforation may be necessary.

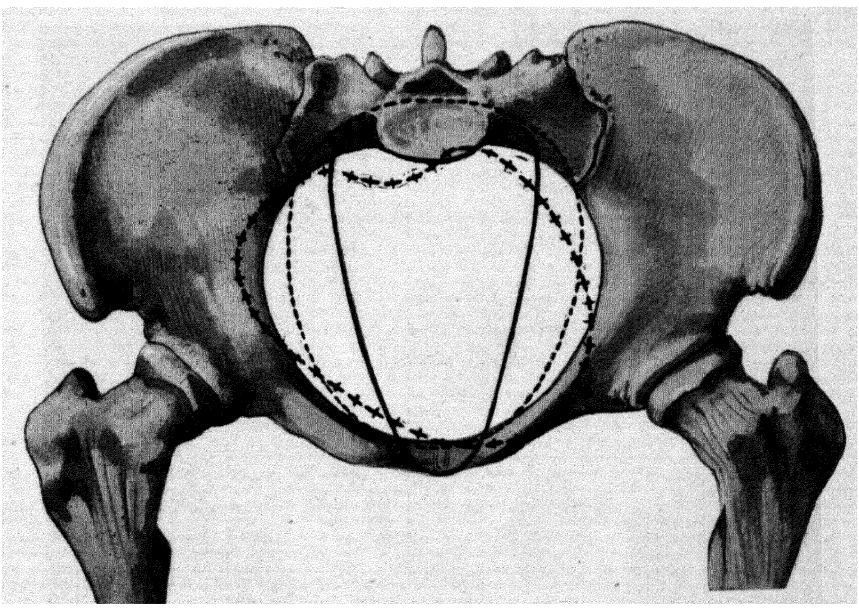
The mortality to the mother in published cases has been 15-20 per cent., but should be much lower with more careful examination of the pelvis under anæsthesia and treatment appropriate to its size.

Complete rupture of the perineum, with a severe laceration of the rectum, is usual, owing to the backward displacement of the head.

Oblique Pelvis.—If the spinal column is laterally curved (scoliosis), or if one leg is shorter than the other, the pelvis tilting towards the short leg upsets the distribution of the body-weight, and the shorter leg bears more than half of it. Thus the changes which result from the action of the body-weight are accentuated on that side, and the pelvis becomes oblique. Little change takes place in the pelvis unless the disease occurs during childhood. In any case severe obstruction is unusual. The head accommodates itself to the more roomy side of the pelvis.

The diagnosis is made from the presence of spinal deformity or lameness. The amount of space available is found by internal examination, if necessary with the half-hand, under anæsthesia.

Osteomalacic Pelvis.—Osteomalacia is a disease characterized by general symptoms, such as pains in the limbs, bronchitis, and neuritis, and also by extreme softening of the bones. It is rare in this country, but more common in Central Europe. As it attacks adults, the changes in the pelvis occur after the normal pelvis has been formed. The osseous softening is due to absorption of lime



—— Transversely contracted pelvis. + + + Oblique pelvis. - - - - Kyphotic pelvis.

FIG. 180.—A TRANSVERSELY CONTRACTED, A KYPHOTIC, AND AN OBLIQUE PELVIS SUPERIMPOSED TO INDICATE THEIR RELATIVE PROPORTIONS.

salts, which are excreted in increased quantities by the urine. The condition is improved by oöphorectomy and by medication with extracts of ductless glands, especially of the adrenals, and calcium lactate and cod liver oil.

The bones become too soft to act as levers, and so the pelvis resulting from this softening is triradiate, owing to the way in which the acetabula and the promontory are pushed in. As the tuberosities of the ischium are also approximated, the pubes forms a marked projection forward, hence the name of " beaked pelvis " which is sometimes applied to these cases. In some cases the most extreme deformity results, and the bones are so soft that the deformity can be partially remedied by the hand (Fig. 181).

The diagnosis of contraction should be obvious on vaginal examination: the exact nature of the disease may be diagnosed from the extreme softness of the bones, the analysis of the urine, and the general symptoms.

Naegele's Oblique Pelvis.—This rare malformation of the pelvis results from defective development of the lateral mass of one side of the sacrum and synostosis of the affected side with the ilium. An oblique pelvis results with contraction of the side where the sacrum is defective. The deformity is increased by the action of the body

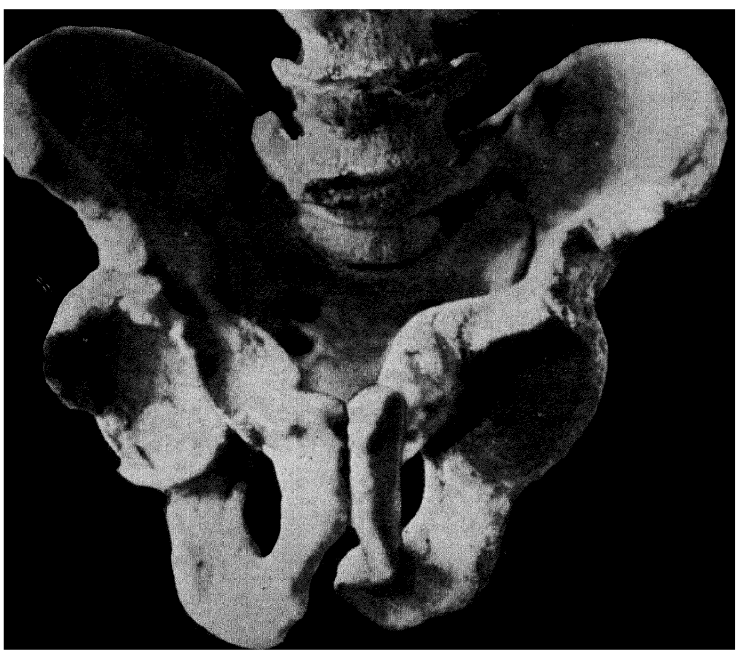


FIG. 181.—PELVIS FROM A PATIENT WITH OSTEOMALACIA.
Note the crumpling up of the bones causing great distortion of the pelvis.

weight, and so a very oblique pelvis results by the time puberty is reached.

The symphysis pubis is displaced towards the sound side, and the distances between the posterior superior iliac spines and the sacral spines are unequal. The prognosis in labour depends on the amount of space available on the larger side. Usually, Cæsarean section is indicated.

The Transversely Contracted Pelvis of Robert.—In this pelvis there are bilateral defects in the lateral masses of the sacrum, and also bilateral synostosis. All the transverse diameters are

diminished, and the pubic angle is narrow. If pregnancy occurs Cæsarean section is necessary, but this type of pelvis is of excessive rarity.

The Split Pelvis.—Here the symphysis pubis is replaced by fibrous tissue. The pelvis is wider than usual, but the sacrum is markedly displaced forward, and the conjugate is diminished. Other malformations, such as ectopia vesicæ, often accompany this uncommon type of pelvis, and therefore pregnancy is rare.

The Spondylolisthetic Pelvis.—This term is given to those rare cases in which the body of the last lumbar vertebra is dislocated

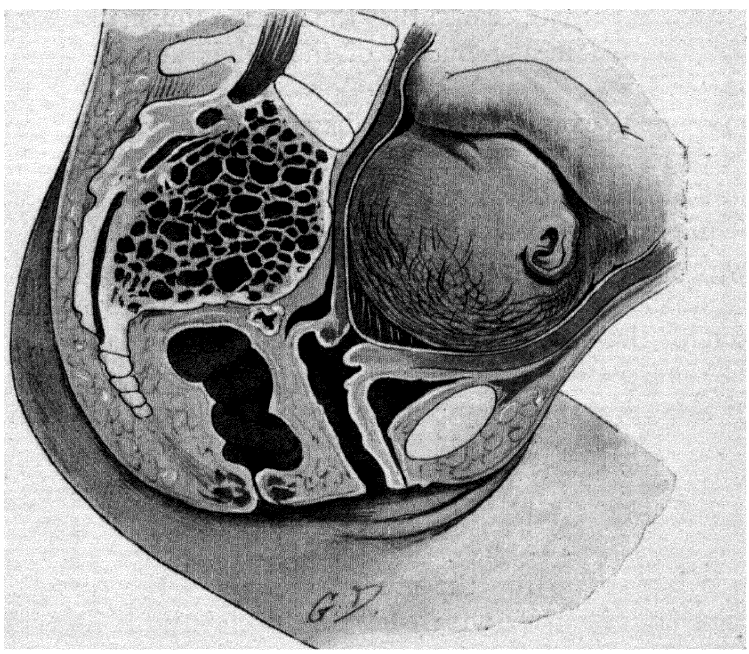


FIG. 182.—CONTRACTED PELVIS DUE TO NEW GROWTH OF SACRUM.

forwards. Such dislocation may be due to caries or congenital malformation of the vertebra. The displaced vertebra naturally occludes the brim. The condition is very rare.

THE DIAGNOSIS OF CONTRACTION OF THE PELVIS

It is a safe rule in obstetrics to regard every pelvis as contracted until the contrary has been proved. The actual proof will depend on measuring the interior of the pelvis directly or indirectly (*vide* Pelvimetry, Chap. XXXVI.). But there are other things which may be of value in directing attention to the strong *probability* that one of a number of patients has a contracted pelvis compared with the

possibility that the others might have, and thus indicating that an especially careful examination must be made before allowing her to go to term. For example, there may be a history of long labours with stillborn children, or the patient may be of small stature (5 feet or less), achondroplasic, kyphotic, scoliotic, lame, or show signs of rickets. These things do not necessarily indicate contracted pelvis, but they show its greater probability, and so an abdominal examination is made.

The suspicion would be confirmed by finding a malpresentation a pendulous belly, marked obliquity of the uterus, a head which projects over the pubes or cannot be pressed down into the brim. The latter shows that either the pelvis is contracted or some other obstruction is present, or else that the head is unusually large.

The external measurements of the pelvis are then made with a pelvimeter.

On vaginal examination the diagonal conjugate is estimated, if possible, and an idea obtained of the distance that the ilio-pectineal line can be traced outwards, so as to estimate if general contraction or obliquity of the pelvis is present. The size of the pubic arch can be roughly measured, and the distance separating the ischial tuberosities also ascertained, either with the fingers or by calipers. In addition to the above, if the patient is already in labour, contraction may be suspected in cases of malpresentations, prolapse of the umbilical cord, when the presenting part is high up or when none can be felt.

Treatment

It is impossible for the student to grasp the essentials of the management of labour with contracted pelvis until he is conversant with the abnormalities of uterine action, especially those described in the chapter on Obstructed Labour, and with the various obstetric operations. For this reason it has been thought best to make the treatment of labour with contraction of the pelvis the last lesson in obstetrics and to postpone its discussion to the last chapter in the book (Chap. LIV.).

CHAPTER XXXVIII

ABNORMALITIES OF THE EXPULSIVE FORCES

NORMALLY the birth of the fœtus is brought about by the rhythmic contractions of the uterus, reinforced towards the termination of labour by the action of the abdominal muscles. The contractions of the uterus may be of normal strength or may be either too strong or too weak or erratic.

PRECIPITATE LABOUR AND EXCESSIVE UTERINE ACTION

When the pains are too strong and follow one another rapidly, and when the resistance of the pelvic floor is slight, the labour may be terminated in a few minutes, and is then known as precipitate labour. Precipitate labour occurs usually in multiparous women, and when it has occurred in primiparæ there has probably been some dilatation of the cervix before the apparent onset of labour.

The consequence of precipitate labour to both mother and child may be grave. Dangerous collapse has been noted, and surgical emphysema sometimes follows the violent expulsive efforts. The chief danger to the mother is tearing of the soft parts, and this varies with the resistance. If the resistance is normal, as in a primipara, the rapid expulsion of the infant may cause laceration of the cervix, and a tear of the perineum involving the rectum. On the other hand, when the soft parts are relaxed, as in a multipara, there may be no tearing, but the child may be damaged by being born before the mother can lie down, and may sustain injuries to the head, and in some cases the umbilical cord has been torn through, leading to fatal hæmorrhage. Should there be some contraction at the brim of the pelvis, the excessive force of the uterine contractions will not allow the head time to mould, and if the contraction is not excessive, the uterus will drive the head past the obstruction and in many instances cause fracture of the skull. Should the obstruction be insurmountable, the symptoms of obstructed labour will arise early and there will be grave danger of rupture of the uterus.

Treatment

Should the attendant be present the pains must be controlled by chloroform. The third stage of labour should be conducted with care, and after expulsion of the placenta a careful examination of the genital canal should be made for lacerations.

PREMATURE RUPTURE OF THE MEMBRANES

During Pregnancy. — Occasionally the membranes rupture before labour has begun. This premature rupture of the membranes may occur spontaneously. Other causes may be a fall or a blow or in rare instances some great emotion. Labour does not necessarily set in at once; indeed, it may be delayed for as long as a fortnight. Except for the first gush the escape of liquor amnii is intermittent, and there may still be sufficient remaining to prevent pressure on the fœtus.

In some rare cases the membranes rupture high up allowing a certain amount of liquor amnii to escape, and yet later on there is found to be a bag of membranes. In this case there is found to be a so-called valvular rupture, and as the head comes down it compresses the hole, and thus the membranes are able to complete the dilatation.

It must be distinguished from a leakage of urine and from the escape of fluid from a double bag of membranes, *i.e.* from the chorio-amniotic space.

Treatment

The immediate treatment is expectant. The patient should be kept in bed recumbent, so that as little liquor as possible be lost. The fœtal heart-beats should be counted, and the temperature of the patient noted daily.

If labour does not set in in the course of a few days, or if the rate of the fœtal heart is increased or diminished in frequency, or if there is any rise in temperature, labour must be induced. The most convenient way of performing this is to dilate the cervix to a size sufficient to allow the introduction of a Champetier de Ribes's bag. This bag acts as a hydrostatic dilator of the cervix, and is a very efficient means of inducing labour surely and expeditiously.

During Labour.—Early rupture of the membranes during labour is an event of importance, not only from the fact that labour may be prolonged and the first stage tedious, but from the fact that this accident is so often associated with contracted pelvis or an abnormal presentation. This should be borne in mind, and a careful

examination should be made to see that the pelvis is normal and the presentation favourable.

Labour is prolonged owing to the absence of the dilating bag of waters, except in those cases in which the rupture has occurred high up, and there is still some liquor in front of the presenting part. The amniotic cavity may become infected by pathogenic organisms which may be introduced on examination or from the vagina itself. The danger to the child is that the maternal blood-supply to the placenta may be impeded by the retraction of the uterine muscle following the diminution in the uterine contents. In the case of hydramnios or contracted pelvis the umbilical cord may prolapse.

UTERINE INERTIA

Uterine inertia is a condition in which as labour progresses the uterine contractions do not occur with increasing strength and at shorter intervals as normally. Consequently dilatation of the os and advance of the fœtus are very slow. This condition may be present from the start of labour and then denotes a sluggish condition of the uterus, which, though tending to prolong labour, will have no bad effect on the patient or fœtus.

The condition of inertia, or rather the absence altogether of uterine contractions, which comes on later in labour and which is associated with greater resistances than are normally met with or which is associated with a weak uterine muscle, is a state of uterine exhaustion and will be described as such.

It has been the prevailing custom to describe inertia under the headings Primary and Secondary, thus suggesting that the one is dependent on the other. This tends to confusion both in theory and practice, and the term "sluggish uterus" will here replace "primary inertia," while "exhausted uterus," a term which explains itself, will be substituted for "secondary inertia".

SLUGGISH UTERUS

Sluggish uterus is a condition in which the expulsive forces are inefficient from the first, although there is no disproportion between the size of the fœtus and that of the pelvis. The whole course of labour is prolonged, but if the membranes are unruptured and the patient is in good condition, the delay, though tedious, may be regarded with equanimity, as with appropriate treatment a favourable termination to the labour may be expected.

Cause

This condition occurs more frequently in primiparæ than multiparæ, and is also associated with complications of labour such as hydramnios, multiple pregnancy, antepartum hæmorrhage, some malpresentation, premature rupture of the membranes, rigidity of the cervix, full bladder and rectum, and adherent membranes.

Treatment

First Stage of Labour.—Active treatment is seldom called for in the first stage of labour, as, although this stage is very prolonged, the patient suffers only from want of rest. The child will not be injured as long as the membranes are unruptured. Various expedients may be adopted to stimulate the uterine contractions. The bladder and rectum should be emptied, as when full they often delay labour. A hot bath and hot vaginal douche of weak lysol solution are attended sometimes with satisfactory results. Ergot should not be given at this stage of labour. In cases in which the membranes are adherent in the neighbourhood of the internal os, they should be separated by sweeping the gloved index-finger round between them and the uterine wall. If these means fail and the patient is getting tired, 20 grains of chloral should be given. If this does not produce sleep a full dose of morphia should be given, and it often happens that after a few hours' sleep the pains are stronger. In rare cases in which the membranes have ruptured early, and the os is small and rigid, and the liquor amnii is draining away, dilatation may be effected with the gloved fingers or de Ribes's bag. Such dilatation would be indicated if the fœtal heart is beating slowly and in the case of an elderly primigravida.

Second and Third Stages of Labour.—If the second stage of labour has lasted two hours and there seems no immediate prospect of the patient delivering herself naturally, ½ c.c. of pituitary extract should be given if no contra-indications are present (see p. 653), and if this does not increase the force and frequency of the pains, the forceps should be applied to reinforce the uterine contractions and complete labour and prevent uterine exhaustion. The third stage of labour is usually prolonged, but retraction being present there is no undue tendency to postpartum hæmorrhage.

EXHAUSTED UTERUS

Uterine exhaustion is quite distinct from the sluggish uterus, as in this condition normal contractions have been present, but

the pains become weaker with longer intervals, and finally tend to disappear entirely. In this condition an attempt to deliver the patient may be followed by disastrous hæmorrhage when the placenta separates, as the power of retraction as well as contraction of the uterus is completely absent.

Cause

It is a rare condition that occurs chiefly in multiparæ. The labour has usually started in the ordinary way with regular and good uterine contractions, and then, because the uterine muscle is poor or inefficiently enervated, or because the resistances met with are greater than normal, the uterine muscle ceases work and labour comes to a standstill. This condition of uterine exhaustion may also follow severe antepartum hæmorrhage and overdistension of the uterus.

Treatment

The disastrous consequences of effecting delivery in the absence of uterine contractions cannot be too strongly emphasized, and the whole line of treatment aims at recruiting the patient's strength with sleep and nourishment to re-establish contraction. When the uterus begins to act again and not till then, delivery can be safely effected by the forceps.

If uterine exhaustion is threatening late in the second stage, contractions must be stimulated by the use of the hypodermic injection of pituitary extract, $\frac{1}{2}$ c.c. or ergotin $\mathfrak{m}$ 10 to 15, and the forceps applied. The treatment of inertia in the third stage of labour will be described in the section on postpartum hæmorrhage.

COLICKY UTERUS.

There is a further variety of abnormal uterine action which the term "sluggish" does not cover. In this variety the contractions occur regularly, but only cause intense discomfort and do not dilate the os. The term "colicky uterus" is used to describe this variety. The use of scopolamine $\frac{1}{150}$ gr. combined with $\frac{1}{6}$ gr. of morphia will often relieve this condition, and be followed by regular and strong contractions which dilate the os almost painlessly. It is advisable for the medical attendant to wait in the house or to be very near at hand after administration of scopolamine and morphia, as sometimes labour is terminated expeditiously and unexpectedly (see Chap. L.).

SPASMODIC RIGIDITY OF THE CERVIX

The circular fibres of the uterine muscle are strongly developed in the region of the internal and the external os, forming sphincter muscles. When labour starts these fibres should relax, but in a certain number of cases they remain in a condition of spasm and give rise to obstruction. This condition is met with chiefly in elderly primiparæ. The initial cause may be uterine sluggishness, some reflex disturbance, premature rupture of the membranes, morbid adhesions of the membranes preventing formation of the bag of waters, malpresentation, great sensitiveness to pain on the part of the patient, and the injudicious administration of ergot. The os is usually found to be very thin and resistant.

Treatment

This depends upon the cause. If the pains are weak, they may be stimulated by emptying the bowel and bladder, by copious hot vaginal douches, or by a hot bath. Should the pains be very badly borne, then the administration of opium, morphia, chloral hydrate or chloroform may abolish the spasm. If the membranes are adherent they may be separated, or if the membranes are ruptured the os may be dilated manually or by means of Champetier de Ribes's bag.

TONIC CONTRACTION OF THE UTERUS

Definition.—Tonic contraction is a condition of the uterus induced by some insuperable obstruction to the birth of the child. In this condition the muscle of the upper uterine segment becomes progressively shortened with consequent elongation and stretching of the lower uterine segment and vagina.

It must be remembered that after each contraction of the uterus some retraction persists and maintains the position of the fœtus gained by the contraction. If this were not so the fœtus would, with each relaxation of the uterus, slip back into the position in which it was before the contraction, and labour would be prolonged indefinitely. In the course of normal labour the upper uterine segment becomes progressively thicker and shorter, see page 264. If the fœtus descends the upper segment can retract without stretching the lower segment. If the fœtus remains stationary the total length of the uterus must be constant to contain the fœtus, thus necessitating stretching of the lower part of the uterus and vagina. With the contractions excessively strong as in tonic contraction, progressive retraction causes the upper segment of the uterus to become very

thick, with consequent thinning of the lower segment. This is pathological retraction. The line of junction of the two segments is then marked by a well-defined ridge, running obliquely, which can be felt abdominally between the symphysis pubis and the umbilicus, varying in height according to the degree of thinning of the lower uterine segment. It is sometimes found as high as, or above, the umbilicus. This ridge is known by the names of the retraction ring or Bandl's ring, though the former name appears preferable, as it does to some extent suggest the mode of origin (Fig. 184).

Occasionally in the first, but more commonly in the second, stage of labour, the contractions of the uterus may follow one another so rapidly that there is no interval between them and the uterus passes into a state of tetanic spasm. This condition sometimes occurs in the early stages of labour, but as a rule passes off and is followed by orderly and regular contractions, though the administration of chloroform may be necessary. The commonest variety occurs during the second stage of a prolonged labour, in which the labour pains started normally, but owing to some obstruction the contractions have followed one another tumultuously in their efforts to expel the contents of the uterus.

Cause

The causes of this condition are:—

1. Obstructed labour (see p. 461). As a rule obstruction excites the uterus to further efforts and eventually, if the obstruction is not relieved, a condition of tonic contraction with over-retraction will result. Occasionally, however, after a period of very strong pains extreme fatigue of the woman may produce a condition of uterine exhaustion. When the woman recovers from the fatigue the exhaustion may be succeeded by tumultuous uterine action leading to tonic contraction with over-retraction.

2. The administration of ergot or pituitary extract in an unsuitable case (see p. 653).

Symptoms and Signs

Clinically tonic contraction is recognized by the condition of the patient becoming grave, with a raised temperature and a quickened pulse-rate. The expression is anxious, and the patient complains of a severe cramp-like pain in the abdomen, and often exhibits a characteristic restlessness. On examination the uterus will be found to be hard and tender, and moulded to the shape of the fœtus, fœtal parts will not be felt, and there will be absence of the

fœtal heart-sounds, as the child will be dead owing to the cessation of the placental circulation. If the head is impacted in the pelvis it will be found that the normal moisture of the genital canal is absent, and the vagina itself œdematous. There will be overlapping of the bones of the skull unless the head is above the brim, the caput succedaneum will be large, showing that at any rate for some time the fœtus was able to withstand the intra-uterine pressure, and on pressing upwards the fœtal skull is found to be fixed in the brim or impacted, *i.e.* the head is in the pelvis and cannot be moved down by the uterine contractions or pushed up from below. If the shoulder is presenting it will be found to be impacted, the arm prolapsed and the hand projecting at the vulva.

Treatment

The treatment comes under two headings :—

1. To diminish as far as possible the spasm of the uterus
2. To effect delivery.

To diminish the spasm of the uterus, morphia should be given ($\frac{1}{3}$-$\frac{1}{2}$ grain) hypodermically, and the patient should be put and kept under the full influence of chloroform. This is done with the idea of obtaining relaxation of the uterus, and it will be then noticed that the spasm will to a great extent pass off, and the child must then be extracted. Manipulations undertaken too soon will cause the spasm to return.

Delivery of the Fœtus.—As the fœtus has already perished owing to the circulation to the maternal part of the placenta being arrested by the compression of the vessels in the uterine wall, the whole line of treatment is directed to the safe delivery of the mother. If the presentation is a vertex, the operation known as craniotomy (see p. 703) must be performed; if an abnormal presentation is present, some appropriate destructive operation, such as decapitation. Valuable time should not be wasted in attempting delivery with the forceps.

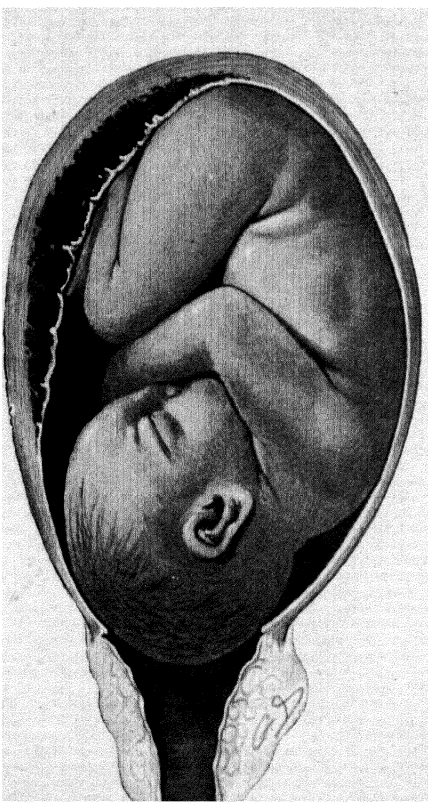
There are two other varieties of a pathological over-activity of the uterus. This over-activity may involve the uterus as a whole or locally. When the uterus is involved as a whole the condition is known as the "irritated uterus," or the generally contracted uterus. When only a part of the uterus is involved the condition is known as the "contraction ring".

The outstanding feature of these two conditions is the absence of over-retraction and thinning of the lower uterine segment, which

serves to distinguish them from tonic contraction of the uterus. In both cases there is active retention of the fœtus in the uterus, as until the spasm has disappeared it is impossible to extract the fœtus.

IRRITATED UTERUS OR GENERALLY CONTRACTED UTERUS

Advanced cases of tonic contraction of the uterus are exceedingly rarely seen in civilized countries, and what is commonly termed tonic



IG. 183.—DIAGRAMMATIC REPRESENTATION OF NORMAL LABOUR, SHOWING THE SYMMETRICAL SHAPE OF THE UTERUS.

The child is nowhere closely embraced by ıe uterus and there is room for liquor annii.

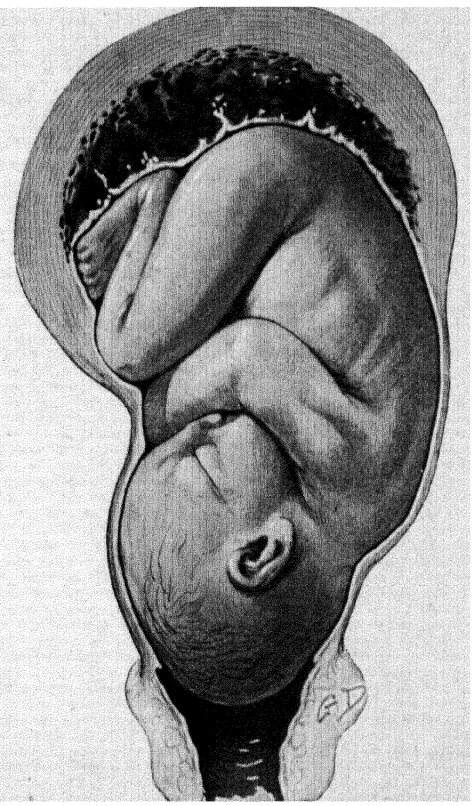


FIG. 184.—TONIC CONTRACTION OF THE UTERUS.

The upper segment of the uterus is thick ened, the lower segment thinned. The uteru as a whole closely embraces the fœtus.

contraction is really an "irritated uterus" caused by repeated attempts at delivery. It has been surmised that sepsis of the uterus may cause this condition, which is recognized by the uterus being moulded to the child although the upper uterine segment has not been withdrawn over the body of the child, and there is no great stretching of the lower uterine segment. Any attempt at introduction of the hand is resented by the uterus, which grips the hand on its introduction. Attempts at delivery with the forceps, or indeed any

internal manipulation, are definitely contra-indicated on account of the risk of rupture of the uterus. This condition will yield to treatment by morphia and chloroform, and it is dangerous to attempt delivery until the uterus has become relaxed again. A full dose of morphia, $\frac{1}{3}$-$\frac{1}{2}$ grain, is given, and chloroform administered to the full surgical degree. After thirty minutes to an hour

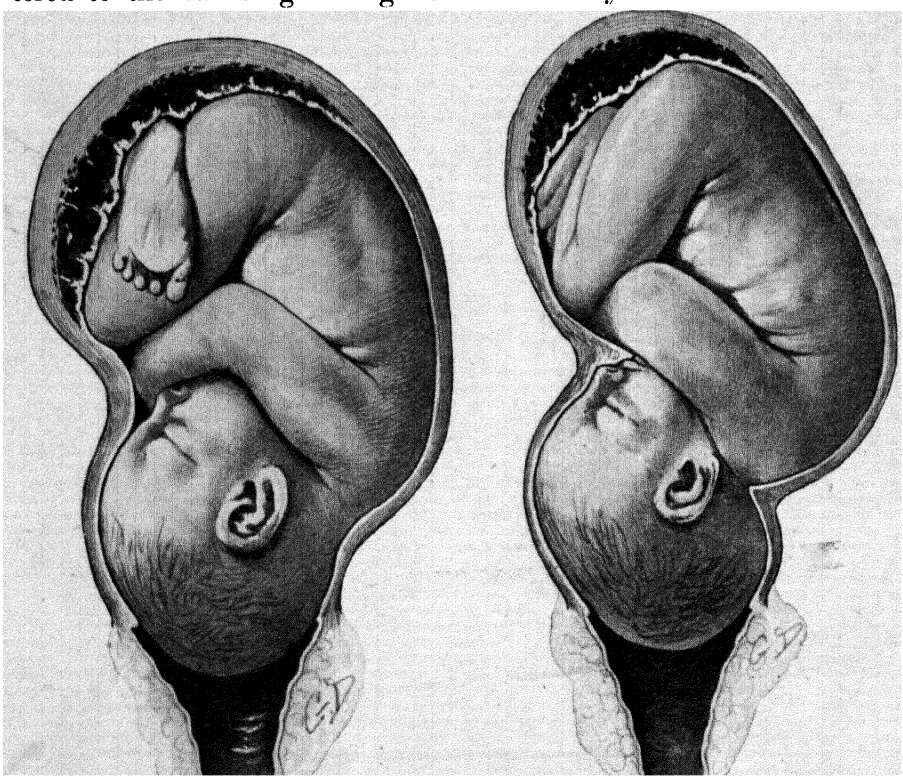


FIG. 185.—THE IRRITATED OR GENERALLY CONTRACTED UTERUS.

The uterus as a whole closely embraces the fœtus, but the lower uterine segment shows no thinning.

FIG. 186.—THE CONTRACTION RING OR LOCALLY CONTRACTED UTERUS.

The fœtus is not closely embraced by the uterus except round the neck, where it is gripped by a constricting band. There is no thinning of the lower uterine segment.

it will be found that the uterus is relaxed and permits intra-uterine manipulations, which should be carried out skilfully, as prolonged attempts at delivery will again cause the uterus to become irritable, and if the attempts be persisted in there is great danger of rupturing the uterus (Fig. 185).

CONTRACTION RING OR LOCALLY CONTRACTED UTERUS

The contraction ring is a localized thickening of the wall of the uterus due to the contraction of the circular fibres over a point

of slight resistance, most frequently over a depression in the child's outline and sometimes below the presenting part (Fig. 186).

Cause

Malpresentation accompanied by premature rupture of the membranes, or intra-uterine manipulations associated with increased uterine irritability.

Physical Signs

Abdominally, the uterus is not hard or tender, and uterine contractions occur and are followed by relaxation. It is unusual to feel any ring or localized contraction. The fœtal heart may be heard. *Per vaginam,* the hand introduced into the uterus feels a contraction round some part of the fœtus. The fœtus is not impacted.

Diagnosis

The diagnosis is made by intra-uterine examination in a case in which there has been great delay, usually in the second stage of labour. The examining hand feels a constriction round some part of the fœtus, while above, if the fingers can pass the constriction, the uterus is relaxed.

Pathology

The contraction ring is a localized thickening of the uterine muscle, and the uterus above and below the constriction is thinner than at the point of thickening. The ring fits into some depression in the child's outline.

Treatment

(*a*) *Drugs.*—The injection of morphia hypodermically and inhalation of chloroform have not been found to relax the constricting ring.

(*b*) *Dilatation of the Ring.*—In minor cases the ring may be dilated manually.

In more severe cases continuous steady traction for quite an hour applied to the head or breech by a suitable instrument to which is attached a weight of about 7 lbs. may be successful.

(*c*) *Embryotomy.*—If traction or version fail, embryotomy may be employed. The operation is technically very difficult and not always successful.

(*d*) *Cæsarean Section.*—If the fœtus is alive and a thorough trial of delivery by steady traction has failed, Cæsarean section is preferable to embryotomy. The risk of Cæsarean section is increased if there have been repeated intra-uterine manipulations, and the difficulty is increased as it may be necessary to incise the contraction ring, which is in the lower segment of the uterus, before the child can be extracted.

In other cases with a dead fœtus it may be necessary to perform Cæsarean section if other attempts at delivery have failed, or, if there is a probability of sepsis, the whole uterus with the fœtus *in situ* must be extirpated.

CHAPTER XXXIX

OBSTRUCTED LABOUR

THIS condition may be defined as one in which there is some mechanical obstruction and delivery by the natural forces cannot be accomplished. The causes may be conveniently grouped under the headings maternal and fœtal.

Maternal.
1. Contracted Pelvis.
2. Pelvic tumours.
3. Organic rigidity of cervix.
4. Cicatricial contraction of vagina.
5. Malposition of os uteri.

Fœtal.
1. Malpresentations, such as transverse lie, brow presentation, complex presentations, persistent occipito-posterior and mento-posterior positions and impacted breech.
2. Large and post-mature infants.
3. Abnormalities of the fœtus, such as hydrocephalus, encephalocele, monsters, ascites and dropsy.

Contracted Pelvis.—Various degrees of contraction of the pelvis may be met with which give rise to obstructed labour. They are described in Chapters XXXVI and XXXVII.

Pelvic Tumours.—These tumours will be growing from the organs or structures in the neighbourhood and comprise ovarian tumours, fibroid tumours, bony growths from the pelvis, hydatid cysts, displaced and enlarged kidneys and spleen, or any other morbid growth which may be found in the pelvis. They are described in other parts of this work under their respective headings.

Organic Rigidity of the Cervix and Cicatricial Contraction of Vagina.—This is a diseased condition often due to a laceration and cicatrix from a previous labour. It also occurs with hyperplasia of the cervix associated with prolapse. A pinhole os offers great resistance to dilatation by the longitudinal fibres of the uterus; cases have been described in which, although the whole cervix was expanded, the

external os would scarcely admit a catheter. Cancer of the cervix and fibroids occupying the cervix often form an insuperable bar to its dilatation.

Treatment

Artificial dilation of the cervix by a small de Ribes's bag or other hydrostatic dilator may be required if the condition of the mother or child demand it, and in a few cases incision of the cervix may be necessary. This is done by exposing the cervix with a speculum and incising with scissors the margin of the os in several places to the depth of a quarter of an inch. Labour complicated by carcinoma of the cervix or fibroids occupying the cervix or lower part of the uterus often requires delivery by Cæsarean section, followed by extirpation of the uterus if the case is suitable.

Atresia of the cervix may be mentioned here, a condition in which no opening can be discovered at the onset of labour, though naturally the canal must have been permeable for conception to have taken place. A puncture must be made at the site of the os, and this hole dilated sufficiently for the membranes to bulge into it. It is due to inflammatory adhesions or to operations on the cervix.

Malpresentations and Malformations.—Transverse lie, persistent mento-posterior position, brow presentation, locked twins and conjoined twins will be found described under their respective headings.

Pendulous Abdomen.—In many multiparæ the abdominal walls are so lax as to form no support to the enlarging uterus during the last few months of pregnancy. In some the laxity is so marked that the recti become separated and the uterus comes to lie in a hernial sac. If this condition is not remedied by a firm abdominal belt during pregnancy and by a tight binder during labour, the head may not enter the pelvis, the axis of the uterus pointing directly backwards, and this may lead to rupture of the uterus or vagina.

Hydrocephalus.—Hydrocephalus is a congenital malformation in which the ventricles of the brain are distended with fluid; in some cases it is associated with fluid between the brain and the skull. The head is enormously enlarged and the brain is spread out in a thin layer. The cranial bones are small and incompletely ossified and cover only a small area of the brain, thus the sutures and fontanelles are very wide. The face is relatively very small, and the bulging forehead overhangs the face, and the inter-frontal sulcus is very well marked. It is often associated with other deformities, such as spina bifida. Breech presentations are common in this condition, and it is often not discovered till there is great delay in

the birth of the after-coming head, and then the large size of the uterus reveals the true state of affairs.

The mortality is high unless the correct diagnosis is made early, when the danger to the mother is small, though the child usually perishes.

An encephalocele or meningocele may from its size and situation cause obstructed labour (Fig. 187). Enormous enlargement of the abdomen of the fœtus from ascites, cystic disease of the kidneys or ovary, over-distended bladder, or any other disease of the abdominal viscera may give rise to grave obstruction.

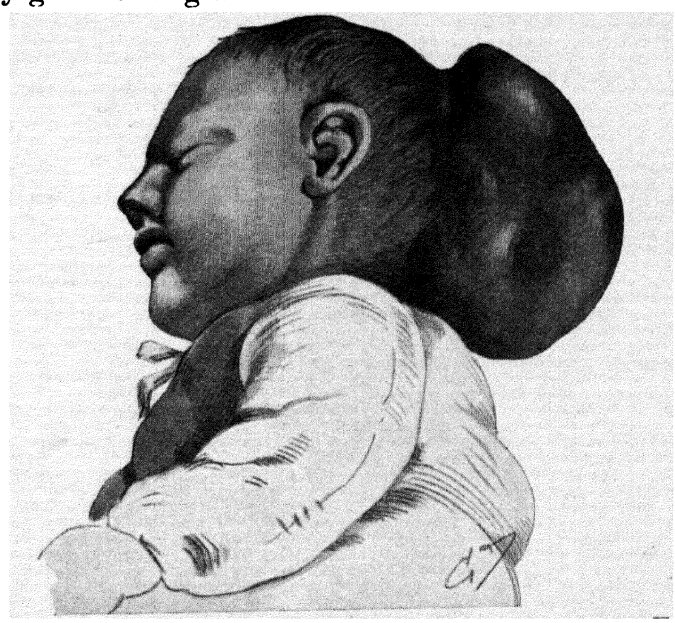


FIG. 187.—MENINGOCELE GROWING FROM THE REGION OF THE POSTERIOR FONTANELLE.

TREATMENT

On a diagnosis of hydrocephalus being made the treatment is to perforate the head, and if it is not sufficiently reduced in size to pass through the pelvis the cephalotribe can be applied and traction made. In obstruction from the after-coming hydrocephalic head it may be easier to cut across the spinal column, and when the fluid has drained away to deliver by traction, but perforation of the cranial cavity is a quicker method. Minor degrees of hydrocephalus may be delivered spontaneously or with the aid of the forceps.

Cases of obstruction associated with great enlargement of the abdomen are treated by tapping the abdomen or evisceration.

Effects of Obstructed Labour in the Several Stages of Labour.—Generally speaking, excessive retraction of the upper part of the

uterus only occurs after rupture of the membranes. When some obstruction is present, it may, however, occur in the first stage of labour when the pains are good and have been acting for a long time, and there is some increased resistance to dilatation of the cervix.

Before escape of the liquor amnii there is no immediate danger to the mother or child, since they are protected from undue pressure. With premature rupture of the membranes and the draining away of the amniotic fluid the infant is likely to perish and symptoms of exhaustion to overtake the mother.

In the second stage of labour with the os retracted over the child's head, prolonged pressure on the vagina is likely to be followed by sloughing of the wall and the formation of a vesico-vaginal fistula.

With a powerfully acting uterus and a normal-sized child moulding can often take place, and when the obstruction is not excessive the child may be born with or without the use of the forceps.

Obstructed labour, unless recognized early and treated, is extremely serious. That labour is obstructed is recognized by the fact that no advance takes place in spite of good pains. The patient begins to show signs of exhaustion by quickening of the pulse-rate and later by rise of temperature. There is dryness of the mouth and vomiting. The caput succedaneum will be large, and in a vertex presentation the child may pass meconium, thus showing signs of impending suffocation. If the obstruction is not relieved there will be tonic contraction of the upper segment, with over-distension and thinning of the lower uterine segment and great danger of rupture of the uterus and vagina, and the fœtus will perish.

Treatment

If the systematic examination of pregnant women during the last six weeks of pregnancy was faithfully carried out, obstructed labour would be almost an unknown complication of labour, the presentation would be determined, the relative size of the fœtal head and pelvis noted, and abnormalities could then be treated before they had given rise to danger.

If on abdominal examination during the early stages of labour the presenting part is not engaged, or if on vaginal examination the presenting part is either very high up or cannot be felt, then in all probability the pelvis is contracted or the presentation or size of the child is abnormal. The exact degree of contraction must be noted and treated accordingly, or the presentation rectified. If this is discovered in the second stage of labour before the uterus has become tonically contracted there is still a possibility of saving the child

and delivering the mother safely. If the uterus has become tonically contracted the child must be delivered by some destructive operation such as craniotomy or decapitation.

RUPTURE OF UTERUS

Rupture of the uterus may be conveniently studied under the headings Spontaneous and Traumatic Ruptures.

Spontaneous Rupture.—This occurs very rarely during pregnancy, and then is due to some degeneration of the uterine wall following

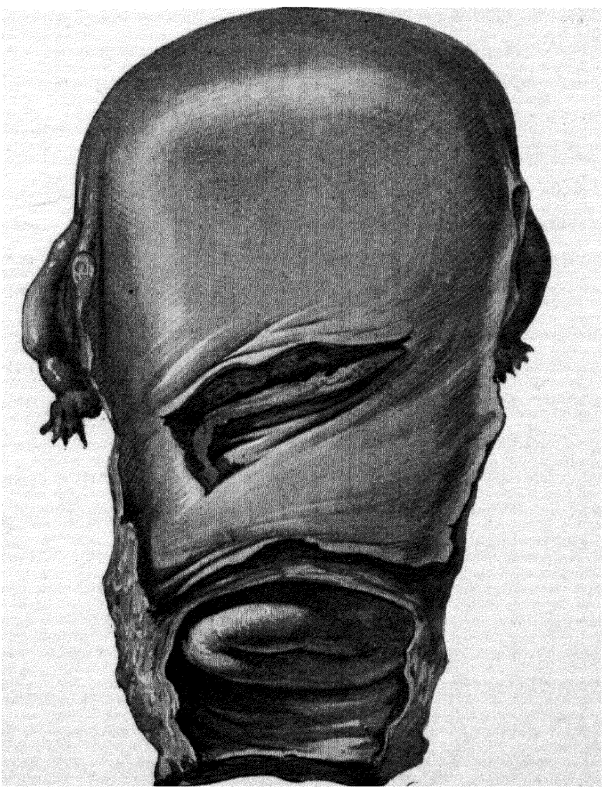


FIG. 188.—RUPTURE OF THE UTERUS. A COMPLETE TEAR ON THE ANTERIOR WALL.

previous pregnancies, to a cicatrix of a previous Cæsarean section giving way, to a wall injured in a previous confinement stretching and giving way, or to rupture of a pregnancy in a rudimentary horn of a bicornute uterus. During pregnancy this accident is not necessarily accompanied by a severe loss of blood, and may only be discovered by the fœtus being found free in the peritoneal cavity. On the other hand, it may assume as serious an aspect as rupture occurring during labour.

Spontaneous rupture during labour is more frequent and occurs—

1. From obstructed labour.
2. From degenerative or other changes tending to weaken the uterine wall.
3. From deviation of the uterine axis due to a pendulous belly or a faultily ventrofixed uterus.
4. From previous cicatrices in the uterine wall.
5. From carcinoma of the cervix.
6. From pregnancy in a rudimentary horn of a bicornute uterus.

Traumatic Rupture.—Traumatic rupture of the uterus occurs occasionally during pregnancy from a blow or a fall, but more frequently during labour from operative measures undertaken to deliver the fœtus, such as forcible dilatation of the cervix, version, forceps-delivery or craniotomy, especially if performed in unsuitable cases. By far the most common cause is unskilful attempts at delivery.

The mechanism of the rupture is explained by excessive retraction of the upper with corresponding thinning of the lower segment of the uterus (see p. 454). When this thinning has reached a certain degree, there comes a time when the slightest extra strain will lead to rupture. Further delay in delivery may cause the uterus to give way spontaneously, but more commonly some manipulation, unwisely undertaken, determines the rupture.

Pathology

Rupture of the uterus generally takes place in the overdistended lower uterine segment and may be limited to it, but sometimes spreads upwards into the upper segment, or downwards involving the cervix and the upper part of the vagina.

If the rupture is in the neighbourhood of the broad ligament it is usually longitudinal, whereas if it is in the region of the cervix it may be transverse. After rupture part or the whole of the fœtus may escape into the peritoneal cavity, further tearing the uterus in its passage; this tear may involve the upper uterine segment or the cervix and vagina.

Ruptures are generally divided into: (1) Complete or intra-peritoneal; and (2) Incomplete or extra-peritoneal, depending upon whether the peritoneal coat is torn through or not. Spontaneous rupture of the uterus is generally complete, and traumatic rupture is often incomplete. A tear in the lateral wall of the uterus, although it may involve the whole thickness of the uterine wall, is not complete unless the effused blood bursts through one or other layer of the broad

ligament into the peritoneal cavity. When the rupture is complete, the fœtus usually escapes into the peritoneal cavity together with the placenta. If, however, the presenting part is firmly engaged in the pelvis only a portion will escape. The tear itself presents a jagged irregular margin, the edges of which, owing to retraction, are in close approximation unless part of the fœtus occupies the rent.

Symptoms and Diagnosis

There are no classical symptoms of rupture. As a rule, following a long and tedious labour, the premonitory symptoms described under tonic contraction with over-stretching of the lower uterine segment are present, when suddenly, at the height of a pain, the patient cries out and complains of a sharp tearing pain in the lower abdomen. On the other hand, rupture may take place in the course of an apparently normal labour. Shortly after the rupture the patient presents symptoms of shock, the face becomes pale and drawn, and the forehead is covered with a cold sweat. The pulse becomes thready in character and its rate is increasingly rapid. If the hæmorrhage is more severe there are air hunger, disturbances of vision, and finally unconsciousness. Many cases, however, do not present such severe symptoms. If the fœtus is partially retained in the uterus, the retraction of the uterus on the part of the fœtus in the tear stops the hæmorrhage to a certain extent for a time. After an incomplete tear the symptoms may be slight, depending upon the vascularity of the area torn through. In the absence of great hæmorrhage many incomplete tears pass unrecognized. A rupture into the broad ligament may not give rise to severe symptoms, as the pressure of the blood effused between the two layers tends to stop the hæmorrhage.

In rupture of the uterus there is no great amount of external hæmorrhage and only exceptionally severe intra-peritoneal hæmorrhage. On abdominal examination, unless the fœtus has escaped into the peritoneal cavity there is no outstanding feature. If the fœtus has escaped into the peritoneal cavity it is usually strikingly palpable with the small firm uterus; in rare cases the fœtus may be concealed by lying behind the uterus. On vaginal examination there will be absence of the presenting part if it is not impacted.

In some cases the condition is discovered only after the delivery of the child, for instance, after a difficult forceps-delivery or a case in which version has been performed, the hand introduced into the uterus because the placenta does not come away naturally, discovers a rent through which the placenta has escaped into the peritoneal cavity; or else troublesome hæmorrhage in the third stage

of labour with a firmly retracted uterus excites a suspicion of rupture which is confirmed by digital examination. The symptoms in some cases may be so latent that no thought of rupture is entertained till some few hours after labour, when symptoms of collapse come on.

The mortality resulting from rupture of the uterus is very high, and is variously estimated at 40 per cent. to 70 per cent. The rate of mortality is accounted for to some extent by the fact that this accident usually occurs in cases of prolonged labour with much manipulation, often complicated by sepsis and inefficient surgical aid.

Prophylaxis.—Since in most cases of protracted labour in which the lower uterine segment is thinned the child is already dead or unlikely to survive delivery, the whole of the treatment is directed to saving the mother's life. A full dose of morphia and chloroform to the full surgical degree will often permit of safe delivery by craniotomy or decapitation. After perforation it is safer to use the craniotomy forceps than the cephalotribe, as the craniotomy forceps does not distend the lower uterine segment so much.

Treatment

Cases in which the whole or part of the fœtus has escaped into the peritoneal cavity.

These cases must always be dealt with by abdominal section.

Cases in which the tear is discovered after the birth of the fœtus.

If the placenta is in the peritoneal cavity it is inadvisable to attempt to drag it through the tear by traction on the cord, as not only may the rent be enlarged, but, in addition, the hæmorrhage may be increased. To deliver the placenta the abdomen must be opened, the placenta removed, and the tear sutured, if in a favourable position, or hysterectomy performed.

Cases in which the tear is confined to the broad ligament will not be diagnosed till after delivery. The diagnosis as to whether the tear involves the broad ligament only will be determined by passing the finger into the rent, and if bowel is not felt the tear involves the broad ligament only.

The hæmorrhage in these cases can usually be arrested by packing the cavity of the broad ligament.

Tears opening the posterior fornix, if complicated by prolapse of bowel, must be sutured.

Small tears of the uterus without serious hæmorrhage can be left alone.

When it has been advisable to open the abdomen.

It is rarely possible to suture the rent. This may be due to its position or from the bruising or raggedness of the tissues involved. In the few cases with little bruising and an accessible tear the rent should be sutured. Interrupted sutures are passed through the whole thickness of the uterine muscle and tied, and a finer continuous catgut suture is used to approximate the peritoneal edges.

Many cases are best treated by hysterectomy, as efficient suturing may be difficult and almost impossible. Owing to the great possibility of the uterus being infected, hysterectomy offers the greatest chance of recovery to the patient, and at the same time removes an organ which may possibly be a danger to the patient in a future pregnancy.

ACUTE INVERSION OF THE UTERUS

Inversion of the uterus occurring during labour is called acute inversion of the uterus.

In this condition the body of the uterus becomes more or less completely turned inside out. It is a rare complication of labour, only one case being noted in 150,000 deliveries at the Rotunda, Dublin. There may be three stages of inversion :—

1. When the fundus bulges into the uterine cavity and does not protrude through the os.
2. When the fundus protrudes through the os.
3. When the inverted body passes completely through the os.

In the latter two stages the fundus may prolapse through the vulva and lie outside the body. Inversion may take place either before or after separation of the placenta.

Cause

For the production of inversion of the uterus, there must be relaxation or inertia of the uterine wall and fundal attachment of the placenta. The inversion may be spontaneous; relaxation of that part of the uterine wall to which the placenta is attached permitting this part to be grasped and carried down by a contraction of the rest of the uterus stimulated by the presence of the fundus acting as a foreign body, the patient aiding the inversion by bearing-down efforts. Or the inversion may be started by a short or relatively short cord being dragged upon by an instrumental delivery in an interval between pains.

Inversion may be produced by injudicious attempts at expression of the placenta when the uterus is relaxed or from pulling on the

cord. Inversion may also be caused by attempting to pull out a morbidly adherent placenta when the uterus is relaxed.

Inversion generally occurs soon after delivery, and if not observed till later the probability is that it started during the third stage but took some time to develop.

Symptoms

The chief symptoms are shock and hæmorrhage. The shock is accompanied by pain, faintness, rising pulse-rate, and vomiting.

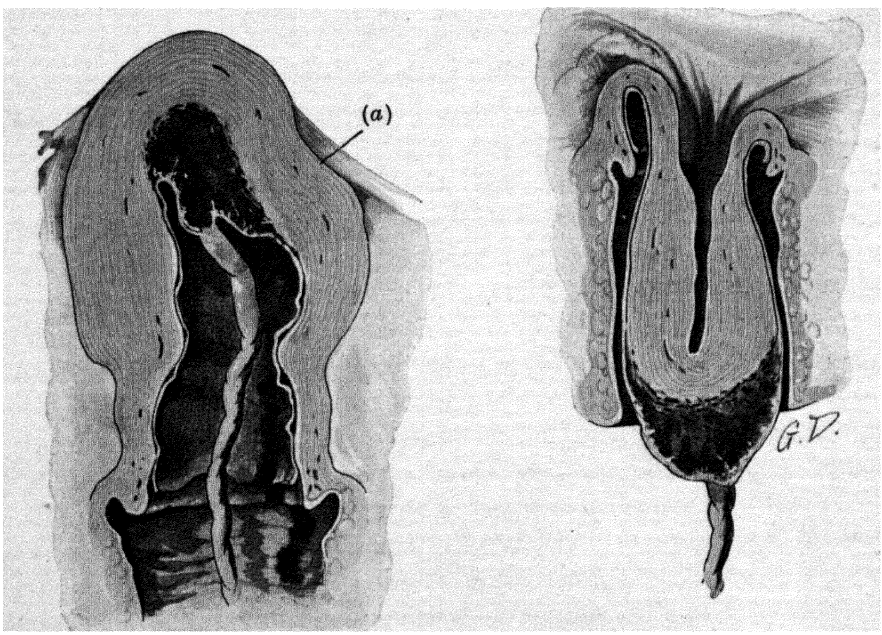


Fig. 189.—Inversion of the Uterus.

A shows fundal attachment of the placenta with a furrow on the anterior wall at the point (*a*) where the inversion is starting.

B shows the inversion almost complete with the cup-shaped depression in place of the rounded fundus.

Hæmorrhage is variable in amount and depends upon whether the placenta is separated or not. If the inversion is slow in onset the shock is small, and the condition may not be discovered for some time. Cases which remain untreated run a very grave risk of sepsis and hæmorrhage. In the absence of sepsis involution may proceed normally.

Prognosis

If the patient recovers from the initial shock and hæmorrhage she may succumb later to septic infection combined with the effects of continued hæmorrhage.

Diagnosis

In complete inversion before separation of the placenta the diagnosis is simple. After separation of the placenta the inverted fundus has been removed under the impression that it was a fibroid polypus. Diagnosis should be assisted by abdominal examination, when the absence of the usual hard uterus from the hypogastrium will reveal the nature of the case. In the place of the fundus there may sometimes be felt a cup-shaped depression (Fig. 189).

Treatment

The two factors which threaten the patient's life in acute inversion of the uterus are shock and hæmorrhage, of which the former is by far the more important. The treatment depends entirely upon the amount of shock present. An attempt at reposition of the inverted uterus in a patient suffering from shock cannot be too strongly deprecated, as, although the inversion may be rectified, it may be followed by death of the patient.

If the patient is suffering from hæmorrhage in addition to or without shock, pituitary extract should be administered hypodermically together with morphia. If the placenta is still partially attached to the uterus it should be stripped off, and heat by means of a hot douche applied to the placental site to encourage retraction.

In the absence of hæmorrhage treatment is solely directed to overcoming the shock. A preliminary injection of morphia should always be given. Saline infusion should be given subcutaneously, or, if the shock is profound, intravenously. When the shock has been overcome, or in those rare cases in which shock is not present, active treatment may be undertaken.

After cleansing the vulva and vagina with an antiseptic lotion, the placenta is peeled off, if still attached, as the bulk of the mass to be replaced is thus reduced in size. If the condition of the patient will permit it, she is anæsthetized, preferably with ether. Counter-pressure is made with one hand on the abdomen, while the other hand steadily presses up the fundus, squeezing it up rather than pushing to avoid indenting the fundus, which would necessitate four thicknesses of the uterus being pushed through the constricting part instead of two. When the replacement is completed, hot intra-uterine douches are given to cleanse the interior of the uterus and favour retraction. The condition sometimes recurs owing to the reposition being incomplete. The inversion must then be reduced completely and the uterus well massaged to maintain retraction.

Should the condition be discovered some days after labour, an anæsthetic should be given and a gentle attempt at reposition made. If this fails hot vaginal douches should be given a trial, as it has been found that partial inversion may be reduced by this means. Should this fail it is necessary to wait till involution is complete, when continuous pressure may be made on the fundus with some instrument such as Aveling's repositor, or a hydrostatic dilator such as Champetier de Ribes's bag placed in the vagina.

The treatment of chronic inversion of the uterus will be found in the volume on Diseases of Women.

LACERATIONS OF THE GENITAL CANAL

Lacerations of the Cervix.—Lacerations of the cervix, though they must occur frequently as shown by the fact that most parous women have a more or less torn cervix, are often overlooked as they rarely give rise to immediate symptoms.

Extensive lacerations of the cervix occur in precipitate labour, in a cervix which has a previous cicatrix present, when the forceps has been applied to a head and strong traction exerted with the cervix insufficiently dilated, or in rapid delivery of the after-coming head with incomplete dilatation of the cervix.

When the cervix is deeply lacerated there may be a continuous hæmorrhage after the third stage of labour, although the body of the uterus itself may be well retracted. This hæmorrhage will continue until the laceration is sutured or treated in some other adequate manner, as by a hot douche or pressure by means of vulsellum forceps.

If it is necessary to suture the tear, the patient is anæsthetized and the anterior and posterior lips of the cervix seized with vulsellum forceps and drawn well down. Interrupted sutures are inserted, passing through the thickness of the cervix. It is advisable to pass the upper suture first. After the sutures are tied the hæmorrhage ceases. The hæmorrhage in most cases stops after a hot vaginal douche, or in more severe cases when the torn surfaces are pressed together with a pair of vulsellum forceps (Fig. 190).

Lacerations of the Perineum and Vagina.—Lacerations involving the perineum and vagina are of frequent occurrence following normal labour in primiparæ, or following an abnormal presentation such as face or breech or a posterior position of the vertex in multiparæ. For prevention see page 313.

The first class of laceration involves the anterior part of the perineum and the posterior wall of the vagina, but may be overlooked

if the labia are not separated and the parts examined. The tear in the vagina generally extends in a lateral direction and for some distance up the posterior vaginal wall.

Treatment

The vaginal tear is first sutured with interrupted sutures of catgut passing right down to the base of the laceration. The tear

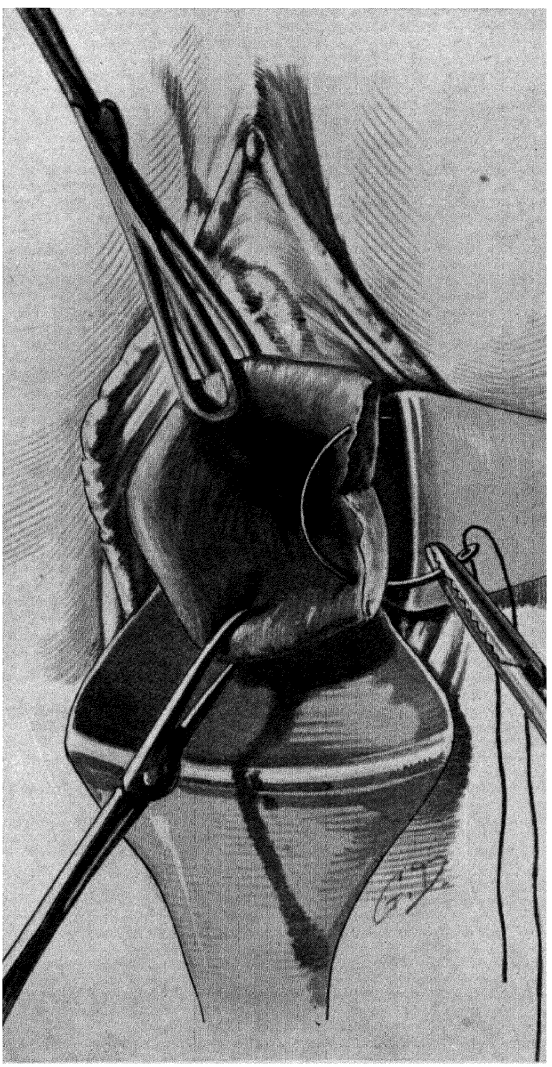


Fig. 190.—The Repair of a Tear of the Cervix by Interrupted Catgut Sutures. The cervix is depicted outside for the sake of clearness.

of the perineum is then sutured in like manner with silkworm gut or stout catgut.

The second class of tear involves the perineum up to the external

sphincter with a corresponding tear in the vagina. This laceration is sutured in the same way as the previous one. Both these lacerations can be sutured before the separation of the placenta, the sutures clipped with artery forceps and tied at the termination of the third stage. By this means the sutures can be inserted but

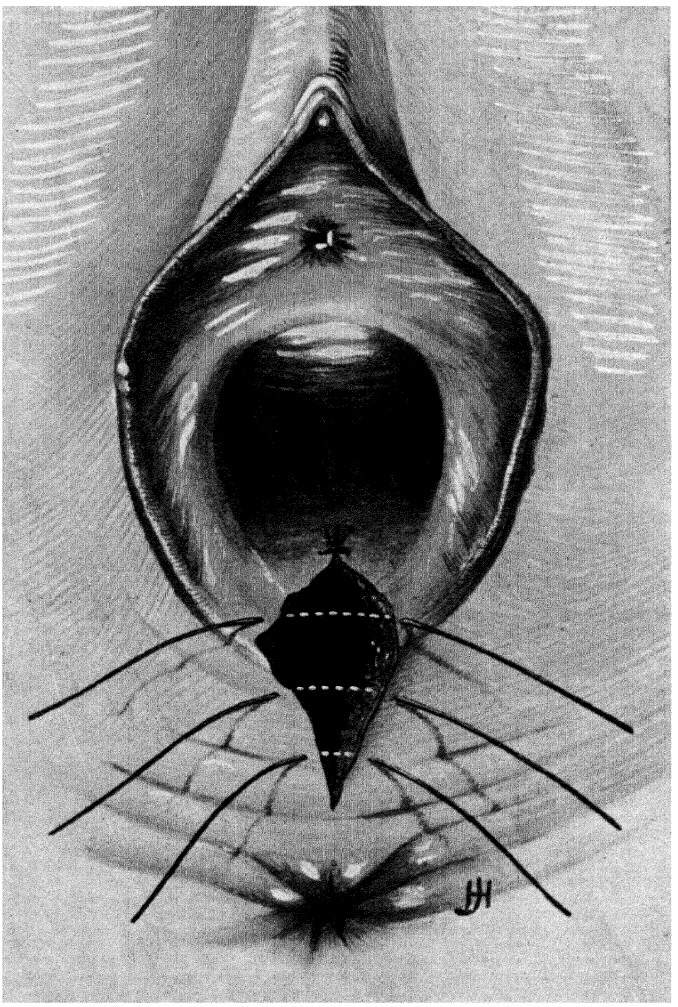


FIG. 191.—TEAR OF PERINEUM AND POSTERIOR VAGINAL WALL. SUTURES PASSED AND READY TO TIE.

not tied while the patient is still under the influence of chloroform, then, if it should be necessary to remove the placenta manually, they will not tear through and render resuturing necessary.

The third class of laceration is of greater extent and includes a tear of the sphincter ani, and may commonly extend an inch or more up the rectum. This is called a complete tear of the perineum.

Treatment

For the accurate sewing up of this tear it is essential to have a good light and a field of operation not obscured by hæmorrhage, so it is necessary to wait for the expulsion of the placenta. Should the confinement take place at night it is wise to wait till the

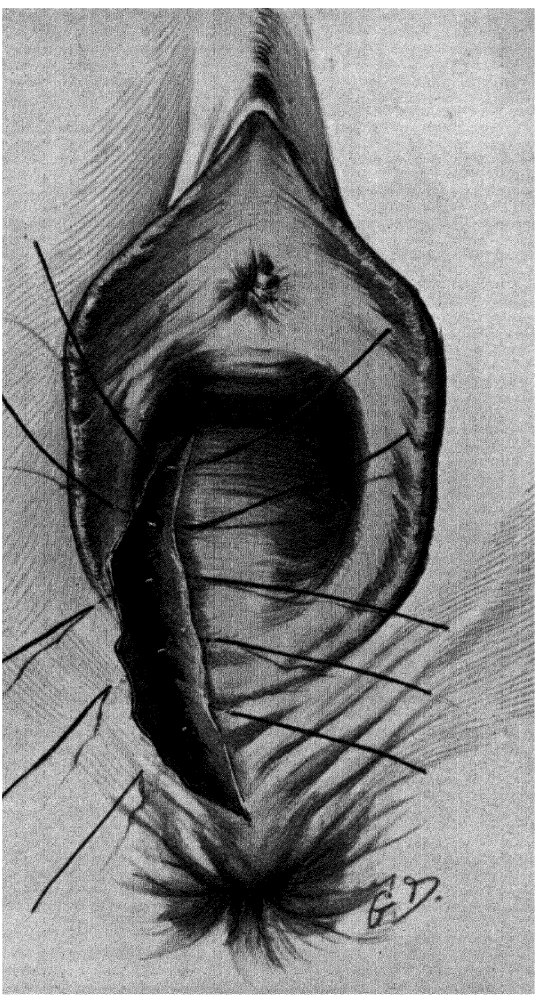


Fig. 192.—Method of Suturing a Tear of the Perineum and Vagina. The Sutures embrace the Whole Thickness of the Tear.

next day, when a good light and efficient assistance can be commanded, as it is so important for the patient's subsequent comfort that an accurate suturing of the rectum and sphincter should be made. An attempt to suture a tear of this magnitude in the manner indicated for the smaller tears is quite useless. The patient is anæsthetized and placed in the lithotomy position and the parts well swabbed with an antiseptic lotion. The wound in the rectum

is first attended to and united with sutures of fine catgut. The sutures are passed through the muscular coats only, and the knots are tied on the perineal surface and so invert the cut edges of the rectum towards the lumen of the bowel. The cut ends of the

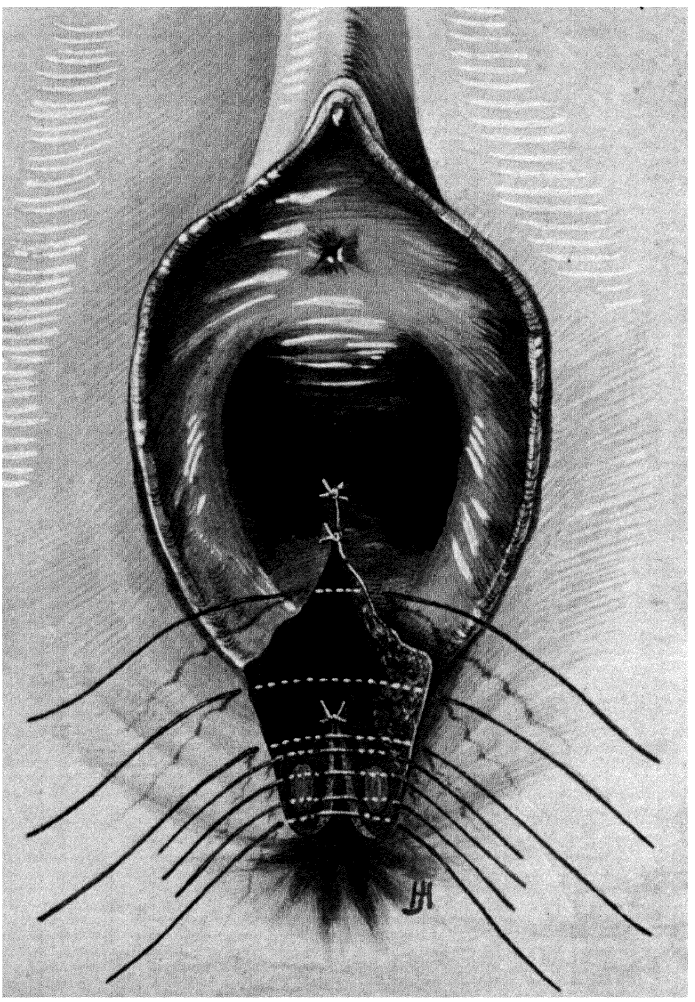


FIG. 193.—SUTURING A COMPLETE TEAR OF THE PERINEUM.

One of the sutures in the rectal wall is tied to show that the knot is in the perineal body and not in the rectum.

sphincter are then united with two stretches of stout chromic catgut, and the operation completed by sutures uniting the perineal and vaginal surfaces. Some buried sutures of catgut may be put in the perineal body uniting the levatores ani.

The treatment of all lacerations of the perineum by immediate suture is a matter of the greatest importance, as the raw surface

otherwise left acts as a breeding-ground for numerous organisms, and paves the way for septic infection during the puerperium. Occasionally cases of puerperal sepsis may have their starting-point in lacerations of the perineum and vagina. Deep lacerations involving the levator ani lead to weakness of the pelvic floor, which may be followed later by vaginal or uterine prolapse.

Lacerations of the perineum and vagina usually heal well if the surfaces are cleansed and the sutures are passed sufficiently deeply to embrace the whole depth of the tear. Sutures which merely unite the surfaces are worse than useless, as behind the sutures there is a pocket which soon becomes filled with decomposing lochial discharge.

There is a rare variety of laceration known as central tear of the perineum, in which the presenting part forces its way out and is born between the rectum and the fourchette. Such tears must be made complete by cutting through the bridge of tissue into the vagina, and then be sutured as previously described.

In rare cases the head may be born through the rectum owing to the recto-vaginal septum giving way rather than the perineal body.

FISTULÆ

Fistulæ may occur as the result of pressure by the presenting part in a case of prolonged labour. The pressure is generally caused by the head, as the breech is not sufficiently hard to cause injurious pressure.

If the head is delayed above the brim prolonged pressure may cause bruising of the uterine wall against the symphysis pubis or the promontory of the sacrum, but it is rare for this to cause a vesico-uterine fistula or a perforation into the peritoneal cavity, though occasionally one of them or a ureteric fistula may be produced. It is much more common for the head to be arrested in the pelvic cavity, by some moderate degree of contraction of the pelvis or the large size of head, and for the pressure to cause sloughing of the anterior vaginal wall, with the formation of a vesico-vaginal fistula. A fistula on the anterior wall is much more common than one on the posterior wall. A fistula on the posterior wall can only be caused by direct trauma, *i.e.* from slipping of the forceps or destructive operations as craniotomy. The only common cause of a recto-vaginal fistula is a complete tear of the perineum extending into recto-vaginal septum followed by healing of the superficial and external part only (Fig. 194).

The fistula may not manifest itself till some few days after labour,

when the patient has either incontinence of urine or passes her motions into the vagina. On examination it is found that there is a hole leading into the bladder or rectum. Generally the destruction of tissue is greatest on the vaginal surface, and it sometimes happens that when this wound granulates the fistula heals. Unfortunately this is not always the case, and it will then be necessary to perform some plastic operation at a later date. No attempt should

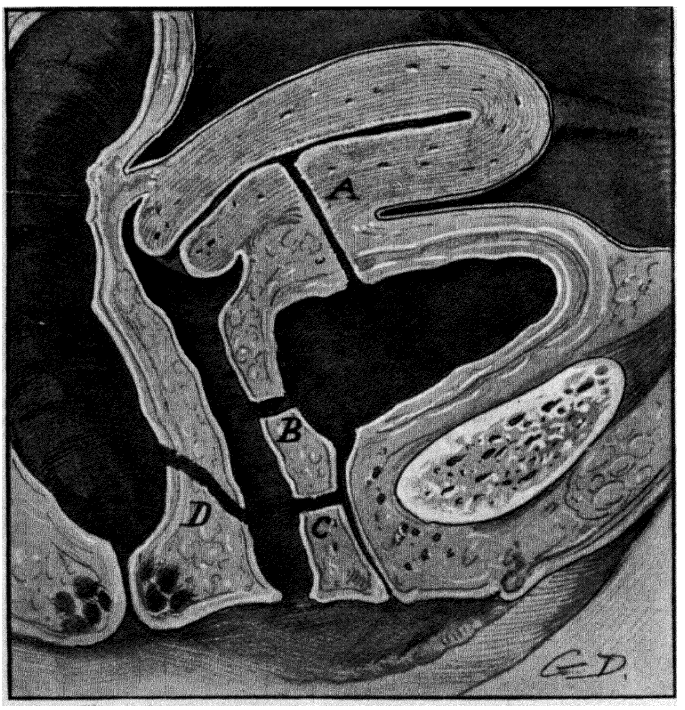


FIG. 194.—DIAGRAM TO SHOW POSITIONS OF FISTULÆ.

A, Vesico-uterine fistula. B, Vesico-vaginal fistula.
C, Urethro-vaginal fistula. D, Recto-vaginal fistula.

C is a very rare form of fistula and would not result in incontinence like A and B, but only in urine dribbling through the vagina during micturition.

be made to close this fistula till at least three months after the birth of the child. Sometimes a tear occurs in the bladder at the time of a uterine rupture, and if the uterine rupture is treated by operative measures the tear should be sutured at the same time (*vide* Operative Treatment in volume on Diseases of Women).

ATRESIA OF THE VAGINA AND VULVA

CAUSE

Cicatricial contraction of the vagina and vulva, sufficient to delay or prevent the birth of the child, may result from a

previous labour which was complicated by severe trauma and sepsis, or from some operation, especially colporrhaphy.

Treatment

With a moderate degree of contraction, dilatation may be effected by a Champetier de Ribes's bag or the gloved hand. In other cases it may be necessary to incise the cicatricial tissues, though this requires the exercise of great judgment, lest the tear, which is inevitable, may result in a recto-vaginal or vesico-vaginal fistula. If the atresia is so marked that it is impossible to overcome it without grave injury to the patient Cæsarean section should be performed.

TUMOURS OF THE VAGINA

Cause

Such solid tumours of the vagina as carcinoma and fibroma and cystic tumours growing from the vagina, may, from their size and position, give rise to delay or obstruction in labour. If a cystic swelling has suppurated there will be an additional risk to the patient.

Treatment

If the tumour is likely to cause obstruction, it should be enucleated if a fibroid, punctured if a cyst, and if malignant the treatment must depend on the state of the growth. It may be possible to excise some malignant growths if small; on the other hand, it may be necessary to deliver by Cæsarean section.

HÆMATOMA OF THE VAGINA AND VULVA

Cause

This is a rare complication of labour, and is due to the rupture of varicose veins from the increased tension therein during the second stage of labour. It is sometimes due to injury during delivery with the forceps, or to a laceration which tears through a vein.

Symptoms

The patient usually complains of severe pain in the neighbourhood of the lesion.

Signs

The signs following rupture of the vein are generally apparent after the child is born, as the escape of blood is prevented, for the time being, by the counter-pressure of the head. Rarely the swelling

forms below the advancing head. The vein may rupture externally with free hæmorrhage, but as a rule it ruptures subcutaneously. If noticed first at an early stage, the swelling will be seen to become progressively larger up to a certain point, after which the tension of the blood extravasated may be sufficient to arrest the hæmorrhage.

The swelling presents as a tender, œdematous swelling, purple in colour, and, as a rule, spreading downwards occupies one or other side of the vulva. Less frequently the effused blood may track upwards, in which case the swelling will be found by the side of the vagina.

Results

If the effusion of blood takes place before the birth of the child, it may retard its birth. Later it may form an obstruction to the escape of the lochia. As a rule the blood is eventually absorbed, though on occasions it may become infected with resulting abscess-formation.

Treatment

If the rupture is noticed before the birth of the child, delivery should be effected as quickly as is consistent with the safety of the mother and child.

If the vein has ruptured externally, it will be necessary to stop the hæmorrhage by pressure.

If the tension of the swelling is so great that there is danger of the tissues covering it sloughing, it should be incised, the clot turned out as far as possible, and the torn vein, if it is seen, should be ligatured.

If the hæmatoma suppurates, the evidence of which is œdema of the tissues covering it, and fever, the swelling must be incised, as near the vulva as possible, and efficiently drained.

PELVIC HÆMATOMA

Cause

The formation of a hæmatoma alongside of the genital tract is not a common complication of labour, but when it occurs may be a serious one. In the form usually seen it is confined to the vulva or the lower end of the vagina and is below the level of the levator ani and its fascia. In much rarer cases the hæmatoma is partly below and partly above the levator ani and therefore may spread up into the base of the broad ligament, between the uterus and the bladder or by the side of the rectum. In any case the cause of the effusion of

blood is injury to a vein, which may or may not have been varicose previously. The injury is most often a pressure necrosis of the wall of a vein which gives way either before, during or after labour. Most frequently the bleeding occurs immediately after labour, so that the hæmatoma is seen a few hours or days later. In occasional instances there has been actual laceration of the tissues with subsequent hæmorrhage from a vein into the loose tissues of the vulva or beside the vagina. Fortunately in most cases there is no complicating external laceration, for whenever there is one the chance of the hæmatoma becoming infected is much greater.

Symptoms and Signs

When the hæmatoma extends up beside the lower end of the vagina it can be felt as a soft doughy swelling, continuous with the visible external lesion. If the blood extravasation extends above the levator ani muscle it can be felt only on bimanual examination.

A pelvic hæmatoma usually undergoes gradual absorption, more or less time being consumed during the process according to the amount of effused blood. Occasionally the blood-mass becomes infected and suppurates, especially if it is associated with a small external wound, but the complication is not essential. Very rarely the blood-mass becomes an encapsuled tumour which remains *in statu quo* for very long periods. Apart from the few recorded cases in which the amount of blood effused has been so great as to kill the patient from hæmorrhage, infection of the hæmatoma is the most serious complication. Practically all the fatal cases have been the result of septicæmia following septic infection of the hæmatoma. In this respect those blood effusions which spread up above the level of the levator ani have proved to be the most prone to infection and to end fatally. Apart from pain and the swelling there are no symptoms in uncomplicated cases, unless the hæmatoma extends up into the pelvis and presses upon some part of the bladder or rectum. Infection is shown by rigors, sweating, wasting, and high fever.

Treatment

A hæmatoma spreading up into the broad ligament may have to be incised on account of infection. The cut must be made as low down in the vaginal wall as possible, so as to make it easily accessible for washing out the resulting cavity and for the insertion of a large drainage tube.

CHAPTER XL

ANTEPARTUM HÆMORRHAGE

By antepartum hæmorrhage is usually meant bleeding occurring from the placental site during the last twelve weeks of pregnancy or during the first or second stage of labour. Hæmorrhage which takes place before the twenty-eighth week of pregnancy is usually classified as due to abortion. This division is only one of convenience and not a scientific classification, for it will be seen that a patient bleeding from separation of a placenta inserted on the lower uterine segment would be said to be suffering from some form of abortion if seen at the twenty-sixth week of pregnancy, whereas the same patient a month later would be referred to as a case of unavoidable hæmorrhage.

Hæmorrhage may also occur which is not from the placental site; for instance, from a carcinoma or polypus of the cervix, from a varix of the vulva, or in rare cases from rupture of the uterus.

All these conditions may cause bleeding during pregnancy and labour, but such hæmorrhage is not what is usually meant by an obstetrician when he uses the term "antepartum hæmorrhage".

As defined above, antepartum hæmorrhage may be divided into two classes:—

1. Hæmorrhage due to the partial separation of a placenta normally situated on the upper segment of the uterus. This is called "accidental hæmorrhage".

2. Hæmorrhage due to the partial separation of a placenta abnormally situated on the lower uterine segment (placenta prævia). This is called "unavoidable hæmorrhage".

The terms "accidental hæmorrhage" and "unavoidable hæmorrhage" were introduced by Rigby at the end of the eighteenth century. Till then cases of antepartum hæmorrhage had not been differentiated, but he demonstrated that there were two classes of case in which bleeding occurred.

In one the placenta was normally situated in the upper segment. Labour might progress without hæmorrhage, although in occasional cases blood might be lost without obvious reason—the occurrence being, in fact, fortuitous, "accidental".

In the second class of case the placenta was so situated that the lower segment could not be dilated to let the child through without hæmorrhage of necessity occurring in every case. The hæmorrhage here was the reverse of accidental, *i.e.* it was unavoidable. The term "accidental" thus had no connection with the same word used to denote gross trauma, although this is an occasional cause of hæmorrhage. It may be repeated that low insertion of the placenta and separation of a normally situated placenta are common causes of hæmorrhage during the early months of pregnancy. They form a considerable proportion of those cases of abortion in which the causation is clinically obscure.

ACCIDENTAL HÆMORRHAGE

Varieties

1. External.
2. Concealed.
   - (*a*) Retro-placental hæmatoma.
   - (*b*) Retro-membranous hæmatoma.
   - (*c*) Intra-amniotic hæmorrhage.
3. Mixed.

Owing to the separation of a portion of the placenta from its uterine attachment, part of the wall of the uterine blood-sinus is removed and blood pours from the opened sinus.

This blood may track down between the membranes and the wall of the uterus and so escape at the cervix (*external accidental hæmorrhage*), or may remain inside the uterine cavity (*concealed accidental hæmorrhage*). The latter may be subdivided according to the exact position of the blood clot into—

(*a*) Retro-placental hæmatoma, when the blood is pent up behind a placenta which is adherent to the wall of the uterus at its circumference

(*b*) Retro-membranous hæmatoma, when the blood is similarly pent up behind membranes which are adherent to the uterus at the internal os.

(*c*) Intra-amniotic hæmorrhage, when the membranes give way and allow the blood to mix with the liquor amnii.

Most often the hæmorrhage is partly concealed and partly external: this is mixed concealed and external hæmorrhage.

Cause

External Accidental Hæmorrhage.—In the majority of cases no definite cause can be assigned, but the one that appears most obvious

is the toxæmia of pregnancy. In a large percentage of cases albuminaria is present. In a small percentage of cases there is a history of trauma, such as a blow on the abdomen, a fall, severe exertion, or in some cases mental shock, which would explain the detachment of a normal placenta by producing a sudden violent uterine contraction; but in others no such cause can be found, and so we may presume that in them the placenta is not attached to the wall of the uterus as strongly as usual. This might be due to disease of the decidua or of the endometrium which precedes it. Various conditions, such as Bright's disease, cardiac disease, syphilis, fibroids,

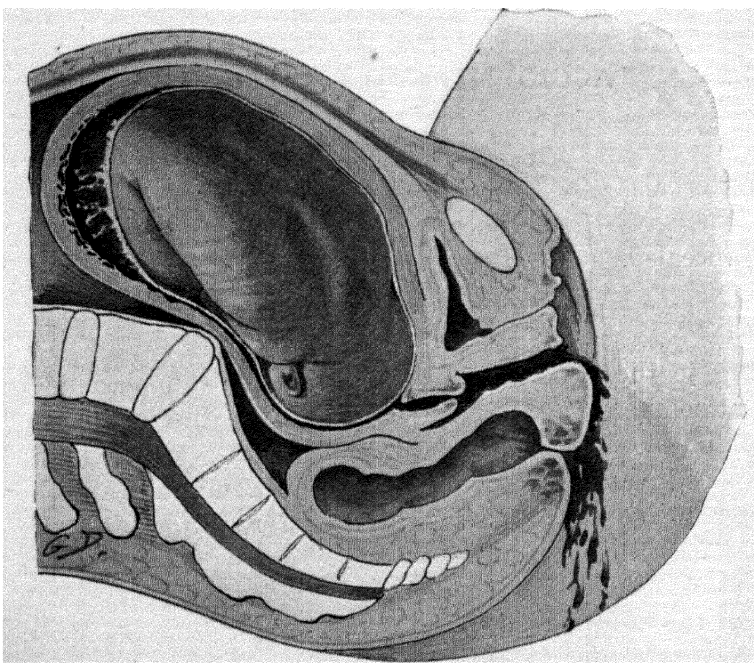


FIG. 195.—EXTERNAL ACCIDENTAL HÆMORRHAGE.

have been advanced as facilitating the detachment, but little proof has been given of their influence, and their great frequency as compared with the comparative rarity of accidental hæmorrhage makes it probable that they are associated conditions rather than actual causes (Fig. 195).

About 80 per cent. of cases occur in multiparæ, and as infection of the endometrium by organisms is more likely to exist in a multipara than in a nullipara, it seems probable that pre-existing inflammation of the endometrium may alter the decidua in such a way that placental separation is produced more easily than usual.

In the course of labour, in rare cases, a short cord may pull on the placenta during delivery of the child and cause its detachment.

Concealed Accidental Hæmorrhage.—Whether, in any given case, the blood remains concealed or is expelled into the vagina depends mainly on the expulsive power of the uterus; if the uterus is inert it may allow itself to be distended by blood, but if active it will respond to the stimulation caused by the increased intra-uterine pressure produced by the blood, and will contract and force the blood down between the membranes and the uterine wall and then out at the internal os.

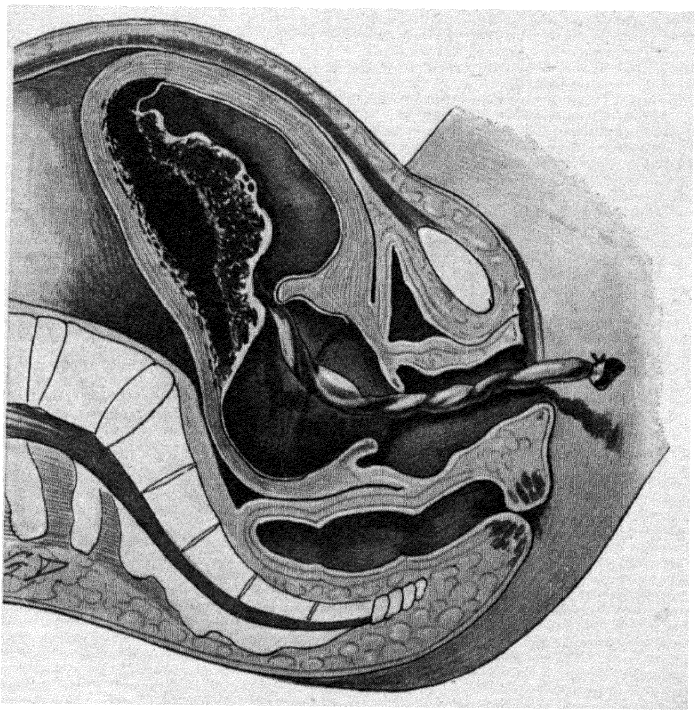


FIG. 196.—CONCEALED ACCIDENTAL HÆMORRHAGE AT END OF SECOND STAGE.
The placenta and a part of the membranes are separated from the uterine wall by a mass of blood-clot.

The extravasated blood is wholly maternal, none coming from the fœtal circulation.

In many cases of concealed accidental hæmorrhage, interstitial hæmorrhage takes place into the uterine wall.

SYMPTOMS AND SIGNS

External Accidental Hæmorrhage.—Either without any obvious exciting cause, or sometimes following mental or bodily shock or over-exertion, the patient notices blood coming from the vagina. There may be slight abdominal discomfort, but pain is, as a rule, absent.

Abdominal palpation shows nothing abnormal.

On vaginal examination, friable smooth blood-clot may fill the vagina and cervix, but no placenta can be felt. The amount of blood lost varies from a slight "show" which the patient may term a menstrual period, to a violent flooding which may prove fatal in a few minutes.

Concealed Accidental Hæmorrhage.—The symptoms and signs naturally vary with the severity of the case. In the extreme cases the gravity of the patient's condition may be out of all propor-

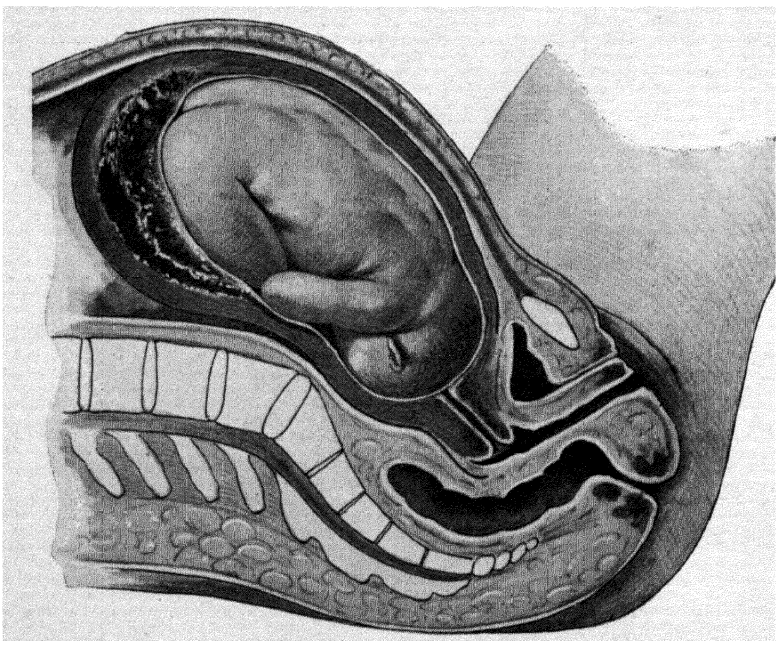


FIG. 197.—CONCEALED ACCIDENTAL HÆMORRHAGE.

A collection of blood can be seen between the placenta and uterus and below between the chorion and uterus, but no blood has reached the external os.

tion to the amount of blood effused in the uterus. This has been ascribed to shock from a generalized or localized overdistension of the uterus. The clinical picture is then one of internal hæmorrhage with the added effects of the uterine distension.

The patient is pallid with a waxy white skin; the exposed parts and extremities are cold with bluish-grey lips and finger-tips, and there is often a cold clamminess or sweat on the skin. As hot bottles and blankets packed round the patient may give a false impression of warmth to the body under the bedclothes, a hand placed on the cheeks will more correctly appreciate this coldness of the surface.

Air-hunger causes a distressing gasping for breath, and with this dyspnœa there is a constant restlessness, the patient tossing in bed

and throwing the arms and bedclothes about, thus increasing the difficulty of retaining the body-heat. Thirst is always present and vomiting is not infrequent.

The temperature is subnormal and the pulse small, low in tension and its rate is frequent, so that it may become "running" and uncountable at the wrist.

The overdistension of the uterus gives rise to severe and constant abdominal pain. The uterus is larger than would be expected for the period of gestation reached and more globular in outline. It has a firm wooden consistence and is extremely tender. No contraction or relaxation can be detected, the fœtal outlines cannot be made out, and the fœtal heart cannot be heard. Examination *per vaginam* will usually show that the cervical canal is still present and that there is no dilatation. If there has been enough uterine action to start dilatation there will probably be some blood escaping externally and the case will then become one of the next variety.

Mixed Concealed and External Accidental Hæmorrhage.—This form partakes of the characteristics of both, and includes the less severe cases of concealed hæmorrhage and the more severe case of external hæmorrhage. The symptoms and signs may be those of concealed hæmorrhage with some external loss and generally some dilatation of cervix, or there may be external hæmorrhage with little or no evidence of distension of the uterus by retained blood, although after delivery a large quantity of dark blood found behind the placenta and membranes with clot adherent to the separated area will show that concealed bleeding had occurred. To put it in another way, in those cases in which the contractile power of the uterus is absent the hæmorrhage will be entirely concealed; when the contractile power is present but feeble some blood will be expelled, but much more retained; when the contractile power is active little will be retained and most of it will be expelled.

The clinical point that must be kept in mind is that the severity of a case with external hæmorrhage must never be judged solely by the amount of blood lost *per vaginam*, but by the general condition of the patient. A trifling external loss may be accompanied by serious internal hæmorrhage.

Diagnosis

External Accidental Hæmorrhage.—External accidental hæmorrhage can only be differentiated from unavoidable hæmorrhage by failing to feel the placenta on vaginal examination. To do this the

vagina and cervix should be cleared of blood-clot by douching, and then an attempt made to palpate the placenta near the internal os. The lie of the child is usually longitudinal in accidental hæmorrhage, whereas placenta prævia is frequently complicated by malpresentations.

After delivery the diagnosis can be confirmed by examining the membranes, as the hole through which the child is delivered should be within 3 inches of the placental edge if the case has been one of placenta prævia.

The possibility of the case being one of hydatidiform mole must not be forgotten; in this case the uterus is tense and frequently larger than would be expected from the duration of the amenorrhœa, and, as an embryo is usually absent, no ballottement can be obtained.

Concealed Accidental Hæmorrhage.—Here the diagnosis is more difficult; a mild case may very closely resemble one of hydatidiform mole, and if the blood-clot obscures the fœtus the two cases may be indistinguishable till the diagnosis is made obvious by the passage of the hydatidiform vesicles *per vaginam*.

Students sometimes confuse concealed accidental hæmorrhage with tonic contraction of the uterus; but if it is remembered that in tonic contraction the patient is advanced in labour and has strong pains, that the uterus is not larger than normal, that it is not globular, but is moulded to the shape of the child, and that the membranes are ruptured, such a mistake should be impossible.

The diagnosis must be made from cases of intra-peritoneal hæmorrhage, such as advanced ectopic gestation, spontaneous rupture of the uterus, or ruptured gastric ulcer with pregnancy.

These, although rare complications of pregnancy, closely resemble accidental hæmorrhage of the concealed variety. They must be diagnosed by their histories and on the physical signs present in each case, noting that in accidental hæmorrhage the uterus encloses the whole mass, whereas in other conditions, *e.g.* advanced ectopic gestation, the uterus should be recognizable as a separate tumour.

This description applies to the extreme cases, which are fortunately seldom seen. In the mildest cases there may be no symptoms whatever, a mass of old blood-clot evidently produced prior to the third stage of labour being found attached to the placenta. This may produce death of the fœtus by cutting off the function of a portion of the placenta All degrees from these mild cases up to the severe ones described in detail may be seen.

Prognosis

Death occasionally takes place from shock with or without profuse bleeding before the patient can be delivered. Owing to the fact that uterine inertia is usually marked (especially in the concealed form) the patient may succumb after delivery to the collapse occasioned by postpartum hæmorrhage. Apart from postpartum hæmorrhage death may occur from shock due to rapid emptying of the uterus. Sepsis and lacerations of the genital tract produced by manipulations in attempts at delivery may prove fatal.

The most important factor in the prognosis is the contractile power of the uterus. If the uterus contracts well the patient will generally recover. Other factors are—

The degree of shock.

The amount of blood lost.

The rapidity of the loss.

It is obvious that statistics comprising cases of all degrees of severity are of no value in gauging the danger in any individual case. A multipara with a fully dilated os, a small premature child, and a uterus which can be stimulated to act well, will run little risk, whereas the rare case of a primigravida with an inert uterus containing a big child, with an almost closed os and rapidly occurring hæmorrhage, is almost hopeless unless heroic measures are taken.

The prognosis to the child is bad, as about 80 per cent. do not survive.

This is due to (*a*) prematurity; (*b*) the loss of oxygen from placental separation; (*c*) injury during delivery.

Treatment

External Accidental Hæmorrhage.—Since under this heading are included cases which vary in severity from a slight "show" of blood during labour to a profuse and rapidly fatal flooding, it will be seen that no single method of treatment will be applicable in all cases.

From the point of view of practical treatment cases may be divided into three groups, according to the severity.

Slight Cases.—If the amount of bleeding is only slight and the pregnancy is still some weeks short of term, the best treatment to adopt is that which is employed in cases of threatened miscarriage, *viz.* to temporize in the hope that the bleeding will cease and the pregnancy continue to term. Before deciding to temporize make sure that there is no evidence of concealed hæmorrhage by noting that the uterus is soft and not tender or tense, and that the pulse-rate is not much quickened. This temporizing, which is done in the

interests of the child, means keeping the patient absolutely at rest in bed, administration of sedatives, the best of which is morphia, followed up if necessary by a bromide mixture, and avoidance of douches, purges, or enemata, which might induce or increase uterine contractions. In the absence of further contractions it is possible that the bleeding vessels in the exposed part of the placental site will become thrombosed and that no further bleeding will occur. It is not uncommon to see such treatment successful, the bleeding ceasing, and the pregnancy continuing to term. The appearance of the placenta in such cases shows that part of it had been detached too soon, some portion of it being brown, shrunken, and more solid than the rest, and having old blood-clot adherent to it.

Cases of Moderate Severity.—This group consists of cases in which the bleeding, though not of such severity as to threaten immediate danger to life, is too copious to justify an attempt to prolong the pregnancy in the interest of the child. It is impossible to lay down a hard-and-fast rule as to the treatment of accidental hæmorrhage of moderate severity—the treatment must vary according to the circumstances of each individual case. It may, however, be said as a general rule that if there are good uterine contractions any common-sense treatment will probably be successful. The object of any treatment adopted is to get the uterus empty, contracted, and retracted with as little bleeding as possible and without any added risk to the mother. If good uterine contractions are present or can be produced without delay, this object can be attained successfully by the methods which are described below. Cases in which, on the other hand, the uterus contracts sluggishly or not at all require a different form of treatment, and are best considered with the third group.

The simplest cases will be considered first. It is assumed that the lie of the child is longitudinal, and that there is no obstruction to its passage through the pelvis. Sometimes a hot vaginal douche will, just as in cases of inevitable miscarriage, cause sufficient contraction and retraction to prevent any further hæmorrhage.

The Cervix is fully dilated.—Give an injection of pituitary extract, rupture the membranes if they are not already ruptured, and apply a tight abdominal binder. If the bleeding continues, apply the forceps and deliver.

The Cervix is dilated to the size of a two-shilling piece or more, but not fully dilated.—If the uterus is contracting well, rupture the membranes and put on a tight binder. If the bleeding continues,

insert a Champetier de Ribes's bag or bring down a leg, and give an injection of pituitary extract. If the uterus is not contracting well, plug the vagina.

The Cervix is almost closed.—Cæsarean section is the best treatment. If this cannot be performed, and the pains are good, which is unusual at such an early stage of labour, the membranes should be ruptured and a tight binder applied. If the uterus is not acting well, failing Cæsarean section, plugging is the best treatment.

Vaginal Plugging.—This is an old method of treatment, said to have been recommended as long ago as 1776, and revived in recent years, especially by the Dublin School. Some obstetricians object to it, saying, among other things, that it may convert external into concealed hæmorrhage, that it may cause rupture of the uterus, that it is painful, that it is inefficacious because the plug soon becomes loose, and that it may cause sepsis. However, the evidence of those who have used this method of treatment frequently is almost entirely in its favour. It is not painless, but the pain caused by it is not usually severe. It seldom converts evident into concealed hæmorrhage. If it causes rupture of the uterus, it is not the fault of the method but of the accoucheur who is carrying it out and has not realized that it has been so successful as to cause violent contraction of the uterus. If the plug becomes loose and blood escapes by its side, the method has not been carried out properly. A large amount of sterile material is necessary. Plain sterilized gauze is the best material, but it is not often present in sufficient quantity. Failing sterile gauze, strips of bath towelling about 3 inches broad or large pledgets of cotton-wool, tied together by tape in "kite-tail" fashion and thoroughly boiled, make good material for plugging. The patient is placed on her side or in the lithotomy position, the bladder is emptied, and the vulva is swabbed with tincture of iodine. The perineum must be retracted, best done with a large-size Sims' speculum, and the vagina packed systematically from above downwards. If the cervical canal is open sufficiently it should be plugged first, then all the fornices one after the other, and the whole vagina filled tightly until the plugging material projects at the vulva. The application of a tight binder fastened from above downwards and a tight, strong T-bandage completes the operation. The uterus is then compressed over every part of its surface. In a case of placenta prævia, the bleeding surface is known to be on the lower uterine segment, and it can be compressed by the half breech or by a

Champetier de Ribes's bag. In accidental hæmorrhage, on the other hand, the bleeding may occur from any part of the upper uterine segment; consequently the whole of the upper uterine segment must be compressed. If the os is not sufficiently dilated for the insertion of a Champetier de Ribes's bag to be used with a tight binder, the only way in which this general compression can be achieved is by plugging. The pressure caused by the plug, the T-bandage, and the binder is, as a rule, sufficient to prevent further escape of blood into the uterine cavity, being greater than the blood-pressure. Besides preventing bleeding the pressure usually, though not always, stimulates the uterus to contract. If uterine contractions are induced, the plug should, of course, be removed before it can possibly cause any obstruction to delivery. As a rule, the plug is removed in eight to twelve hours. When it is taken out it is usually found that the cervix has become dilated to a certain extent. Delivery is generally accomplished without much delay, but in some cases, although the bleeding ceases, the uterus does not contract strongly and labour may not be terminated spontaneously for two or three days.

Rupturing the membranes is done to let out the liquor amnii, so that the uterus may contract more efficiently and so control the hæmorrhage. It is a valuable method of treatment in cases in which there is good uterine action. A tight abdominal binder should always be applied after rupture of the membranes, otherwise there may be an unnecessary loss of blood before the uterus retracts sufficiently.

Version partly empties the uterus and so allows of more efficient uterine action, and the leg in the cervix acts like a wedge to dilate it and reflexly stimulates the uterus to contract. Champetier de Ribes's bag has a similar action.

Cases of Great Severity.—Severe accidental hæmorrhage does not occur in the presence of good uterine contraction, consequently there is not, as a rule, much if any dilatation of the cervix in such cases. In these the child is almost certainly dead, and anything that is done is in the interest of the mother alone. It cannot be impressed too strongly on the student that any method of treatment which includes rapid delivery is likely to be fatal to the mother. She is already in a state of collapse from loss of blood, and the additional shock which is entailed by rapid dilatation of the cervix and delivery by the forceps or by version, even if little further bleeding occurs after the treatment is begun, would be sufficient to cause death either immediately or within an hour or two of delivery. It is important to remember that in cases in which a large amount of

blood has been lost the uterus not only does not but *cannot* contract. The essential points in the treatment of such a case are to stop the hæmorrhage at once and to tide the patient over the next few hours, treating the collapse and the effects of loss of blood before taking any active steps to deliver her. Plugging the vagina and application of a tight abdominal binder and T-bandage stop the bleeding without causing any shock to the patient. Whether these measures induce uterine contraction or not is a matter of little moment if they stop the bleeding in the case of a collapsed patient, and as a matter of fact the uterus is not likely to become active until the patient's general condition has improved. As soon as the plug, binder, and T-bandage have been effectually applied measures can be adopted to combat the collapse, by warmth, saline solution injected into the subcutaneous tissues, nourishment given by mouth, and so on. The patient must not be given saline solution until the bleeding has been stopped, or it will tend to increase the bleeding, and if the patient is receiving saline solution and losing blood she will not score by the exchange. In six or eight hours the patient has usually recovered so far that the termination of the labour can be proceeded with safely. Sometimes labour can be allowed to go on spontaneously; sometimes it is best to insert a Champetier de Ribes's bag to complete the dilatation and to deliver by means of the forceps.

Concealed Accidental Hæmorrhage.—Most cases of concealed accidental hæmorrhage are very serious, because the patient is collapsed as a result of the loss of blood and the painful distension of the uterus. If the patient is seen and the condition diagnosed before a large quantity of blood has been lost and before her general condition has become grave, she may be treated by rupture of the membranes, injection of pituitary extract, application of a tight binder and a vaginal plug, as in this case the contractile power of the uterus is not yet lost. Another method of treatment which is successful is to keep the patient warm and give her morphia. However, when concealed accidental hæmorrhage is diagnosed there is generally a large quantity of blood in the uterus. The fact that a large quantity of blood is retained in the uterus is a proof that the uterus is inert. This is a point that must not be lost sight of for a moment in deciding on the method of treatment. The ideal treatment for a severe case of concealed accidental hæmorrhage with a dead fœtus is abdominal hysterectomy, the quickest and safest method of treatment when carried out, after injection of saline solution and pituitary extract, under local or spinal anæsthesia, but it can be carried out only in exceptional circumstances in a private house or in a case in which the immediate removal of

the patient to a hospital or nursing home is possible. Cæsarean section is not such a good method, as the uterine muscle is practically paralysed, as the result of distension and also, in some cases, as the result of interstial hæmorrhage, and may be unable to contract and retract after the cavity is emptied.

When an abdominal operation cannot be performed, the most important point in the treatment is to avoid any attempt at hurrying on the delivery of the child. Any rapid method of delivery, apart from hysterectomy, in a severe case of concealed accidental hæmorrhage would almost certainly kill the patient. There is no doubt that the distension of the uterus is responsible for a severe degree of shock in cases in which a large quantity of blood is retained. Consequently separation of the membranes round the neighbourhood of the internal os to allow some of the blood to escape, and rupture of the membranes, have both been suggested with the idea of relieving the distension, but neither of these methods is free from risk when the uterine muscle is paralysed, since the diminution of pressure may bring about fresh and fatal hæmorrhage. The least dangerous treatment to recommend, failing abdominal section, in this, one of the gravest conditions that can be met with in labour, is application of a vaginal plug with binder and T-bandage, and injection of pituitary extract, followed by treatment of the collapse. As the patient's general condition improves the uterus may gradually recover from the effects of its distension and begin to contract and retract, when some of the blood may be let out or the membranes ruptured with impunity.

Treatment after the Labour is over

The fact that the patient has been delivered after accidental hæmorrhage and that there is no great amount of postpartum hæmorrhage does not necessarily mean that she will do well. In the absence of efficient treatment some of these patients die a few hours after delivery, from heart failure. Such a patient should not be left for several hours, when warmth, saline solution, administration of nourishment by mouth, injection of pituitary extract, and raising the foot of the bed, have helped her to recover from her collapse and shock. The gum-saline solution, mentioned in the treatment of postpartum hæmorrhage, may be given intravenously. An amount of postpartum hæmorrhage which would be trifling in the case of a robust woman may be of grave significance in the case of a patient who has had severe antepartum hæmorrhage. The bleeding must be stopped by bimanual compression, or even by packing the uterus, and good uterine retraction must be obtained before the patient is left.

UNAVOIDABLE HÆMORRHAGE (PLACENTA PRÆVIA)

Definition

A placenta is said to be prævia when it, or part of it, is situated on the lower uterine segment, and during its separation hæmorrhage is unavoidable.

The lower uterine segment during the latter weeks of pregnancy and the first stage of labour is stretched. As the placenta cannot be stretched separation must result, and hæmorrhage from the exposed placental site is therefore unavoidable.

Varieties

1. **Complete** when the placenta covers the internal os uteri (Fig. 198).

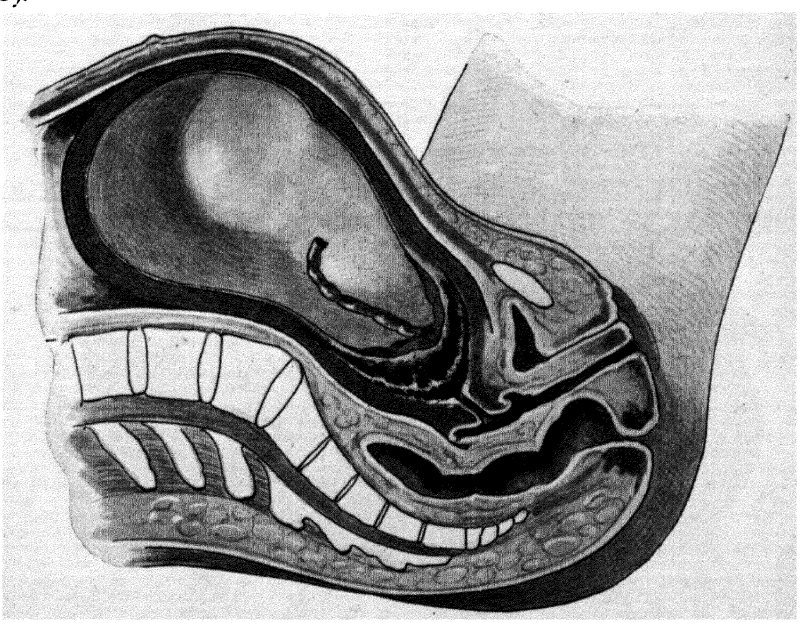


Fig. 198.—Complete Placenta Prævia.

2. **Incomplete** when the placenta does not cover the internal os uteri. There are two varieties of incomplete placenta prævia.

(*a*) When the placenta partly covers the internal os so that the placenta and membranes can be reached by the finger (Fig. 199).

(*b*) When the placenta does not reach as low as the internal os, but is situated partly on the lower uterine segment (Fig. 200).

The old terms central, lateral, and marginal have been discarded, as they only give rise to confusion. It must be understood that the classification adopted is a rough one, and that the findings will

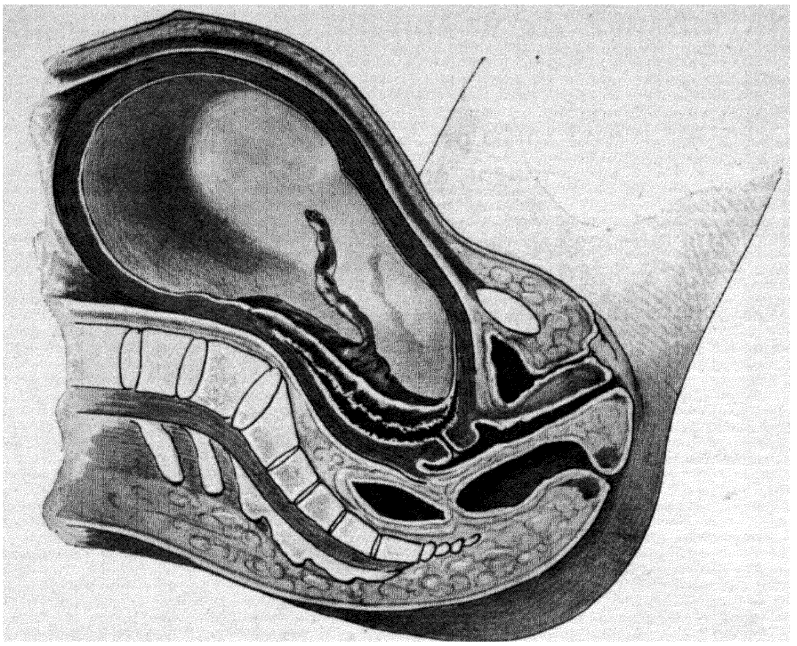


FIG. 199.—INCOMPLETE PLACENTA PRÆVIA (*a*).

The placenta is on the lower uterine segment and extends over the internal os, but the membranes at the lower edge of the placenta are within reach of the examining finger.

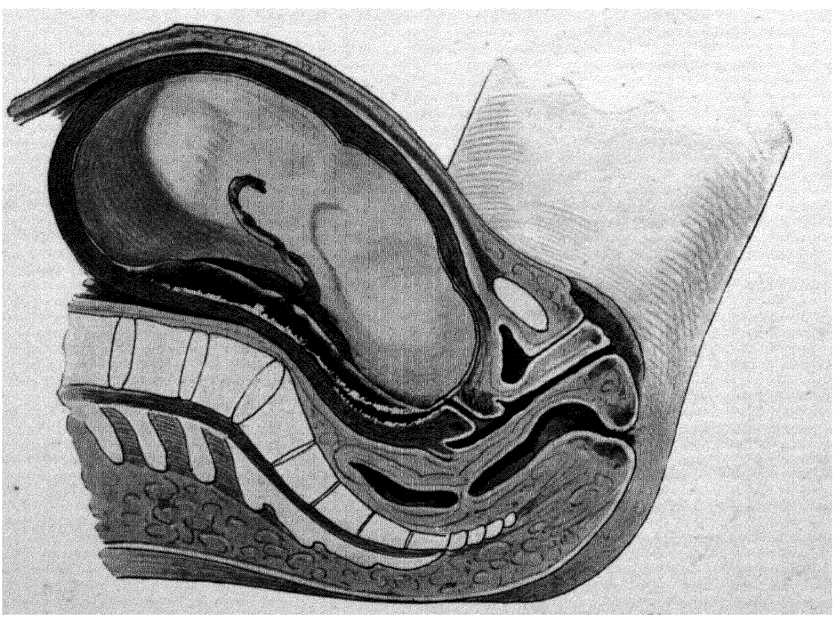


FIG. 200.—INCOMPLETE PLACENTA PRÆVIA (*b*).

The placenta is on the lower uterine segment, but does not reach the undilated internal os.

vary with the degree of dilatation. Thus a case which may appear complete when the internal os will only admit a finger may later be

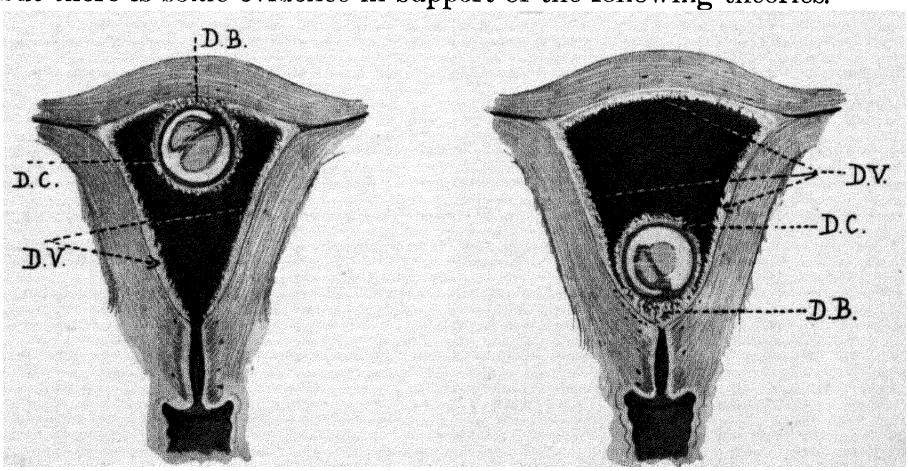
found to be incomplete if further dilatation allows the edge of the placenta to be felt. Many cases of placenta prævia do not continue till the eighth month, but cause abortions in the early months and consequently are not recognized.

Cause

Statistics show that placenta prævia is most common in women who have had a large number of children. Rapid child-bearing and inflammation of the endometrium also seem to have an influence on its occurrence.

Placenta prævia occurs about once in five hundred labours.

Very little of the pathology of placenta prævia is certainly known, but there is some evidence in support of the following theories.



Decidua Basalis in Upper Uterine Segment. Decidua Basalis in Lower Uterine Segment.

Fig. 201.

(*a*) The ovum may be primarily implanted low down in the uterus, and the placenta prævia formed in the ordinary way from the decidua basalis. Why the ovum does not get attached to the upper uterine segment in the usual way is not known; possibly it may be due to some lack of power on the part of the chorionic villi, which do not adhere to the wall of the uterus in the usual way, or possibly the decidua is rendered unsuitable for the embedding of the ovum by some pre-existing inflammation. This is further borne out by the fact that a placenta prævia is often broad and thin, and that succenturiate portions are common.

(*b*) The ovum may have been embedded on the upper uterine segment and a decidua capsularis developed in the usual way, but the villi covered by the decidua capsularis, instead of undergoing

atrophic changes, proliferate and invade the decidua vera of the lower segment after this has been brought into contact with the decidua capsularis by the growth of the ovum. The continued proliferation of the villi covered by the decidua capsularis forms a part of the placenta on the lower segment of the uterus. This variety is sometimes described as a capsularis placenta.

Pathological Anatomy.—The placenta usually covers a larger area than normal; it is frequently degenerated, and contains infarcts which may undergo calcification. These changes are explicable by the comparatively poor blood-supply which the placenta obtains. The cord frequently has a marginal insertion.

The lower segment of the uterus and the cervix are thicker than usual and are more vascular. They do not dilate so well and tear more readily.

Cause of the Hæmorrhage.—The hæmorrhage comes from the maternal blood-sinuses in the lower segment, which are opened up by the separation of the placenta as the cervix dilates. Except in cases in which the placenta is torn through during manipulations, there is no fœtal hæmorrhage.

Bleeding sometimes comes on apparently before labour has started; such cases are explained by the occasional occurrence of painless uterine contractions which open up the internal os during the last few weeks of pregnancy.

Symptoms and Course of Labour

Occasionally at full time, but more frequently during the last three months of pregnancy, the patient notices slight hæmorrhages from the vagina. These come on apparently without any cause, perhaps in the middle of the night, but, as in accidental hæmorrhage, they may follow hard exercise or trauma. These slight hæmorrhages may be followed by a continuous brown discharge. Though repeated slight hæmorrhages are commonly seen, the first bleeding may be a severe one.

Labour, especially in the first stage, is tedious because the uterus acts feebly. The usual bag of waters is not present because the placenta forms part of the lower pole of the ovum, thus diminishing its dilating effect and its stimulus to the uterus. After rupture of the bag the effect of the presenting part in exciting uterine contraction is diminished by the intervention of the placenta, and the thickened and more vascular lower uterine segment dilates less easily. The loss of blood contributes to the feeble action of the uterus.

The third stage is liable to be complicated by immediate and recurrent postpartum hæmorrhage for the following reasons:—

The uterus may continue sluggish as the patient is debilitated by the loss of blood. The placental site is larger than usual and is situated on the lower segment, which does not retract so strongly or so early as the upper segment, and it is larger than usual. Lacerations of the lower uterine segment and cervix are common if undue force is used in delivery.

Diagnosis

The only certain way of diagnosing placenta prævia is to feel the placenta with a finger passed through the internal os.

It is suggested by the following points:—

A history of slight and repeated loss of blood.

On abdominal examination an indication of the nature of the case may be obtained from finding the child lying obliquely or its head above the brim of the pelvis; this is due to the placenta filling up the lower segment. Otherwise the uterus is normal on palpation.

It must be remembered, however, that accidental hæmorrhage may be associated with similar positions of the child if the mother's pelvis is contracted or the child's head is larger than normal.

On vaginal examination, the soft spongy mass formed by the placenta may be palpable through one of the fornices, or the head, if presenting, may be felt plainly through one fornix and indistinctly through the other; but a certain diagnosis cannot be made until the os is open, as it generally is. If the breech is presenting, vaginal examination is not of great value until the os is dilated.

The maternal surface of the placenta can be differentiated from blood-clot, being firmer, more fibrous, and less friable.

Unavoidable hæmorrhage has to be diagnosed from accidental hæmorrhage; this is done by feeling the placenta on vaginal examination. It is conceivable that a large hydatidiform mole with bleeding might be mistaken for a placenta prævia.

Prognosis

Maternal.—The prognosis will largely depend on the presence or absence of uterine contractions, on the amount of the hæmorrhage, and on the time when efficient surgical aid is given. The amount of hæmorrhage is usually greater with a complete than with an incomplete placenta prævia. The time when the patient is first seen is most important, as many of the fatal cases have bled severely or have already been infected before any skilled treatment can be adopted.

The prognosis is most serious in a primigravida with an unyielding cervix.

The maternal death-rate is high, the cause of death being sepsis and hæmorrhage—both antepartum and postpartum. Shock from instrumental delivery, and hæmorrhage when the placenta is extensively separated, are some of the causes of this high death-rate. Sepsis is a frequent complication of the puerperium, because the resistance of the patient is diminished by loss of blood and because in the necessary manipulations organisms may be carried into the uterus, the placental site being low down and within easy reach of infection.

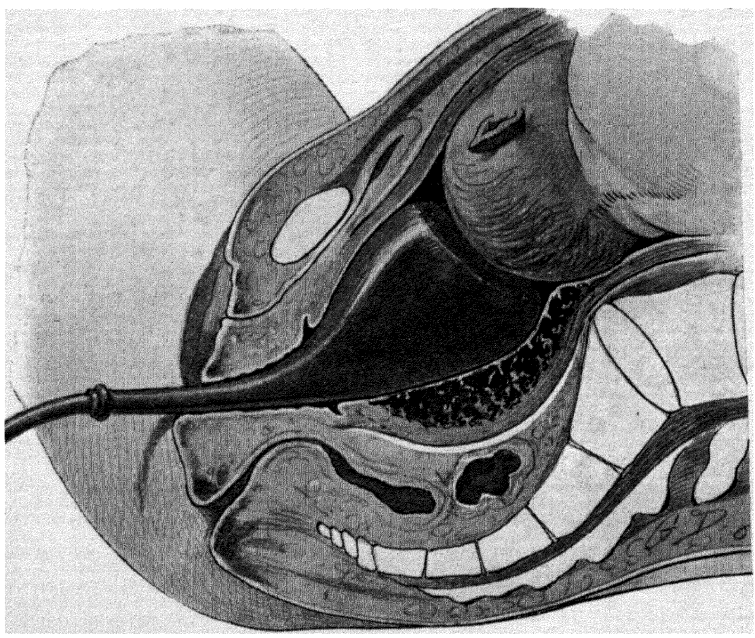


FIG. 202.—DE RIBES'S BAG INSERTED INTO THE AMNIOTIC CAVITY AND MAKING PRESSURE ON THE PLACENTAL SITE IN A CASE OF INCOMPLETE PLACENTA PRÆVIA.

Postpartum hæmorrhage may occur from uterine inertia, from the large size of the placental site, from the placenta being situated low down where the retractile power of the uterus is weaker, and from lacerations of the vascular cervix. Recurrent postpartum hæmorrhage may occur. A small postpartum hæmorrhage may easily be fatal to an exsanguined patient. These patients are also liable to pulmonary embolism with or without recognizable thrombosis.

Fœtal.—The outlook for the child is bad, 65 per cent. of all cases being stillborn and a large proportion of the remainder dying soon after birth.

Prematurity (in some 70 per cent. of cases labour is premature) and asphyxia due to lack of oxygen from the placenta being separated and hæmorrhage from placental laceration or because the umbilical cord was pressed upon during delivery, are the causes of fœtal death.

Treatment

The principle underlying the treatment of placenta prævia is to make pressure on the placental site while the cervix is dilating, and thus to control the hæmorrhage till the mother can be delivered safely.

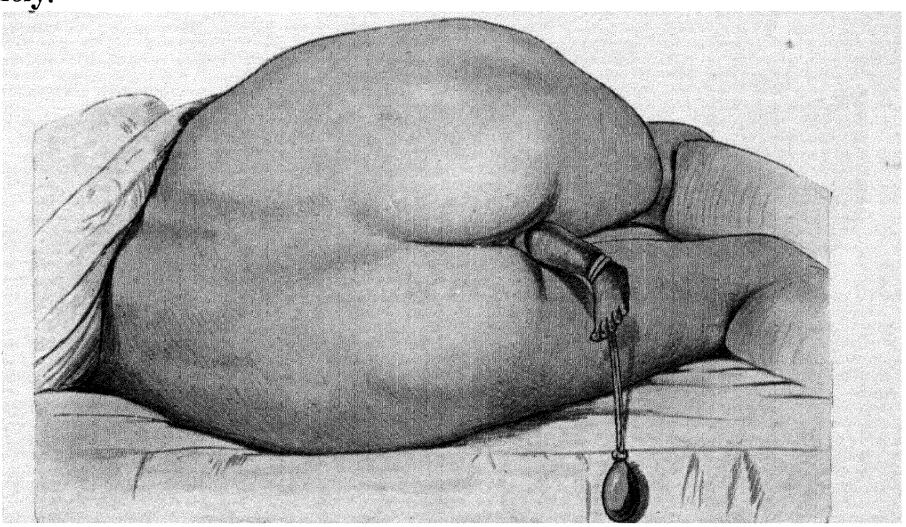


Fig. 203.—Antepartum Hæmorrhage treated by Version.

The weight which is shown attached to the leg is usually unnecessary, but may be of service if persistent oozing of blood continues after the version is completed.

It is found clinically that by the time the practitioner reaches a case of placenta prævia the cervix usually admits a finger. The case may then be treated in one of two ways: either by inserting a Champetier de Ribes's bag into the amniotic cavity (Fig. 202) or by bipolar podalic version without immediate extraction of the child.

Of these two methods each has certain advantages and disadvantages. Version does not require any instruments, and is always followed by the birth of the child without any further interference, but the fœtal mortality is high, and this operation requires considerable skill when the os will only admit two fingers. De Ribes's bag, on the other hand, is easily inserted and gives the child a better chance. Its disadvantages are that its insertion often displaces the child's head so that an oblique lie results, and that its expulsion may be followed momentarily by brisk hæmorrhage. Further, it is not

always at hand just when required, and very easily perishes. Roughly speaking, if the child is alive and viable, and if the mother is in fair condition so that she may stand a second anæsthetic if necessary, a bag should be used, especially if the os is only just the size mentioned. On the other hand, with a non-viable or dead child, an exsanguined mother to whom a second anæsthetic may be serious, and a half-dilated os, version should be the treatment of choice. With central placenta prævia also version is to be preferred, as the chances of a living child are small. In all cases in which the os is half or more dilated, it will be quite easy to dilate it

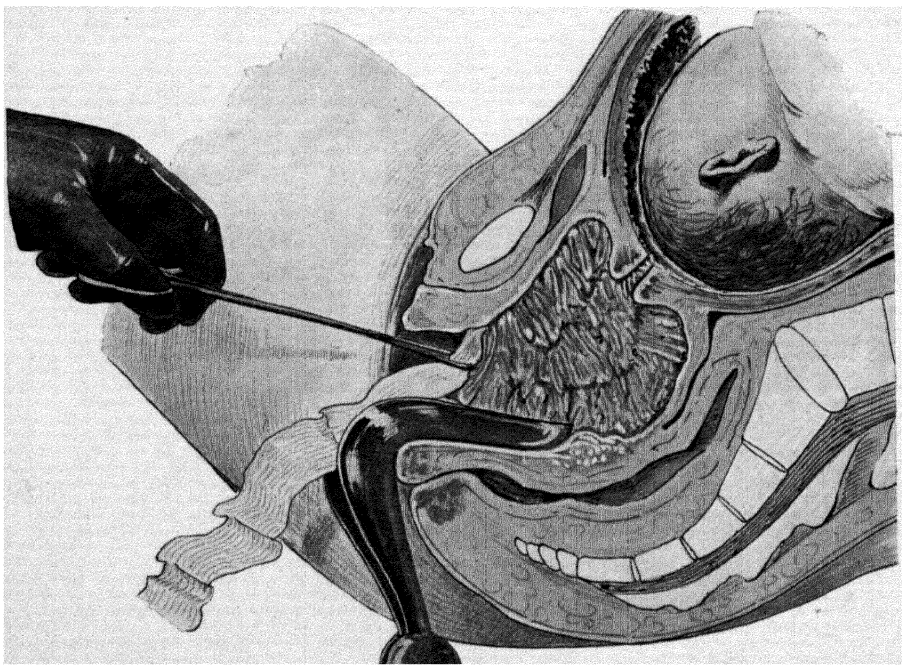


FIG. 204.—VAGINAL PLUG IN POSITION IN A CASE OF INCOMPLETE PLACENTA PRÆVIA WITH THE CERVIX UNDILATED.

further so as to allow the performance of internal version. Whichever method of treatment is chosen a tight binder round the abdomen must be used in addition.

As soon as a leg is brought down or the bag is filled with fluid, the pressure thus made on the placental site usually stops the hæmorrhage. If, however, oozing continues, additional pressure can be made by attaching a weight of one to two pounds to the neck of the bag, or by pulling on the leg (Fig. 203).

If the os is not dilated sufficiently for the bag to be inserted, the vagina may be plugged after rupturing the membranes, and a tight abdominal binder, fastened from above downwards, applied.

The use of the binder in this case is to press the child down on to the plug and thus make pressure on to the placental site; the plug also stimulates uterine action and so hastens dilatation of the cervix (Fig. 204). As an alternative to plugging the vagina the patient may be put in the lithotomy position and, under an anæsthetic, the cervix dilated with Hegar's dilators till it is large enough to admit the bag.

If the cervix is fully dilated there has been good uterine action, and probably, if the head is presenting, rupture of the membranes will result in the head coming down and checking the bleeding by compression of the placental site. Should it not do so, delivery by

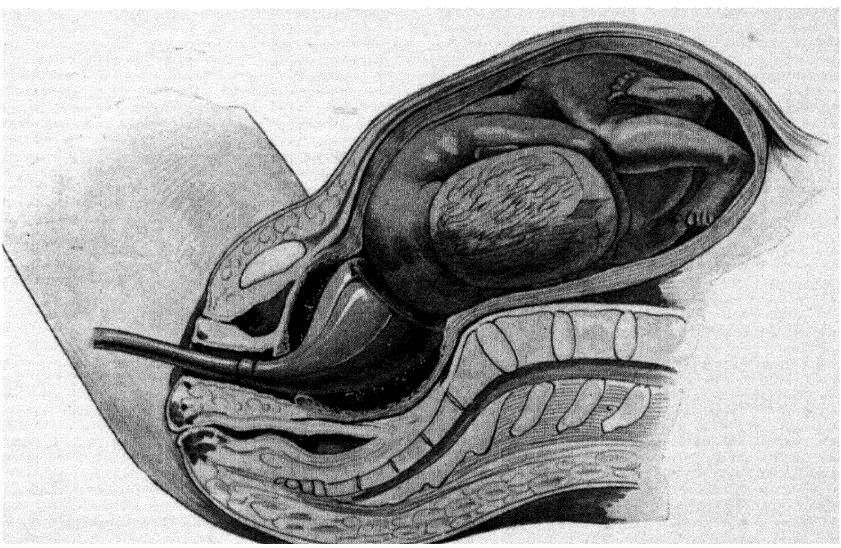


FIG. 205.—DE RIBES'S BAG USED IN A CASE OF CENTRAL PLACENTA PRÆVIA, SHOWING ALSO DISPLACEMENT OF PRESENTING PART.

the forceps should be effected, as delivery by version is less simple and is accompanied by more shock.

In those cases in which the placenta is completely prævia and the membranes cannot be reached, any manipulations such as bringing down the leg by version or putting in a bag must be done after perforating the placenta itself.

Herman's dictum on the essentials of treatment of placenta prævia, *viz.* "early turning, slow extraction, antiseptics," still holds good. When the bleeding has been checked by pressure with the half breech or with the bag, aided if necessary by pulling or attachment of a weight, there is no need for hurry, in fact anything done further in the direction of hurrying on the labour, apart from the production of good uterine action, is bad midwifery. The object is not to get the uterus emptied as rapidly as possible, either by dragging

the child out by the leg, or by extracting it after pulling out the bag, but to ensure that the uterus when empty shall be well retracted. The greater the part that the uterus itself plays in the expulsion of the child the better. Good uterine action is unlikely when the patient is exhausted by loss of blood, hence the advice, "slow extraction". As soon as the bleeding has been arrested the patient has a chance to recover from its effects, with the help of warmth, nourishment, and, possibly, of sleep. When uterine action has expelled the child an efficient amount of retraction will be present, and this will prevent postpartum hæmorrhage.

Cæsarean section in unavoidable hæmorrhage is indicated if the birth of a living mature child is of particular importance, for instance if the patient is a primigravida over forty, whose chances of future conception therefore are small; again, if there is likely to be the least difficulty in delivery, as from a slight contraction of the pelvis, this operation should be performed; and it is also indicated if the uterus is not contracting and the cervix is rigid. Patients afflicted with both eclampsia and unavoidable hæmorrhage should be delivered by Cæsarean section. With central placenta prævia, particularly in a primigravida, and a living child, Cæsarean section under suitable conditions is the best method of delivery.

The dangers and difficulties of a Cæsarean section are not in the performance of the operation itself, but are associated almost entirely with the technique thereof, and the student must remember that while the operation, when performed with skilled assistance and in proper surroundings, is very safe, when the opposite obtains it is a very dangerous one and has a high mortality.

Treatment after Labour is over

The treatment will be similar to that described for accidental hæmorrhage under this heading.

CHAPTER XLI

POSTPARTUM HÆMORRHAGE

Definition

By postpartum hæmorrhage is meant excessive bleeding which takes place from the genital tract after the expulsion of the child.

Two classes are recognized :—

1. Hæmorrhage from the placental site.
2. Hæmorrhage from lacerations of the genital tract.

Of these the former is the more commonly met with and much the more serious.

HÆMORRHAGE FROM THE PLACENTAL SITE

Pathology

It is impossible for the placenta to separate without exposing the open mouths of maternal sinuses in the uterus, and thus some blood must escape during the third stage of labour.

In this way a loss of 8 ounces usually occurs in a normal labour. It is customary to regard a loss of 1 pint and over as pathological, but any loss sufficient to affect adversely the pulse-rate of the patient must be considered as postpartum hæmorrhage.

The mechanism by which the blood-loss is normally controlled is by the retraction of the uterus.

The uterine muscle fibres surrounding the vessels in the wall of the uterus by their retraction compress their lumen, and thus the hæmorrhage is checked.

In this way, and in this way only, is bleeding naturally stopped. Clotting of blood by itself will not suffice, as is proved by the occurrence of secondary postpartum hæmorrhage when retraction is not maintained. Even in conditions in which the clotting power of the blood is deficient, such as purpura, little hæmorrhage takes place if the uterus retracts well.

Frequency

The frequency depends largely on the manner in which the third stage of labour is conducted. A fatal hæmorrhage should be unknown when efficient surgical aid is at hand. A loss of 1 or 2 pints is not always avoidable, and occurs in ½ to 1 per cent. of cases.

Cause

The cause of postpartum hæmorrhage from the placental site is inefficient retraction of the uterus. It is obvious that cases of bleeding from this cause must be divided into two classes :—

1. Cases in which retraction is imperfect because the uterus is not empty.
2. Cases in which the uterus is empty. The absence or imperfection of retraction here is due to uterine exhaustion of varying degree.

Hæmorrhage before the Placenta is expelled.—The invariable cause of this is partial separation of the placenta. It is clear that retraction cannot be complete until the placenta is entirely separated.

Hæmorrhage after the Placenta is expelled.—The chief cause here is want of retraction, although the uterus is empty. Other causes are the increased size of the placental site and certain blood states. The best example of deficient retraction is atony of the uterus from exhaustion. Other causes are over-distension of the uterus in twin pregnancy, excessive liquor amnii, or concealed accidental hæmorrhage; prolonged and deep anæsthesia; multiparity leading to degeneration of the muscle fibres; a fibroid tumour of the uterus, which, as it does not contain sufficient muscle fibres, is itself incapable of retraction, and which also acts as a foreign body and prevents the uterus retracting as a whole; anæmia due to antepartum hæmorrhage; and placenta prævia in which the placental site is situated in the lower uterine segment where the retractile power is weaker.

The size of the placental site being larger than usual in twins and placenta prævia, tends to increase the amount of blood lost.

Certain blood states, such as purpura, the anæmias, hæmophilia and jaundice, which are rare and comparatively unimportant, may increase the amount of blood lost.

Diagnosis

In the great majority of cases in which the blood is issuing from the vulva, the only question to be decided is whether the blood is

coming from the placental site or lacerations (see below), but it must be remembered that severe bleeding may take place into the cavity of an atonic uterus without much appearing externally, and therefore it is necessary to be sure that the uterus is not being distended before the absence of postpartum hæmorrhage can be affirmed.

Hæmorrhage after labour sufficient to cause a decided increase in the pulse rate must be looked upon as excessive.

The diagnosis of inversion of the uterus is made by feeling or seeing a polypoid mass, to which the placenta may be still attached, in the vagina of a patient suffering from shock, which is more severe than the hæmorrhage alone accounts for.

Symptoms

In very severe cases these are—

Pallor.—The patient's skin becomes waxy-white in colour, and the lips and mucous membranes become greyish-blue. The conjunctivæ are pale, and the eyes rapidly become sunken.

Pulse.—The pulse rate becomes progressively more rapid and the pulse is of small volume and low tension, and finally becomes so small that it cannot be felt at the wrist. Occasionally, the pulse may be deceptive and keep full and its rate slow at the wrist for some time, and then rapidly give out and become uncountable.

Temperature.—This falls—it may reach 96·5°.

Thirst is usually present, and sometimes vomiting and retching.

Dyspnœa.—This usually takes the form of "air hunger". The breathing is deep and laboured, and in her efforts to get as much oxygen as possible into her lungs the patient brings the accessory muscles of respiration into use. The dyspnœa may be accompanied by præcordial pain.

Restlessness is present in severe cases; the limbs may be thrown about or the whole body moved. It is of grave import.

Amaurosis.—Temporary complete blindness may occur and cause great alarm to the patient and friends. It clears up within twenty-four hours, and the recovery is complete in nearly every case.

Consciousness is not lost as a rule.

Prognosis

The immediate progress depends on—

(*a*) The rate at which the blood is lost.

(*b*) The amount lost.

(*c*) The previous condition of the patient.

Owing to the increase in the total quantity of blood during pregnancy, a parturient patient stands hæmorrhage comparatively well, and may recover when several pints have been lost, provided the loss is not too rapid. On the other hand, a patient who is exsanguined already by an antepartum hæmorrhage will rapidly die if even a small quantity of blood is lost after delivery; and, in a similar way, a comparatively insignificant secondary hæmorrhage may turn the scale against the patient who has lost freely at the time of delivery.

A patient whose resistance is lowered by anæmia does not react well against even a mild amount of septic infection to which the manipulations necessary to stop the hæmorrhage may expose her. Except in extremely rare cases, the bleeding is not sufficiently copious to cause death in a few moments, and therefore asepsis must be maintained even at the risk of a few seconds' delay.

Treatment

The treatment of postpartum hæmorrhage is divided into prophylactic and curative.

Prophylactic Treatment.—The prophylactic treatment of postpartum hæmorrhage is a matter of great importance. To this purpose, therefore, the pregnant patient should be carefully examined with a view to the presence of any debilitating disease, which if present should be treated with appropriate remedies. Some patients give a history of postpartum hæmorrhage occurring in one or two previous labours. In the absence of any known cause for such a complication, and on the assumption, therefore, that the clotting properties of the blood of the patient are deficient, the administration of lactate of calcium in 30-grain doses every other day during the last month of pregnancy has apparently been successful. Again, labour should be carefully and properly managed, and, particularly, instrumental assistance should be given during the second stage if the uterus shows any signs of becoming exhausted, and during the third stage the uterus should be manually controlled. The arrest of antepartum hæmorrhage as soon as possible is an important point, and it is obvious that in any case of labour the appliances which may be needed to check the bleeding, such as hot water, douche apparatus, and hypodermic syringe, should be instantly available. Under certain conditions (see p. 653) pituitary extract may be a valuable prophylactic agent.

The ultimate prognosis will depend on the presence or absence of sepsis. These patients are also specially liable to thrombosis and pulmonary embolism.

Curative Treatment.—The curative treatment will depend upon whether the placenta has been expelled or not.

Before the Birth of the Placenta.—The first thing to do is to get the uterus emptied of the placenta. Turn the patient on to her back, put the hand on the abdomen, rub the uterus till it becomes firm, and then squeeze the fundus and endeavour to express the placenta. Pressure must not be made on the uterus while it is still flabby, for fear of inverting it. Should squeezing fail to express the placenta, it shows that the placenta is either morbidly adherent to

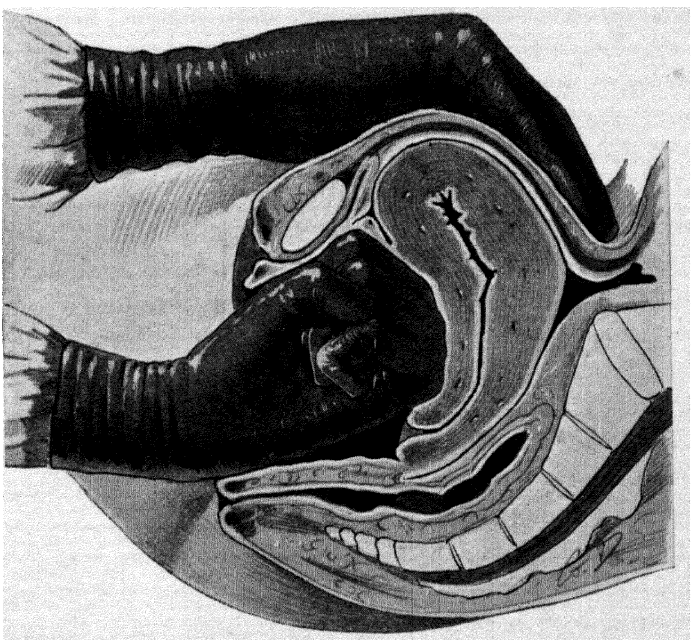


FIG. 206.—BIMANUAL COMPRESSION OF THE UTERUS.

In the illustration the operator is standing between the patient's legs. For this the patient must be placed across the bed with her buttocks resting on the edge. Bimanual compression can be performed equally well with the patient lying on her back in the bed in the ordinary position. In these circumstances it is obviously easier for the operator to place his right hand in the vagina and his left on the patient's abdomen.

the uterine wall, or else is retained by a localized contraction of the lower part of the uterus (hour-glass contraction). In these circumstances, squeezing the uterus having failed, the hand must be introduced into the uterus and the placenta removed as described on p. 516. As a rule, when the placenta has been removed the uterus retracts well, and there is no further hæmorrhage. If, on the other hand, retraction does not occur, the case must be dealt with as described under the next heading.

After the Birth of the Placenta.—If hæmorrhage takes place after the birth of the placenta, the first thing is to grasp the uterus and attempt to empty it of blood by strongly squeezing it. In the vast majority of cases this manœuvre will be sufficient. If this treatment fails, an intra-uterine douche at a temperature of 118° F., if it is ready, should be given, but no time should be wasted in its preparation. If the intra-uterine douche fails to stop the bleeding or is not immediately available, bimanual compression should be performed (Fig. 206).

In the rare cases in which the uterus is distended with blood, the hand may be introduced into the uterus if perfect asepsis is assured, to clear out clot, otherwise the clot should be squeezed out by bimanual compression, which is carried out as follows. Insert one hand into the vagina, close it, making a fist with the back of hand directed posteriorly and the knuckles in the anterior fornix; put the other hand on the abdomen resting on the posterior surface and press the anteverted uterus down on to the fist by the external hand. In this way the posterior wall of the uterus is pressed against the anterior, and hæmorrhage checked. The compression should be kept up until the uterus has recovered its contractility. This, however, is tiring to perform, but is absolutely efficient, aseptic, and leaves no foreign body in the uterus. *In cases of severe flooding it should be performed as soon as the placenta is removed, without wasting time on less effective methods of treatment.* Other methods have been suggested as a last resource, *e.g.* plugging the uterus. This has the single advantage that when finished, it leaves the operator free to resuscitate the patient, but sufficient gauze with which to plug the uterus efficiently is rarely available, it is difficult to avoid sepsis from touching the vulva when introducing it, and it is a very painful treatment. Plugging the vagina is absolutely useless, as hæmorrhage would continue into the uterine cavity above the plug. Pressure on the abdominal aorta has also been advised, but the aorta is difficult to reach in a fat patient, with the soft uterus in the abdominal cavity; and the intestines may be damaged. In no circumstances can pressure be made above the origin of the ovarian arteries, so that this method of treatment is not efficient.

Drug Treatment.—In addition to the methods of treatment described, some assistance may be obtained by the administration of drugs, especially when the uterus is not really atonic or worn out, in which case they would be of no use. The most useful drugs in this respect are ergot and pituitary extract.

Ergot should be given by intra-muscular injection, since if given

by the mouth it will take 20 to 30 minutes to act. Glass ampoules containing one dose of sterile ergotine can now be easily obtained, and will be found most convenient in an emergency. Pituitary extract is also given by intra-muscular injection. For the account of its uses in obstetric practice, see p. 653.

To treat the Collapse caused by the Hæmorrhage.—The ordinary methods in use for combating the effects of hæmorrhage may be used, *e.g.* lowering the head so that gravity helps to keep the medulla supplied with blood, infusion of normal saline solution (1 drachm of common salt to each pint of water) at a temperature of 105° F. into the subcutaneous tissues of the axilla or thighs, 10 to 15 ounces may be run into the rectum through a rectal tube or catheter attached to a funnel; in profound shock, the median basilic vein should be exposed and 2 pints of normal saline slowly run into the vein.

It has long been noted that the beneficial effects of infusion of saline solution are often only temporary. Recent investigations have shown that the saline infusion is apt to fail, being retained within the blood-system for too short a time to maintain the blood-pressure because of the tendency for the solution to diffuse from the smaller blood-vessels into the surrounding tissues. In order to overcome this rapid diffusion a medium containing a larger molecule is desirable.

The experience gained during the war in the treatment of shock resulting from profound loss of blood has proved the value of the presence of a colloid in the saline solution used for intravenous administration. The researches of Bayliss and others have demonstrated that the addition of a colloid such as gum is scientifically sound.

A solution for intravenous use that has given good results is:—

Sodium chloride	2·0 grammes
Potassium chloride	0·05 ,,
Calcium chloride	0·05 ,,
Powdered gum acacia	5·00 ,,
Distilled water	100·00 cubic centimetres

Filter and sterilize.

When a suitable donor is available blood transfusion is to be preferred.

Hot-water bottles suitably protected with blankets and oxygen may be valuable. If the means of giving saline solutions are not available, it may be of great service to bandage firmly the limbs from below upwards with strips of torn sheeting, so as to squeeze blood into the more important viscera—by this simple expedient a patient may be tided over the critical time while other remedies are being

prepared for use. The patient must be left absolutely at rest, since there is great danger of syncope if she is allowed to move.

Late Postpartum Hæmorrhage.—It occasionally happens that relaxation follows the retraction produced by strong stimulation of a partly exhausted uterus, especially when the stimulation has been by drugs whose action is not of long duration. In these circumstances the blood often collects inside the uterus, so that it is a good plan to get the nurse to "hold" the uterus for half to three-quarters of an hour by placing the left hand on the fundus, so that she can tell at once if any distension or prolonged relaxation of the uterus takes place. It is injudicious to leave a patient till her pulse-rate is below 100° F. A retained piece of placenta or membrane may be the cause, and is so often found that an anæsthetic should be given and the fingers introduced into the uterus to remove it. For the first week after delivery it is usually easy to introduce at least two fingers through the cervix, without any instrumental dilatation of the cervix. In this as in all other intra-uterine operations, counter-pressure must be made on the fundus.

Hæmorrhage due to the retention of a piece of placenta may occur quite late in the puerperium, and may be associated with the condition known as placental polypus.

Mental shock has been known to give rise to postpartum hæmorrhage.

HÆMORRHAGE FROM LACERATIONS

A split cervix may cause persistent hæmorrhage, especially in cases of placenta prævia, as the manipulations may cause laceration, and the heightened vascularity of the lower uterine segment increases the amount lost. A ruptured uterus may bleed both externally and into the peritoneal cavity. Lacerations must be suspected as the source of the hæmorrhage if the loss commences immediately the child is born, continues although the uterus is hard, and if the blood is a bright red colour. Although such hæmorrhage is rarely profuse, it tends to continue, as it may come from a branch of the uterine artery, and therefore will endanger the patient's life unless stopped.

The ideal treatment is to tie off the bleeding point. To do this in a deep cervical tear, the patient should be put in the lithotomy position, the perineum retracted, and the cervix pulled down to the vulva with a vulsellum. The split cervix is then stitched with catgut or silkworm gut from above down (Fig. 190); the highest stitch is the

most important, as it will control the cervical branch of the uterine artery from which the blood is coming. If a needle cannot be passed, the two lips of the cervix may be compressed by clamping them together with a vulsellum or an ovum-forceps; traction on either of these will at once arrest the bleeding. If instruments are not available, pressure should be made on the bleeding point with aseptic gauze, after the administration of a hot douche.

Hæmorrhage may also be due to tearing of a varicose vein in the labium majus; a laceration near the clitoris; a tear of the vagina or of the perineum.

A varix of the vulva is difficult to control with stitches, as each stitch may wound a fresh vein, and so it may be treated by the application of an antiseptic pad and firm bandage. Tears near the clitoris should be sewn with catgut. Lacerations of the vagina and perineum should be sutured.

CHAPTER XLII

DELAYED DELIVERY OF THE PLACENTA AND MEMBRANES

THE placenta is usually separated and lying in the vagina 15 to 20 minutes after the child is born. The classical signs that the placenta has been separated and expelled from the uterus into the vagina are that the uterus rises, becomes smaller, harder, and more mobile, the umbilical cord lengthens, and slight hæmorrhage occurs from the vagina. The vagina having a feeble musculature is unable to expel a foreign body; hence it sometimes happens that, unless the patient assists by straining, the placenta may remain in the vagina for some little time after its extrusion from the uterus.

Retention of the Placenta in the Uterus.—The time taken for the placenta to be separated from its uterine attachments and extruded from the uterus depends on the force of the uterine contractions and on the firmness of its attachment to the uterus. Normally the expulsion occurs about 20 minutes after the birth of the child, and if the time is prolonged to over one hour the retention is usually regarded as pathological.

CAUSE

Non-delivery of the placenta may be due to—

(*a*) Sluggishness of the uterus.
(*b*) Morbid adhesion of the placenta.
(*c*) Hour-glass contraction—contraction ring.
(*d*) Rupture of the uterus.

Sluggishness of the Uterus.—If the uterus does not retract sufficiently after labour the diminution in size of the placental site will be less than usual, and so the placenta will not become detached as soon as usual. When the uterus has recovered its tone, efficient retraction occurs and the placenta will be separated and delivered. Uterine sluggishness is rarely sufficiently marked to cause a prolonged delay in the

third stage of labour, but it unfortunately at times leads to partial separation of the placenta with hæmorrhage.

Hour-glass Contraction—Internal Contraction Ring.—This is an occasional cause of delay in the third stage of labour. The contraction ring is most likely to occur after prolonged labour with intra-uterine manipulations, and may also follow the administration of ergot. The ring may form anywhere in the uterine body, most frequently in the lower part. The part above the ring may be relaxed except when the condition is due to ergot, the whole uterus being then contracted.

This condition can only be definitely diagnosed, on internal examination, by feeling the contraction ring as a tight band constricting the uterus below the placenta.

Morbid Adhesion of the Placenta.—During the development of the placenta the chorionic villi penetrate the decidua and obtain a firm grip on the uterine wall. Normally the placenta separates through the ampullary layer of the decidua as being the line of least resistance. In some cases this ampullary layer is not formed, and on sections being made of the placental site it is found that the decidua basalis is absent and the villi are in direct contact with the muscle of the uterus. Under these conditions there is no pre-formed line of cleavage, and the placenta does not separate under the stimulus of normal uterine action. It is then said to be morbidly adherent. The cause of this condition is not known, but it has been thought to be due to syphilis and to endometritis affecting the decidua; in support of this theory is the fact that morbid adhesion of the placenta may recur in the same patient.

So long as the placenta is everywhere adherent, no blood-vessels are opened, and therefore blood does not escape; but if the placenta is adherent over only a portion of its extent hæmorrhage will occur where separation has taken place. As the presence of the placenta in the uterus prevents complete retraction, hæmorrhage will continue till the whole placenta is separated and delivered.

The diagnosis from hour-glass contraction can only be made by an examination showing the absence of any obstruction to the exit of the placenta. On attempting to separate the placenta by the hand it will be found to be densely adherent to the uterus by tough bands. It should be remembered that a placenta succenturiata may be morbidly adherent.

Rupture of the Uterus.—The placenta may escape through a laceration into the peritoneal cavity, and then its delivery *per*

vaginam is impossible. Such cases are very rare, and other more important symptoms are present depending on the rupture (see p. 468).

Treatment

If delay in the delivery of the placenta is accompanied by bleeding, the treatment will be that of postpartum hæmorrhage before delivery of the placenta (see p. 509).

In cases unaccompanied by hæmorrhage the treatment is not urgent, and time must be allowed for the natural processes of separation and expulsion.

If from the diminished size, increased mobility, and raised position of the fundus, together with lengthening of the umbilical cord, it is known that the placenta is merely lying in the vagina, it can be pushed out by pressing the fundus downwards and backwards, the uterus here being merely used as a piston.

If from the absence of the classical signs it appears that the placenta is still in the uterus, efforts must be made to express it. To express the placenta, the uterus must be massaged till it is firmly contracted, as pressure on a flaccid uterus might cause inversion: the left hand should then be placed on the fundus with the thumb in front and the fingers behind, and the body of the uterus should be squeezed until the placenta is felt to leave it, and not pressed at this stage. If this treatment fails after several efforts have been made at intervals of five minutes, it shows either that there is considerable morbid adhesion, or else that hour-glass contraction is present. Both of these conditions will require an anæsthetic, and further efforts to express the placenta should be made after its administration.

Should firm squeezing under anæsthesia fail, the only treatment left is manual removal of the placenta by the gloved hand inserted into the uterine cavity. One hand makes counter-pressure on the fundus of the uterus through the abdominal wall, otherwise the uterus may be torn from the vagina. The other hand is inserted into the vagina and follows the umbilical cord up into the uterus to the placenta; if a contraction ring bars the way, the tips of the fingers should be inserted into it and attempts made to dilate it by steady pressure. The aim is to press the uterus down on to the internal hand rather than to force the hand into it (Fig. 207).

If any portion of the placenta has already separated, a start should be made at that area to separate the rest of the placenta by putting fingers through the membranes and making a saw-like movement behind the placenta. If the placenta is entirely adherent,

the separation should be started at the top, and if it is very adherent it may have to be removed in pieces, and the membranes stripped off, after which a non-poisonous intra-uterine douche should be given. Instruments must not be used in removing the placenta.

Manual separation of the placenta is not to be lightly undertaken, as it is attended by considerable risk to the mother. The finger may perforate the uterus by mistaking the depth at which the

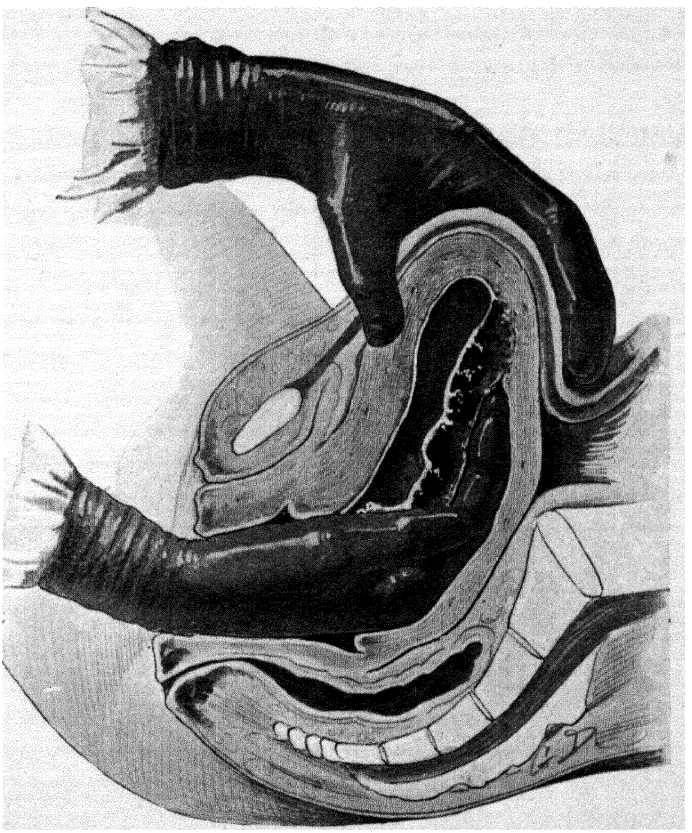


FIG. 207.—MANUAL REMOVAL OF THE PLACENTA.

In this case the separation had begun at the lower edge of the placenta, and so was continued by the fingers up to the top.

separation should be carried on and removing portions of the uterine wall under the impression that they are portions of placenta. As the fingers must come into relation with the blood-vessels, sepsis is a frequent and at times fatal complication. Hence it is best to make a thorough attempt to express the placenta under anæsthesia before attempting manual separation. During the puerperium it is advisable to keep a patient, from whom the placenta has been manually removed, propped up in bed so that any shreds and débris may escape more easily into the vulval pads. It is also well to keep the uterus

firmly contracted by the administration of ergot every eight hours for a week.

Retention of the Placenta in the Vagina.—This condition is easily recognized by the classical signs of separation of the placenta, and if in doubt by feeling this structure in the vagina. To deliver the placenta, the fundus should be pushed downwards and backwards so as to force the placenta out of the vulva. The uterus in this case is merely used as a convenient object with which to make pressure on the placenta lying in the vagina.

Retention of the Membranes.—In cases in which the obstetrician has attempted to hurry the third stage without giving time for the contractions of the uterus to separate the membranes from their attachments, there is a tendency for the chorion to stick to the uterus and not separate. It is a common practice to twist the membranes into a rope; the tension thus produced may be sufficient to separate them if they are only slightly adherent, but if firmly attached this manœuvre has the disadvantage that they become torn at the point of attachment, and thus a portion is left behind in the uterus. If the chorion appears to be definitely adherent, it is best to hold the membranes untwisted under slight tension; the contractions and retraction of the uterus complete the separation. If the chorion breaks during delivery of the placenta, the lower end of the torn piece may be caught in a Spencer Wells' forceps, by which traction can be made when the portion becomes loosened. If on examining the membranes it is found that a considerable piece is missing, it is permissible to make a vaginal examination and feel if any membrane is protruding from the cervix. If membrane cannot be felt, no attempt should be made at intrauterine examination. The retention of a piece of chorion in the uterus does not give rise to any symptoms as a rule, the chorion disintegrates and comes away with the lochia. The possible bad effects of a retained piece of chorion are subinvolution with persistent red lochia or sepsis. Of these the last is the only serious sequel, and therefore the essential thing is the perfection of the asepsis in such a case. If there are any signs of decomposition of the retained portion of chorion, the uterus must be explored under an anæsthetic.

CHAPTER XLIII

TUMOURS OF THE UTERUS AND OVARY

LABOUR COMPLICATED BY OVARIAN TUMOURS

THE frequency with which ovarian tumours complicate labour has been stated (Haultain) to be 1 in 4000 cases.

When the tumour lies wholly in the abdominal cavity, it has little effect at the time of labour apart from causing some diminution in the effectiveness of the contractions of the abdominal muscles, if the tumour is of any considerable size. Very rarely it may displace the axis of the uterus enough to interfere with the entrance of the presenting part into the brim of the pelvis. Sometimes torsion of its pedicle takes place when the child leaves the uterus. When, however, the tumour lies either in whole or in part in the cavity of the true pelvis, labour is usually obstructed partially or completely, but even apart from obstruction, the tumour is likely to be damaged or even ruptured by the passage of the child through the pelvis. Such an accident may be more or less harmless for the time being, or may cause fatal peritonitis if the cyst is a dermoid or if the contents are infected. Very rarely the tumour has been expelled through Douglas's pouch into the rectum or vagina, generally during delivery with the forceps. When anything like complete obstruction is produced, there is of course danger of rupture of the uterus.

It should be remembered that when the cyst is so small that the course of labour has not been interfered with, there may not be any symptoms due to its presence until it has become inflamed during the puerperium in consequence of damage to the tumour or torsion of its pedicle at the time of labour.

DIAGNOSIS

If the ovarian tumour lies above the brim of the pelvis, its recognition is not always as easy as might be expected (see p. 238).

If, on the other hand, it lies in the cavity of the pelvis and is

obstructing labour, the fact that the obstruction is due to a swelling which lies in this situation is easy to ascertain on bimanual examination, but exact diagnosis of the nature of the swelling is not always possible until the abdomen has been opened, especially in the case of a solid ovarian tumour. The cervix is generally displaced either to one side or more rarely upwards.

Treatment

When the tumour lies entirely above the brim of the pelvis, as a general rule it does not cause much trouble during labour, but, since torsion of its pedicle is apt to take place either in the later stages of labour or in the puerperium, ovariotomy should be done within a few days of delivery whether symptoms are present or not.

When the tumour lies either in whole or in part below the brim of the pelvis, the situation needs different treatment. The various methods of treatment which have been adopted in the past in these circumstances are as follows:—

1. Labour has been allowed to occur without artificial aid in those cases in which it was possible.
2. The child, mutilated or otherwise, has been dragged past the tumour.
3. The tumour when possible has been pushed up out of the way.
4. The tumour has been punctured or incised through Douglas's pouch.
5. Cæsarean section has been performed, followed by abdominal ovariotomy.
6. Abdominal or vaginal ovariotomy has been performed.

Briefly, it may be said that it is now generally recognized that the first and second methods are quite unjustifiable. The third method is also certainly inferior to the others, and should only be adopted in special circumstances such as those mentioned below. This likewise applies, though perhaps in a less degree, to the fourth method. Undoubtedly the ideal treatment is abdominal ovariotomy performed preferably near the end of the first stage of labour. The patient can then be delivered with the forceps while still under anæsthesia immediately after the abdominal operation. In this way all strain on the abdominal incision can be avoided. As a general rule Cæsarean section is not needed, though it may be necessary to eventrate the unopened uterus in order to get at the tumour. If the tumour is held in the pelvic cavity by atmospheric pressure, an indiarubber tube without lateral holes can sometimes be insinuated beside and below it to allow air to enter Douglas's pouch as the

tumour is withdrawn. In the case of solid tumours or those fixed by adhesions, Cæsarean section is often unavoidable. At the same time it must be acknowledged that the surrounding circumstances of the case may be such that it is not feasible to do an abdominal section. A case of this kind may be met with in a cottage where the medical attendant is single handed and far from help, and the obstruction may be urgent. In such a case the methods available are either to push the tumour up above the brim of the pelvis or to puncture it, or better still incise it, before delivering the child.

The risks involved in pushing the tumour up are torsion of the pedicle, damage to, or rupture of, the tumour, when it is cystic and there is any difficulty in the reposition, and the possibility of peritonitis resulting therefrom. If reposition is attempted, it is necessary to see that the presenting part is not engaged in the brim of the pelvis at the time the attempt is made. It should not be attempted if the presenting part is fixed or if the tumour is impacted or adherent. In any case if the tumour has been pushed up out of the pelvis, ovariotomy should be done as soon afterwards as possible. Deep anæsthesia is often necessary for reposition of the tumour.

Puncture or incision of the tumour, when it is cystic, through Douglas's pouch involves the risk of peritonitis or of the formation of adhesions or possibly of the dissemination of malignant disease according to the contents of the tumour. The best method of dealing with the condition *per vaginam* is to open Douglas's pouch deliberately by an incision through the vaginal wall and peritoneum just behind the cervix so as to expose the lower surface of the tumour. The tumour is then opened, its contents evacuated, and the cavity so made plugged with gauze. When a case has been treated in this way, ovariotomy should be done as soon afterwards as possible.

LABOUR COMPLICATED BY FIBROIDS OF THE UTERUS

In the vast majority of cases fibroids do not cause any trouble during labour.

A subperitoneal or submucous fibroid tumour may obstruct labour if it is situated below the presenting part of the child, and a cervical fibroid may prove an insuperable obstacle to delivery (Fig. 208).

A fibroid may be the cause of inversion of the uterus, and rarely may prevent efficient retraction; in either case postpartum hæmorrhage may result.

Treatment

If there is obstruction and the tumour can be pushed up, it may be possible to deliver the child with the forceps or by traction on the breech. During this manœuvre the fibroid may be bruised and is then more liable to sepsis.

If a submucous fibroid is delaying the advance of the child and has a pedicle, this can be divided, otherwise the tumour must be enucleated.

As a general rule the best treatment for a fibroid obstructing labour is to open the abdomen and then deal with the fibroid by

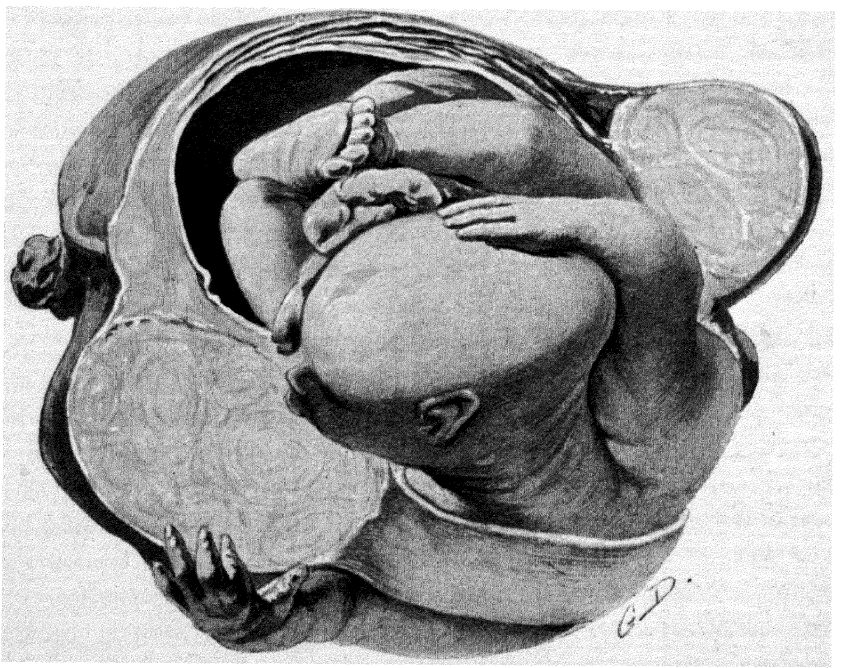


Fig. 208.—Fibroid that proved an Insuperable Obstacle to Delivery.

The left arm is projecting through the cervix. The front of the uterus has been cut away to show the cavity of the uterus (containing the greater part of the child), and two subperitoneal fibroids. (From a specimen in the museum of the Royal College of Surgeons.)

hysterectomy, myomectomy, or ligature and division of its pedicle, whichever method is most suitable, after delivery of the child by Cæsarean section.

LABOUR COMPLICATED BY CANCER OF THE CERVIX

The treatment of labour complicated by cancer of the cervix will depend upon whether the disease is operable, or if inoperable whether the child is alive or dead.

Disease operable.—In this case the child should be delivered by Cæsarean section and the uterus forthwith removed by a radical hysterectomy.

Disease inoperable.—If the child is alive, it should be delivered by Cæsarean section, after which the uterus should be removed at the level of the internal os to prevent its subsequent infection from the growth in the cervix.

If the child is dead, and it can be delivered by means of craniotomy without any serious laceration of the diseased cervix, this is the proper plan to pursue.

If, however, from the nature of the growth, it is obvious that there must be severe laceration of the diseased cervix even if the child can be delivered *per vias naturales*, then the proper treatment is to remove the child and body of the uterus *per abdomen*.

Section III—THE PUERPERIUM

CHAPTER XLIV

PHENOMENA OF THE PUERPERIUM

The puerperium is the period after the completion of labour during which the organs and structures which have been altered by the pregnancy are returning to their normal state. The return will not be completely to the condition before pregnancy, as certain of the changes are permanent. For example, some enlargement of the vulval outlet remains; skin striæ, if present, can only be replaced by scars; and the size of the uterus and of the walls of its vessels do not again become quite as small as they were before the onset of gestation. The time occupied in effecting these changes cannot be definitely stated, but during the first three weeks the changes are rapid, but slow changes continue for at least a month longer.

INVOLUTION OF THE UTERUS

By involution of the uterus is meant the gradual diminution in size that occurs during the puerperium. Soon after delivery the walls of the uterus are nearly 2 inches thick, and the cavity of the uterus 6 inches long, thus the total length of the organ is about 8 inches. On the day after delivery the fundus will be found to lie about $5\frac{1}{4}$ inches above the pubes. The following figures were obtained in one series:—

Day.	Height above Symphysis Pubis.
1st	5 inches
2nd	$4\frac{1}{2}$,,
3rd	4 ,,
4th	$3\frac{1}{2}$,,
5th	3 ,,
6th	$2\frac{1}{2}$,,
7th	2 ,,
8th	$1\frac{1}{2}$,,
9th	1 ,,

The position of the umbilicus is somewhat variable, but on an average the fundus will be found to be just below it on the day after delivery. As involution proceeds the fundus will be found to sink just under half an inch each day. There is little difference in the rate in multiparæ and primiparæ, but in the former the uterus remains in many cases more bulky than in the latter at the completion of the puerperium (Fig. 209).

Several precautions must be taken before measuring the height

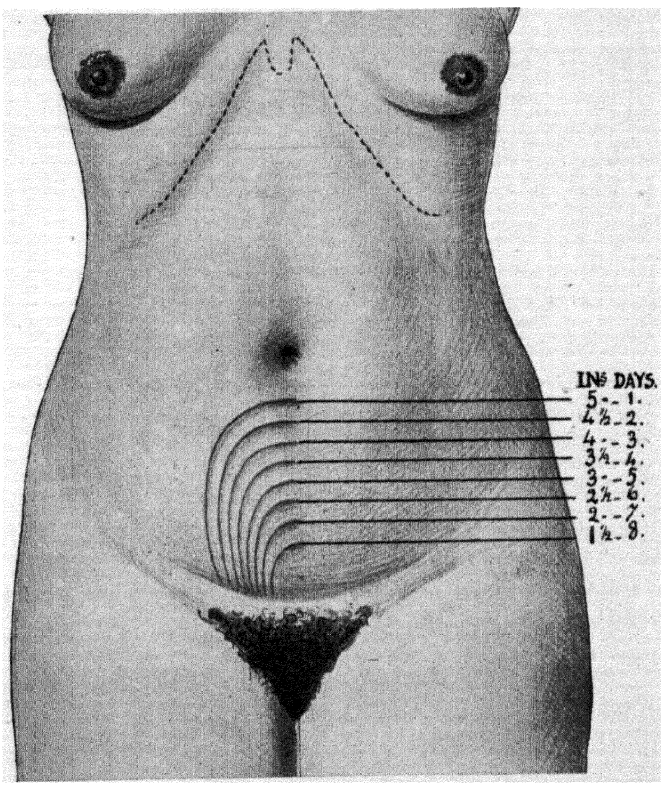


FIG. 209.—SHOWING THE NORMAL LEVEL OF THE FUNDUS OF THE UTERUS ON ABDOMINAL EXAMINATION DURING THE FIRST EIGHT DAYS OF THE PUERPERIUM.

of the fundus, the most important of which is to see that the bladder is empty. The uterus after delivery is to some extent supported by the bladder, and as the latter fills it elevates the uterus so that in cases of over-distension of the bladder the fundus of the uterus may almost reach the ensiform cartilage. The rectum, if distended, may also push the uterus upwards, but only to a slight extent. Blood-clot inside the uterus or a fibroid tumour in its wall may also cause the fundus to be higher than usual, but these conditions are not as frequently met with as a full bladder, which is the usual cause of upward displacement of the fundus during the first few

days of the puerperium. The height of the fundus in inches above the pubes may be recorded on the temperature chart and forms a valuable index to the progress of the patient. The height of the fundus is conveniently measured with a ruler. In recording the figures on the temperature chart it is usual to take the 100 as corresponding to the level of the top of the pubes, and each degree above 100 corresponds to 1 inch. Thus if the fundus is found to be $5\frac{1}{2}$ inches above the pubes, the height would be charted at 105·5 on the temperature chart (Fig. 210).

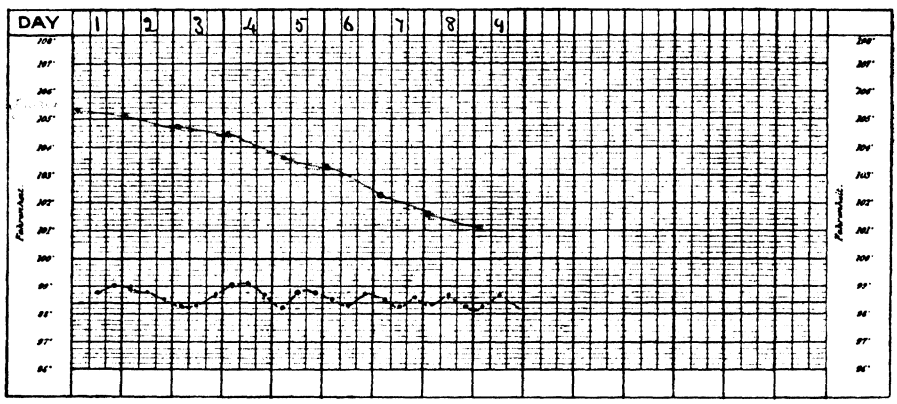


FIG. 210.—TEMPERATURE CHART OF LYING-IN PATIENT; ALSO SHOWING THE INVOLUTION OF THE UTERUS.

Chart of anactual case showing the involution line (red) of the uterus for the first nine days of the puerperium. This is inserted to show the method of recording the height of the fundus on a chart, but the figures do not correspond exactly with those given in the text.

In the case of the average patient with normal development of the abdominal muscles the fundus cannot be palpated after the eighth or ninth day.

SUB-INVOLUTION OF THE UTERUS

A uterus which has been over-distended during pregnancy, from such causes as the presence of an unusually large child, hydramnios, or twins, is likely to be larger than is usual immediately after delivery.

Delay in involution may occur as a result of the uterus not being completely emptied of placenta, chorion, or blood-clot; the delayed involution is especially marked when the retained matter becomes infected with organisms and sapræmia results. In cases also in which the patient does not suckle the child involution may be slower than normal.

Retroversion of the uterus tends to delay involution, and, if present, will need correction.

Signs

After delivery the uterus weighs just over 2 pounds, and when involution is complete about 2 ounces, or rather less. During the first week involution is rapid, so that on the eighth day the weight has gone down to 1 pound; during the second week it loses between ¼ and ½ pound. After the end of the second week the loss is slow. The uterus never entirely regains the condition that was present before gestation took place. The parous differs from the virgin uterus in being slightly larger and more globular; the cervix is less prominent, and the external os is altered from a circular opening to a transverse slit from which lacerations of varying severity may radiate. The coats of the uterine blood-vessels are also permanently thickened.

Involution results from autolysis. As a result of such auto-digestion the large muscle-fibres of pregnancy gradually shrink to their original size. The superficial portions of the decidua are cast off and discharged with the lochia, but the deeper portions of the uterine glands which extend into the muscle remain, and the mucosa is regenerated from these deeply-lying glandular remnants within two months of delivery.

In rare cases the process of involution goes on too far so that the uterus becomes permanently smaller than normal, and thus partial or complete amenorrhœa and sterility may ensue. This uncommon condition has been termed "super-involution".

The signs of sub-involution of the uterus are persistently red lochia, and a uterus which is unduly large with its cervical canal patulous.

Treatment

The treatment of sub-involution is to keep the patient in bed till the lochia cease; this is important, as the occurrence of red lochia indicates that the uterus is larger and therefore heavier than usual, and to permit the patient to walk about with an unduly heavy uterus is to expose her to the risk of prolapse. In addition to the rest in bed half-drachm doses of the liquid extract of ergot should be given thrice daily, and hot (110°-115° F.) vaginal douches night and morning. Should the hæmorrhage continue after a week of such treatment, it is possible that a portion of placenta is retained, and the question of emptying the uterus under an anæsthetic might

have to be considered. Calcium may be useful, and some such prescription as the following may be given :—

Concentrated lactic acid	200 grains.
Precipitated calcium carbonate . .	75 ,,
Chloroform water	to 8 ounces.

Two tablespoonfuls every other night.

AFTER-PAINS

After-pains are sufficiently common, especially in multiparæ, in a puerperium which is otherwise uneventful to be worthy of consideration here. Normally after delivery the uterus remains firmly retracted, and such a condition is without pain to the patient. If the uterus is unduly irritated so that irregular or violent contractions ensue, the patient experiences intermittent pains in the lower abdomen to which the term "after-pains" is applied.

Causes

In many cases this is simply a painful colic of the uterus for which no cause can be assigned. The presence of some foreign body in the uterus, such as a piece of chorion or blood-clot, is sometimes a cause of after-pains. They are much more frequent in multiparæ. Abdominal pain early in the puerperium may also be due to retention of urine or intestinal colic; these so-called "false after-pains" may be differentiated from true after-pains by noticing that they occur at irregular intervals, that they do not coincide with the hardening of the uterus, that they do not increase with the uterine contractions that occur when the child is put to the breast, and that they are relieved by emptying the bladder or bowel.

Treatment

If there is any evidence that there is anything in the uterus it should be emptied. To this end firm pressure may be made on the uterus, and the liquid extract of ergot may be prescribed in drachm doses, together with hot vaginal douches to make the uterus contract strongly. If the pain persists and it is thought that it is simply due to a painful uterine colic, a hot-water bottle above the pubes may be found comforting by the patient. Morphia is very rarely necessary, but occasionally, when the pain persists after the uterus is apparently empty, relief may be afforded by giving 10 grains of phenacetin, phenazone, or acetyl-salicylic acid.

THE LOCHIA

The discharge from the genital organs during the puerperium is called the lochia. They consist of blood, shreds of decidua, secretion and epithelium from the uterus, cervix, vagina and vulva, leucocytes, and occasionally traces of maternal urine.

The amount passed is in all about ½ pint—the quantity varies to some extent with the size of the placental site from which the serum is exuded.

During the first few days they are mainly made up of blood which oozes from the raw surface of the placental site, and of decidual shreds which had remained attached to the uterus. As the amount of blood becomes less the colour of the discharge becomes paler. In an average case, with the mother suckling the child, the lochia remain bright red for three or four days, and then become pinkish-brown for three or four days; at the end of eight, nine, or ten days they lose their colour and are represented by an almost transparent fluid chiefly made up of leucocytes and serum which gradually lessens in quantity until it totally disappears. The lochia may remain coloured for rather longer than usual in cases in which the mother does not suckle the child.

The lochia as they issue from the uterus are alkaline, almost odourless, and sterile. During their passage to the vulva they are usually contaminated with non-pathogenic organisms which cause them to decompose and become acid in reaction, and to acquire a faint but distinct and characteristic odour. This decomposition continues in the vulval dressings after they are removed, and therefore the vulval dressings, when examined some hours after removal, do not give an accurate idea of the condition of the inside of the uterus.

In cases of sapræmia the lochia are usually free, and if the infection includes organisms of the coli group they may smell offensively. The absence of odour does not exclude sepsis, as some of the more virulent organisms which may cause a fatal septicæmia do not cause the lochia to become offensive. The lochia may be apparently suppressed in cases in which a swab has been left in the vagina, or in which the uterus becomes acutely flexed so that the fundus is below the level of the cervix. Such stagnant lochia rapidly decompose, and severe symptoms result from the absorption of toxins. True suppression of the lochia has been described as occurring in septicæmia, but, except in a patient moribund from peritonitis, is extremely rare.

CHAPTER XLV

MANAGEMENT OF THE PUERPERIUM

AFTER delivery the vulva should be cleansed of all blood and swabbed with an antiseptic lotion, such as biniodide of mercury 1 in 1000, and then covered with a pad of sterilized or antiseptic gauze. The nurse should change the pads as soon as they become sodden with lochia, and after each occasion on which the bowel or bladder is evacuated. If expense prevents antiseptic or properly sterilized pads being used, the ordinary pads should be baked in a tin before use. The vulval pads should be kept in position with a T-bandage. It is usual for the patient to wear an abdominal binder; if she wishes to do so, it may be put on after she has had her first sleep. The binder is of little use except that by increasing the tension inside the abdominal cavity it may lessen flatulent distension and enable fulness of the bladder to be appreciated by the patient earlier than would otherwise be the case. As a passive support to the abdomen it obviously cannot have any useful action in improving the nutrition of the abdominal muscles, and so enabling the abdomen to return to its normal contour. To improve the condition of the abdominal and limb muscles massage may be employed after the first week. Nevertheless the patient may derive considerable comfort from a binder during the first twenty-four hours.

A patient lying in bed will not desire a full meat diet for the first few days after labour, and would probably suffer from dyspepsia if she took it; otherwise, in the absence of albuminuria she can have any ordinary diet that is reasonably digestible, including green vegetables and fruit, unless diarrhœa is produced in the infant. Fluids, such as milk, water, and soda-water, should be freely given to increase the quantity of urine and milk. Alcohol is contra-indicated; there is no scientific evidence that either ale or stout is a galactogogue. Protein has a far greater effect in improving the quality and quantity of a mother's milk than either fat or carbohydrate.

After any initial faintness that hæmorrhage may have caused has passed off, the patient should be propped up in bed, as the lochia

are discharged from the vagina more easily when she is propped up than when she is lying down flat in the bed. Vaginal douching is unnecessary, and the passage of the douche tube into the vagina may carry up organisms from the vulva, so that the douche may be a source of danger to the patient rather than a safeguard. Routine vaginal douching during the puerperium is therefore not advised.

CARE OF THE BLADDER

Excepting the question of sepsis, the state of the bladder is the most important thing to be looked after during the puerperium.

RETENTION OF URINE

Retention of urine is frequent, and is more commonly found in private patients than among those of the hospital class.

Cause

The reasons why a patient finds difficulty in emptying her bladder are—

1. The unusual position, lying down in bed.
2. Lax abdominal muscles may prevent the patient straining, and may also prevent her knowing when the bladder is distended.
3. Reflex spasms from the vulva ; this is especially seen in patients with many stitches in the perineum.
4. Bruising and œdema of the urethra and urinary meatus.

It should be remembered that owing to the laxness of the abdominal parietes, the bladder may get very much distended without the patient suffering pain or even discomfort. Also that a puerperal patient may pass small quantities of water at intervals without completely emptying the bladder. Hence retention may exist although some urine may be voluntarily voided at intervals. In cases of great distension small quantities are passed involuntarily, so that the patient complains of incontinence; this condition is known as "overflow incontinence". That the bladder may be greatly distended without the patient being aware of it is responsible for many mistakes in diagnosis. It is not uncommon for a patient to pass water, in fair quantity, three or four times a day, so that both she and the nurse report that there is no urinary trouble, while only a portion of the total amount secreted is passed each day, the bladder becoming more and more distended as time goes on. This state of affairs may continue for as long as a

week or ten days after the confinement before any untoward symptoms arise. There may then be a rise of temperature up to 101° F. or higher, or the patient may complain of discomfort or sometimes of severe pain. In cases in which there is a great amount of distension there may be œdema of the legs and thighs.

It is partly on account of retention of urine or imperfect emptying of the bladder that routine examination of the abdomen is essential. If the distension of the bladder is of moderate degree the uterus is pushed upwards, if of greater degree the uterus is obscured and cannot be felt at all, while in some cases of extreme distension the uterus is pushed upwards and to one side, usually to the left, so that the fundus lies just under the ribs in the renal region. Diagnoses of ovarian cyst, peritonitis with distension, ascites, and of uterine tumours, are sometimes made by an attendant who has omitted to examine the abdomen for several days. Passage of a catheter in any doubtful case will usually clear up the difficulty at once, and even in some cases in which there was a considerable rise of temperature no further trouble may result, but in other cases atony of the bladder wall or cystitis or both may supervene and call for special and more or less prolonged treatment.

Retention with overflow is the commonest cause of dribbling of urine, a symptom which should always be investigated by passage of a catheter.

Treatment

Retention of urine due to the unusual position is best treated by changing this position, so that the patient may sit up or assume the knee-elbow position if perineal stitches have not been inserted. Reflex spasm from the vulva is best treated by applying hot fomentations over the pubes.

Retention due to bruising and œdema of the vulva may be treated with hot fomentations of 1 in 3000 biniodide of mercury, or warm sterile water may be poured over the vulva. Lax abdominal muscles may be supported with a binder, or the nurse may try the effect of gentle pressure on the abdominal wall just above the pubes.

If all these methods fail it may be necessary to pass a catheter. It must be remembered that if the bladder is once allowed to get grossly over-distended (*viz.* when it contains 2 pints or more) it loses tone, and therefore may be unable to expel urine for some days. For this reason it is a good rule to see that urine is evacuated within eight hours of delivery. For passage of the catheter the patient should be on her back with the knees separated, and each leg covered with

sheets. The labia should be separated with the thumb and fingers of the left hand and the meatus thoroughly sponged with antiseptic swabs. The last swab should be placed over the inlet to the vagina to prevent the lochia contaminating the catheter just as it is being passed. The sterile catheter should then be passed for about 2 inches into the urethra. It is usual to use during the puerperium a glass catheter, which can be sterilized by boiling.

The greatest care should be taken to prevent repeated catheterization, as the lochia form an excellent culture medium for organisms, and it is found in practice that puerperal patients are very easily infected even when all the usual antiseptic precautions are taken. Hence a urinary disinfectant should be given by the mouth as a prophylactic. If it is thought that the patient makes no effort to void her urine, it is a good plan to give a purgative or enema so that the bladder may be emptied at the same time that the bowels act, and the desire to avoid repeated enemata may make the patient really try to pass water herself. Intramuscular injections of pituitary extract, ½ c.c., cause vesical contractions and may be helpful.

Should cystitis ensue the symptoms usually manifest themselves at the end of a week or ten days. As stated above, the easiest way to tell if the bladder is full or empty is to palpate the position of the fundus of the uterus. The latter is easier to locate than the soft bladder. If the fundus of the uterus is raised above the umbilicus, the cause will nearly always be found in the condition of the bladder.

INCONTINENCE OF URINE

Cause

False incontinence or overflow incontinence may occur in a neglected case of retention in which the bladder has been allowed to become so overfilled that it can hold no more and the excess of urine dribbles away.

True incontinence results from a vesico-vaginal fistula. This may be due to a tear resulting from an instrumental delivery, in which case the incontinence occurs immediately after labour, or it may result from the separation of a slough caused by prolonged pressure, in which case the slough separates at the end of a few days, and therefore the incontinence is noticed at about that period after labour.

Treatment

A fistula when small, if kept aseptic with douches, may close of itself, and in any circumstances it is not advisable to attempt

any operative treatment till at least eight weeks after delivery, as the tissues are too vascular and do not hold the sutures well owing to their softness.

CARE OF THE BOWELS

Constipation is the rule during the puerperium. If the patient has had a free purge during labour, the bowels may be left unopened till the third day; but in cases of rapid labour, when no purgative was given at the time of labour, it is advisable to open the bowels on the second day. Castor-oil in 1-ounce dozes will be found most reliable, and has the advantage of not affecting the milk-supply. Once the bowels have been well opened a milder laxative will suffice, but the patient will usually require double the dose that she may have been in the habit of taking previously. Senna-pods to the number of 10 to 20 made into an infusion with half a tumblerful of hot water or liquid paraffin in repeated small doses are efficient laxatives during the puerperium. Saline purges and rhubarb should not be given, as they diminish the quantity and affect the taste and quality of the milk. Enemata may be given if the laxative fails, but a routine enema every day accentuates any existing tendency to hæmorrhoids, and so the nurse should not be allowed to give enemata without some good reason.

Sleep.—It is important to ascertain if the patient is sleeping well, as insomnia is often an early symptom of mania.

Pain from perineal stitches, hæmorrhoids, and distended breasts are common causes of sleeplessness.

Stitches.—Stitches should be irrigated with a weak antiseptic lotion night and morning, and every time that the patient passes water or a motion. A clean dry antiseptic dressing, such as cyanide wool, is then applied to the perineum. Stitches may be removed on the ninth day.

Visits to the Patient.—The number of visits paid to any patient will depend on her special requirements, but every patient should be seen the day after delivery to ascertain that the bladder is empty and that there is no undue hæmorrhage; on the third day, which is the most common day for puerperal sepsis and mastitis to become manifest; and about the tenth day, in order that the involution of the uterus, cessation of lochia, milk-supply, and progress of the child, may be noted. It is usual to visit an uncomplicated case daily for the first week, and then at increasing

intervals, so that visits cease after the end of the third week. At each visit the nurse's report should be received, if possible before the patient is seen. A chart, on which is recorded the temperature and involution curve should be kept (see Fig. 210). The abdomen, and especially the uterus, should be palpated. If the attendant does not make himself familiar with the normal rate of involution he will fail to notice that the uterus is not diminishing in size as rapidly as it should, in a case of sub-involution. The amount and character of the lochia must be investigated. The breasts and nipples should be inspected and inquiry made as to any difficulty in suckling. If the patient is not sleeping well an attempt should be made to find out the cause. If no cause can be found mental disturbance must be thought of. The behaviour of the bowels and bladder must receive attention.

The chief points to be investigated about the child are the condition of the eyes, whether it takes nourishment well, whether it sleeps well, the condition of the umbilical cord or umbilicus, the character of the motions, any difficulty in passing water, and the weekly increase in weight. All these points with regard to both mother and child can be investigated in a few minutes, and none of them must be omitted, though if both mother and child are progressing normally investigation of some of the points becomes unnecessary as time goes on.

THE TIME OF GETTING UP

As the uterus weighs considerably more than its normal weight in the early weeks of the puerperium, it is obvious that patients who insist on getting about before the end of the third week after delivery must stand a greater chance of suffering from prolapse than those in whom involution has proceeded more fully before getting up. In the ordinary way a patient should be advised to keep her bed for two or three weeks, but during the latter part of this time she may be allowed to rise for a few minutes daily, when the bowels act, as many patients object to remaining in bed chiefly on account of the discomfort caused by the bed-pan.

The patient should not rise till the lochia have ceased, and should they again become coloured she should be advised to rest till they once more become colourless. A vaginal examination should always be made to exclude retroversion of the uterus, for although retroversion is not very common after a properly conducted puerperium it is wise to ascertain that the uterus is in its normal position, before finally giving up charge of a case. In order to prevent retroversion

the patient should be encouraged to lie on her side from time to time, and warned to empty her bladder at fairly frequent intervals.

For some years past there has been a movement in favour of allowing the lying-in patient to leave her bed as early as the third or even the second day. The advocates of this system ask why more than a few days' rest to recover from the strain and exertion of a normal labour should be required, and urge that movement and the erect position favour drainage from the uterus, while the muscular slackness and wasting and the generally diminished bodily activity, especially the feebler circulation, which result from strict confinement to bed, delay involution and the resumption of the ordinary duties of life. That they can show excellent results and rapid recoveries by their practice, and that it has many advantages in selected cases and in special circumstances, cannot be questioned. Its general and routine adoption is, however, open to several objections.

So long as a patient is confined to bed she is under the close observation and control of her medical attendant and nurse to a degree that is impossible so soon as she is no more than merely up and about her room. The proper nursing of the patient and the precautions to avoid infection—a possibility that is present for quite a week after labour—can be much more thoroughly carried out with the patient in bed and the risk of hæmorrhage minimized. Once a patient has so far obtained her liberty as to be out of bed and on her feet there is the difficulty of controlling her further activities and obtaining for her that complete relief from domestic and other worries which means so much to the woman who has been through the strain of pregnancy and labour and has before her the strain of the nursing and care of her child. With many it is a case of give them an inch and they will take an ell. The advantage of the rest to body and mind, which the time-honoured two or three weeks in bed and a month in charge of a nurse give, is one not lightly to be thrown away. The working woman looks old and worn beyond her years largely from frequent child-bearing, early rising from child-bed, and early return to household duties. The student who sees how the hard-worked mother of a large family appreciates a fortnight's rest in a maternity hospital, where everything is done for her and she is free for the time being from domestic cares, will think the advantages of early rising are far to seek. The advocates of that system say that uterine prolapse is rendered less common, but prolapse is much more frequent among the hospital patients than in private practice among the more leisured classes. Straining and muscular effort with a bulky uterus and a relaxed outlet predispose to prolapse, and hence it is more often met with among those who resume their household duties or

perhaps go out to daily work after ten days in bed and a few days' convalescence than in those who have a longer rest in bed followed by a further period in which fatigue and strain are avoided. There is, therefore, much to be said for the old-fashioned plan of waiting till the uterus has diminished in size and weight, and has sunk well down into the pelvis, and its muscular and ligamentary supports have recovered from the stretching and relaxation of pregnancy and labour before permitting the assumption of the erect position.

In all classes there is much to be gained by seizing the opportunity afforded by the convalescence after childbirth to obtain for the mother a period of rest and making the most of it. To the working woman the relief from physical strain gives time for recuperation and diminishes the wear and tear of the human machine. To women in a higher social position the relief from nervous strain is the more important factor. Pregnancy brings more disturbance and discomfort to them, the labour may be the hardest day's work they have ever done, and the care and suckling of the child distract them more, so that there is no better restoration for what they have been through or better preparation for what is to come, than a modified rest-cure under the care of a good monthly nurse. When a patient can afford it three weeks' rest in bed or on a couch, with freedom from visitors and domestic worries, followed by a week or two of fresh air with gentle exercise before resuming her ordinary life, will give both physical rest and the best chance of complete recovery from nervous and mental strain.

The movement towards early rising represents a revolt against an unreasonable and inflexible management of the puerperium, and as such has done much to introduce better general principles and more common-sense ideas into our methods.

The best plan would appear to be one which includes as much as possible of the advantages of early rising while retaining the control over the patient and what she does, which is lost as soon as she gets enough liberty to be up and about, and further to endeavour to adapt these principles to the individual characteristics and circumstances of each patient.

Considering normal cases only in which there have been or are no complications, for even a perineal laceration must introduce modification, movement in bed should be encouraged from the first. By alteration of position, especially by sitting up, the free escape of the lochia is favoured and muscular movement tends to prevent wasting. The abdominal muscles are of special importance, and much can be done to obviate that looseness of the viscera that follows relaxation of the abdominal walls. The binder should be discarded as soon as

the patient is comfortable without it, and stiff towelling which may form a species of splint to the abdomen and check muscular action should be forbidden. Bed gymnastics, physical exercises, and massage are most valuable aids towards keeping the patient in good physical condition while resting, and may be begun within three or four days of delivery. The monthly nurse of the next generation will doubtless receive instruction in massage and Swedish exercises and be prepared to undertake this treatment for those who can adequately compensate her for her extra training and special accomplishments. Massage of the abdomen and of the legs and thighs, and movements designed to bring their muscles into action, will give much of the benefit of early rising without its disadvantages. The patient after the first week can be allowed to lie on a couch or long chair, and if possible the bed or couch should be moved to the window, and, during the daytime, at any rate when the weather is favourable, it should be open so that she can obtain such fresh air and sunshine as the climate and season will permit. If there is a balcony or verandah on to which she can be moved so much the better; so long as she is kept warm by extra blankets, wraps, and hot bottles, nothing but good can come from all the fresh air she can get.

Besides trying to avoid the general physiological sluggishness which too strict a confinement to bed involves, an effort must be made to modify the regimen to meet the requirements of each particular case.

Early rising would suit a woman of placid temperament, who is amenable to discipline and conscientiously follows instructions, and is more especially indicated if she is also of the heavy phlegmatic type with a tendency to obesity. On the other hand an excitable highly strung woman of spare build, who is easily disturbed by trifles and takes her domestic duties much to heart, should be treated to a somewhat strict rest-cure, and kept for the full month from any knowledge or part in her household and from receiving visitors other than her immediate family circle. So also with the society dame who rushes from one social function to another, and who, as soon as she is free from the tyranny of doctor and nurse, will resume her customary habits, the opportunity should be taken to secure for her that quiet and freedom from visitors who require to be entertained, which will secure for her a temporary respite from wear and tear. Nervous complications during pregnancy, such as sleeplessness, headaches, or troublesome vomiting, a history of neurasthenia or nervous breakdown, are all indications for strictness in the duration and type of the rest-cure. Naturally complications in pregnancy, labour, or the puerperium call for extra precaution.

Varicose veins and hæmorrhoids, a tedious labour with subsequent prostration, slow involution with redness of the lochia, sleeplessness and other disturbing conditions are all indications for going slow.

It is impossible to enumerate all the factors which require consideration, but enough has been said to indicate the lines on which a sensible management of the lying-in time may be carried out between the extremes of keeping the patient on her back for a week and to her bed for three weeks, and letting the patient up a day or two after her labour, so that she obtains too much liberty of action and too early freedom from control. Under the stress of modern social conditions, the opportunity of easing the nervous strain which the convalescence during child-bed affords is one not to be missed by the medical attendant.

Temperature.—After a severe labour the temperature may be found to be 100° or 101° for a few hours. It then falls to, and remains at, normal. This is known as a "reactionary" temperature.

Similarly a sudden rise, followed by an equally sudden fall, of temperature may occur as the result of strong excitement or mental shock, in cases in which no evidence of infection can be found on the most careful investigation. *All cases in which the temperature remains raised for more than a few hours should be regarded as due to infection of some kind until the contrary is proved.* The onset of normal healthy lactation is *not* accompanied by fever. Mastitis, if definitely present, will naturally cause a rise of temperature like any other inflammatory disease, but it should be quite understood that there is no such condition as "milk-fever". The cases which were once diagnosed as "milk-fever" were mostly cases of sapræmia which underwent spontaneous cure.

Constipation and great engorgement of the breasts may occasion transient rises of temperature during the puerperium.

The Pulse.—The pulse-rate is, as a rule, slower than normal for the first few days. It is commonly between 60 and 70, and in exceptional cases may drop to 50. A persistently rapid pulse-rate of, say, over 100 should be regarded with uneasiness.

CARE OF THE BREASTS

During lactation the mammary glands are in a condition of activity which is so different from their ordinary resting state that pathological changes can very easily be induced. Should septic infection of the nipple occur, there may be a rapid spread of the infection through the whole gland with resulting destruction of

tissue. It is, therefore, most necessary to avoid infection by applying the principles of surgical cleanliness in the case of the nipple so far as is possible.

The treatment of the breasts should commence towards the end of pregnancy, when the patient should be instructed that the nipple should be brushed gently with a tooth brush and soap and water. If the nipple is flattened, it must be gently drawn out and rendered prominent so that the child may be able to take it easily.

During the latter half of pregnancy, secretion oozes from the milk-ducts in small quantity and dries on the nipple, where it forms small adherent scales. These should be removed early, as otherwise they may become firmly united to the superficial epithelium and thus leave a partially raw surface when detached. If these crusts are very adherent they should be softened, by applying to the nipples a compress of sterile olive oil for twenty-four hours, and then washing them away with soap and water.

During the first two or three days the breasts secrete colostrum only, but it is important that the child should be put to the breast in order to stimulate the secretion of milk and to teach it to suck. The colostrum may also possibly have some laxative effect on the child.

As the amount of colostrum is small, the child should only be put to the breast every six hours, and not allowed to remain there more than five minutes, as otherwise the child may continue sucking after the breast is emptied, and thus make the nipple sore. On the second day six-hourly, and on the third four-hourly, feeds may be given, and the period of suckling increased a few minutes each day. Every time that the child is put to the breast its mouth should be wiped with a piece of rag boiled in water, and the nipple similarly treated. After the child is removed the nipple should be carefully wiped with boiled rag and then dried, powdered with boric acid powder, and covered with a simple dressing. The latter should be as aseptic as the circumstances of the patient permit. In the majority of cases the patient will be more comfortable if the breasts are supported by a "breast-binder". This is especially the case if the breasts are pendulous. The binder may take the form of a piece of towel or sheet which extends from the axilla to below the breasts, and is fixed with safety pins in front. The ends may be slit up like a "many-tail" abdominal bandage with advantage, and if it tends to slip downwards shoulder straps may be added.

The mother should never be allowed to go to sleep while the child is sucking for fear of overlying the child, and the child should never sleep while at the breast, because the nipple is likely to become soft and sore by being retained too long in the mouth.

CHAPTER XLVI

PUERPERAL SEPSIS

PARTURITION is almost inevitably accompanied by wounds of the genital canal. The placental site is itself in the nature of an abrasion, while if the cervix of a recently delivered woman is examined, it will be found to exhibit laceration or abrasion in more or less degree in all cases. In first labours some tearing of the perineum and vaginal outlet constantly occurs, while in multiparæ, these injuries are by no means rare. In difficult labour the cervix may be split by dragging the head through it with the forceps, or the perineum deeply incised by the edge of the blade, or by extraction of the head in a faulty position or in a clumsy or rough manner.

PATHOLOGY

The organisms which can be isolated from the genital canal in cases of puerperal sepsis are chiefly those commonly found in septic wounds in other parts of the body. Thus in the more severe types some variety of *streptococcus* is found in the vast majority of cases. With it is often associated the *colon bacillus*. In a small proportion of cases the *pneumococcus* takes the place of the streptococcus as the predominant organism. In the clinically slighter cases, *staphylococci* or colon bacilli, either alone or in combination, are the organisms most commonly found, but at times streptococci are present even in these. Occasionally rarer organisms may be isolated, such as the *gonococcus*, *B. diphtheriæ*, *B. pyocyaneus*, and *B. typhosus*, but such bacteriological findings are exceptional, and do not invalidate the main fact that in the vast bulk of the cases of puerperal sepsis the infecting organism belongs to that group which is usually associated with all infected wounds, irrespective of their situation.

In the past certain investigators laid great stress on the *rôle* of anaërobic saprophytic organisms as a cause of puerperal sepsis. They stated that in a considerable number of the cases the symptoms

were due to absorption of the toxic substances produced by these organisms acting on retained placental débris or blood clot. These statements led to the division of cases of puerperal sepsis into two classes, the sapræmic and the septicæmic.

From the putrid-smelling discharge which characterizes many cases of "puerperal fever" anaërobic organisms can indeed be not infrequently isolated, but they represent merely a secondary infection, having little or no influence on the course of the disease, which is in nearly all cases due to the ordinary pathogenic organisms of wound infection.

The term "sapræmia" has, by long usage, been adopted as meaning a condition of septic intoxication by the chemical products derived from organisms localized to the cavity of the uterus and to the endometrium. In nearly all such cases the organisms are causing decomposition of some retained products of conception, as well as infecting the endometrium. Thus the products of decomposition, commonly known as ptomaines, may be absorbed through the uterine vessels, as well as the toxins which are produced by the growth of organisms in the endometrium. The condition is essentially a simple toxæmia, but the term "sapræmia" is retained, because it is well recognized and established. At the same time it must be understood that the organisms which produce this condition are by no means confined to the less harmful saprophytes as was formerly claimed, but are essentially pyogenic and pathogenic, more commonly streptococci, which are themselves facultative saprophytes. The majority of the cases of puerperal sepsis are of this type.

The Normal Bacteriology of the Parturient Canal.—The puerperal uterus is normally sterile, but from the vagina on the other hand organisms can always be cultivated. These, however, are not as a rule of high virulence, Staphylococcus albus and B. coli communis being those most commonly found, but a streptococcus, most often of the fæcalis type, may be present or other rarer organisms. When vaginitis has existed prior to labour the infecting organisms will be present in the puerperium. In antepartum infection the gonococcus or streptococcus is the commonest infecting organism. B. coli can always be isolated from the vulva in the puerperium as well as staphylococcus albus, while streptococci are not infrequently isolated from the vulva in cases presenting nothing abnormal in the puerperium.

It is further to be remembered that in close proximity to the genital canal lies the rectum, a canal swarming with organisms of potential virulence.

Cause

Infection of the wounds caused by childbirth can occur either :—

1. By organisms resident in the genital canal before parturition or in the parts adjacent to it (intrinsic infection).
2. By organisms conveyed from without (extrinsic infection).

Uterine infection is not always due to conveyance from without, since, although the uterine cavity is normally sterile, organisms may reach the placental site by ascending growth from the vagina or by migration from the neighbouring intestine under conditions of local tissue-damage or the retention of gross masses of blood-clot or placenta in the uterus.

Bond showed experimentally that minute particles of carmine and indigo placed in the upper vagina could be detected in the Fallopian tubes thirty hours later, apparently conveyed by an ascending current along the wall of the canal.

In extrinsic infection the agency is either the hands or instruments of the attendant. There are two degrees of conveyed infection. In the first, foreign organisms are directly introduced from without the genital canal. These are the gravest cases, for the organism is often of high virulence, usually a streptococcus. This is the explanation of the outbreaks of malignant puerperal fever that periodically ravaged lying-in hospitals before the days of antisepsis.

In the second method of conveyed infection the organisms already present in the vagina or vulva are deposited in the uterus by the hands or instruments of the attendant.

Whatever the method of infection, the effect of the organisms is more likely to be serious if the resisting power of the tissues has been previously lowered by tearing and bruising during the labour or by hæmorrhage or organic disease. Further, the retention in the uterus of a mass of blood-clot, placenta, or chorion favours the growth of organisms by providing them with a medium in which to multiply secure from the activity of the fluids and cells of the living tissues.

THE LESIONS OF PUERPERAL SEPSIS

The lesions of puerperal sepsis may be divided into three groups :—

1. The primary lesion.
2. Local secondary lesions (contiguity).
3. Remote secondary lesions (metastasis).

The Primary Lesion.—This is the point at which the causative organism first finds entrance into the tissues. The placental site is most important because of its extensive area, the presence in it of many large venous channels, and the fact that the drainage from the uterus is often imperfect. The result is acute septic endometritis. In nearly all fatal cases the primary lesion is situated at the placental site, which on post-mortem examination is found in a state of coagulation necrosis, suppuration, or stinking gangrene according to the virulence and nature of the infecting organisms.

A laceration either of the cervix or perineum may constitute the primary lesion, the wound being in a state of suppuration in some instances, while in others it is diphtheroid in appearance or sloughing. It is frequently impossible to say at what point the infection started, all the wounds from the placental site downwards being in a state of infective necrosis; indeed, it is probable that in many instances the infections are simultaneous.

The Local Secondary Lesions.—These are produced by the direct spread of the organisms from the site of primary infection into the neighbouring tissues. The principal varieties are as follows:—

(*a*) *Thrombophlebitis*, due to the organisms invading the veins of the parametrium from the wall of the genital canal. Of these veins there are four chief groups:—

1. Those which accompany the ovarian artery, taking the blood from the body of the uterus, and pass through the upper part of the broad ligament on either side to form the ovarian veins, terminating on the right side by joining the inferior vena cava, and on the left side by joining the left renal vein.

2. The uterine veins, which accompany the uterine arteries and eventually empty into the internal iliac veins. They take the blood from the cervix, the lower part of the uterine body, and the vaginal vault.

3. The vesico-vaginal plexus, which lies in the anterior vaginal wall and communicates with the uterine and vesical veins; and

4. The recto-vaginal plexus, which lies in the recto-vaginal septum and communicates with the hæmorrhoidal veins.

Any or all of these groups may be the seat of thrombophlebitis, but it is commonest in the upper and middle groups, especially the upper, because these veins are in direct continuity with the sinuses of the placental site.

(*b*) *Lymphangitis*, due to the lymphatics running from the vagina and uterus to the pelvic lymph glands becoming infected. A lymphangitis is thus set up, which in the more severe cases is often ac-

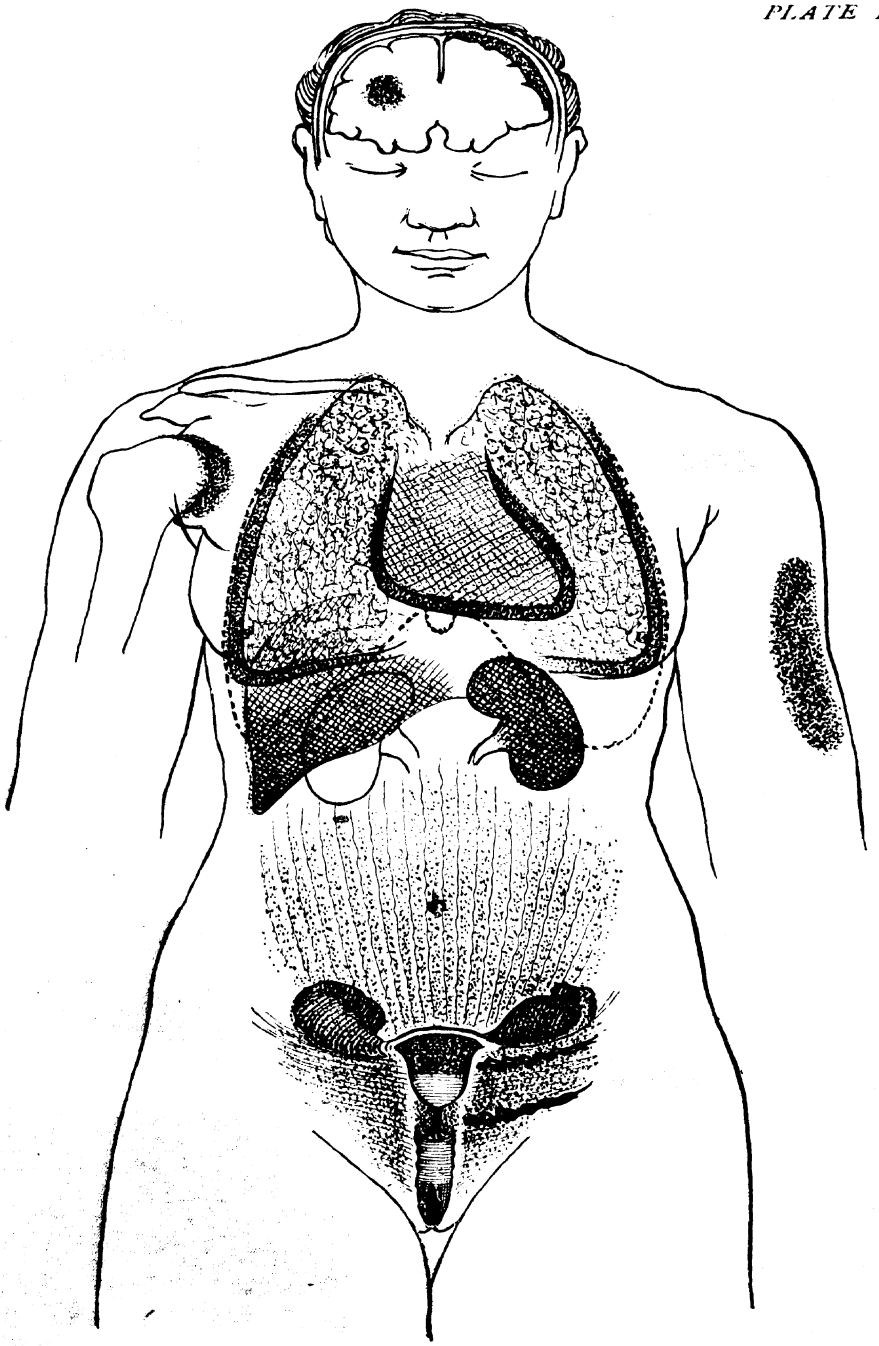


DIAGRAM TO ILLUSTRATE THE POSITION OF THE LESIONS IN PUERPERAL INFECTION.

In Yellow.—Primary lesions— the placental site, the cervix or the perinaeum.

In Blue.—Local secondary lesions—Thrombo-phlebitis of the uterine and ovarian veins—pelvic cellulitis—salpingitis—oophoritis and peritonitis.

In Red.—Remote secondary lesions—septic pneumonia—pleurisy—pericarditis—endocarditis—toxic or septicaemic hepatitis and pyelitis—meningitis—cerebral abscess—septic arthritis—abscesses in the subcutaneous tissues.

companied by thrombophlebitis. If the infection extends to the lymphatic capillaries as well as to the main trunk lymphatics the condition known as *pelvic cellulitis* is set up, the whole area of cellular tissue involved becoming œdematous, infiltrated and swollen. The result is a mass whose position in regard to the uterus is variable (see p. 552). The inflamed cellular tissue may eventually suppurate, forming a large abscess.

(*c*) *Peritonitis.* In this condition the organisms spread from the uterus to the peritoneum *viâ* the Fallopian tubes or lymphatics. It is, however, important to realize that the presence of organisms does not necessarily imply inflammatory reaction on the part of the tissues infected, for if the organisms are sufficiently virulent the tissues undergo infective necrosis before any protective reaction can occur. Infection without inflammation is therefore a very grave condition. In fatal cases of puerperal sepsis this phenomenon is often to be observed, the peritoneal cavity being loaded with organisms with scarcely any accompanying redness of, or any effusion from, the peritoneum. Similarly the Fallopian tubes, though they are the route by which the organisms have reached the peritoneum, may show little or no change beyond slight swelling and reddening. Indeed, those cases in which the definite signs of salpingitis are present are by far the most favourable, for in them the infection of the peritoneum is generally localized to the pelvis.

In less acute cases, definite inflammation of the Fallopian tube is present and usually a pyosalpinx is formed. The ovary may suppurate and form a large abscess.

The Remote Secondary or Metastatic Lesions.—The remote secondary lesions of puerperal sepsis are of two kinds:—

1. Toxæmic. These are due to the absorption of toxins that is going on at the seat of the primary and secondary local lesions; and

2. Embolic, septicæmic, or metastatic, due to the actual presence in the blood-stream of organisms which have gained entrance into it at the same situations.

Toxæmic lesions are present in all cases of puerperal sepsis to a greater or less extent, but septicæmic lesions only in the minority.

The toxæmic lesions are chiefly found in the liver, spleen, heart muscles, and brain. In their slighter forms they constitute the so-called "cloudy swelling" common to most toxic states, but when the condition is protracted definite fatty or hyaline degeneration of the cells takes place, so that the affected organ looks swollen, pale, and soft while microscopically its essential cells are indistinct and granular or glassy, and take the usual tissue-stains badly.

Septicæmic lesions are produced by the deposit of bacteria, and since in most cases the organisms are deposited in many groups the lesions also are multiple and patchy, thereby differing from the toxæmic lesions which affect the whole organ. The commonest site of embolic lesions is the lung, because the organisms have usually found entrance into the circulation through a vein. Septic pneumonia is characterized by its multiple foci, by the fact that the bronchial walls are not directly affected, and by the early involvement of the pleura. It is nearly always a fatal complication. Other embolic lesions are infective endocarditis, pericarditis, arthritis, meningitis, phlebitis, and multiple abscesses in the cellular tissues.

When the embolic lesions suppurate, the term "pyæmia" is applied to describe the condition.

Variable Characters of the Lesions.—A clear conception of the character of the lesions of puerperal sepsis is necessary before the very variable symptomatology of the condition can be understood.

A primary lesion and toxæmic lesions exist in all cases, while secondary and embolic lesions may or may not be present. On the nature and position of the lesions depend the symptoms exhibited by the patient. Thus one case may present the symptoms of a mild toxæmia with practically no physical signs; another those of a rapidly fatal septicæmia; in another a local secondary lesion such as peritonitis or cellulitis may dominate the picture; while in a fourth multiple suppuration in joints or the intermuscular tissue planes may be the striking feature.

General Symptoms

The one constant symptom of puerperal sepsis is fever. The initial rise of temperature takes place most commonly from the third to the fifth day after delivery, but it may occur as early as the first day or even during the labour, or it may not appear until the second or third week. The earlier pyrexia appears the graver the case. The temperature may rise gradually or suddenly, and in the latter case may be accompanied by a shiver or definite rigor.

The type of pyrexia varies; it may be continuous, remittent, or irregular in different cases.

Accompanying the fever is a rise in the pulse-rate, but not necessarily in proportion to the temperature. The more frequent the pulse the more serious the outlook. A rate of over 120 per minute is always grave.

The general condition of the patient is variable. In the slighter cases there is merely malaise, the patient feels "ill" or "weak" and is often emotional. In the more serious cases, however, a deceptive sense of well-being is very often present, the patient being excitable and the mind acute.

As the case progresses this sense of well-being may become exaggerated, but in others it changes to a profound sense of weakness or passes into delirium or insensibility.

Local Symptoms and Signs

The Lochial Discharge.—Some deviation from the normal in the character of the lochial discharge is common but not universal. In the majority of the cases it becomes more or less offensive and its colour changes to a brownish-red or black, while its character becomes grumous or purulent. Profuse and offensive lochia indicate the retention and decomposition of portions of placenta or membrane in the uterus. It must be remembered, however, that lochia which are offensive at the vulva were not necessarily offensive when they left the uterus. They may be retained in the vagina long enough for decomposition to occur if the perineum is long and the patient lies on her back. In cases in which there is no retention in the vagina, decomposition may take place on a pad left too long without being changed. This is especially noticed in unusually hot weather. In some of the worst cases the lochia as such cease altogether, the discharge containing no blood, this change being due to coagulation-necrosis of the placental site. In a minority no obvious change can be detected in the lochia.

The Uterus.—Septic infection of the puerperal uterus retards involution, and therefore in the majority of the cases the organ is found to be abnormally large. Indeed, nothing is so indicative of profound uterine infection as to find, perhaps on the tenth day after labour, that the uterus still reaches as high as the umbilicus. An infected uterus is tender to the touch as a rule, often locally, and this sign combined with undue size is most suggestive.

The Vagina.—Inspection of the vagina often reveals nothing. When the perineum has been lacerated the wound may look unhealthy, either suppurating or sloughing, and the parts much swollen. In exceptionally severe cases the vaginal wall may show signs of infective necrosis. On digital examination, definite signs may or may not be forthcoming; often nothing obviously amiss is discoverable except an undue size of the uterus, but in some cases

this organ is extremely tender. When pelvic cellulitis is present an induration or a definite mass, which is very tender, will be discovered, usually on the left side. The uterus is displaced to the opposite side and fixed.

Thrombophlebitis may be revealed by the finding of an elongated swelling running from the side of the uterus to the lateral pelvic wall, but the detection of these thrombosed veins is not easy. The occurrence of repeated rigors strongly suggests this condition.

The Abdomen.—In severe cases the abdomen is usually more or less tumid, though the tenderness and rigidity of classical peritonitis are uncommon, because the peritoneum so often remains passive to the infection. When definite salpingo-oöphoritis or pelvic abscess is present the lower abdomen is hard and tender, and after the lapse of some days a definite tumour can be felt more or less centrally situated. Cellulitis produces a very definite abdominal mass when it has extended beyond the limits of the broad ligament. It is a markedly lateral swelling reaching out towards or into the iliac fossa (see p. 552).

A rarer cause of a defined swelling with symptoms of puerperal sepsis is infection of a pre-existent tumour of the ovary or uterus. Such a tumour is generally either a dermoid cyst of the ovary or a fibroid tumour growing from the uterus. The swelling is defined from the outset of the symptoms, therein differing from the swelling due to a salpingo-oöphoritis or broad ligament cellulitis, which appears gradually and only after the inflammatory symptoms have lasted some days.

Other Physical Signs.—In all cases of puerperal sepsis the chest should be carefully examined. Septic pneumonia produces few physical signs in its early stages, merely a few dry crackling sounds, some of which may be due to inflammation of the pleura. Later on signs of consolidation of the lung appear, but in rapidly fatal cases the patient may not survive long enough for these to become apparent. Auscultation of the heart may reveal murmurs due to endocarditis or the friction sounds of pericarditis.

Involvement of the brain or meninges is shown by mental aberration, delirium, and, later on, unconsciousness. Septic arthritis is only met with in the more prolonged cases. The joints may suppurate. Septic rashes are quite common, morbiliform, scarlatiniform, or erythematous eruptions being the commonest. A vesicular eruption, the so-called "miliary fever" of the older writers, is sometimes seen. Very exceptionally the rash may be hæmorrhagic. Jaundice is also occasionally observed.

Clinical Course

This varies very much in different cases, which may be divided into two groups: (1) Those in which the symptoms begin in the first week, and (2) those in which they are deferred till the second or third.

Group 1.—Cases of Early Onset

The cases in which the fever begins during the first week form the large majority. For purposes of description they are conveniently divided into four types, though it must be understood that all gradations between the types are observable.

(*a*) *Mild Cases of Toxæmia*, the so-called sapræmic type.

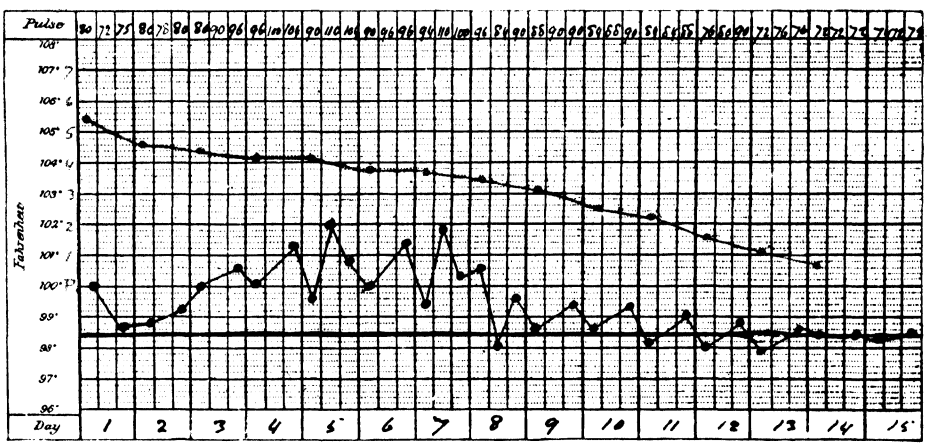


Fig. 211.—A Case of Puerperal Pyrexia of the Toxæmic ("Sapræmic") Variety.

Note that the pulse-rate is not greatly increased. The involution curve shows that the involution of the uterus was delayed during the period of pyrexia.

This is by far the commonest type of case. The temperature usually rises about the third day, and never attains a very high grade. The pulse-rate is quickened, but only moderately so (Fig. 211). The general condition of the patient is one of malaise, and she is often emotional. On examination the uterus is commonly larger than it should be, and definitely tender. The lochial discharge is of unpleasant odour or even foul, and it is often excessive, since in many of these cases the uterus contains breaking-down blood-clot or fragments of placenta or chorion. Appropriately treated these cases usually recover rapidly, but sometimes after a few days the symptoms become more menacing, and the signs of a more severe and extensive infection manifest themselves.

(*b*) *Fulminant Cases.*—In these the fever usually appears early,

sometimes even before the labour has finished. It maintains a high level, and the pulse-rate is very frequent (130 to 140) (Fig. 212). An initial rigor is common. The facies of the patient is expressive of great illness, but the mental condition is commonly clear and alert, though later on confusion, delirium, or delirious stupor often appear. The outlook is very grave; death may occur in as short a period as three days, though generally the patient lives into the second week. Of those cases that recover most pass into a condition of continued fever, with remissions which may go on for weeks in a few the symptoms abort.

(*c*) *Cases of Continued Fever.*—Either with a fulminant onset or after a few days of so-called "sapræmic" symptoms a condition of continued fever may be established, which may last for a long



FIG. 212.—A CASE OF FULMINANT PUERPERAL INFECTION FATAL ON THE NINTH DAY.

Note the high level of the pyrexia and the fact that fever was already present at the termination of labour.

time. The temperature is markedly remittent, or even intermittent, and rigors are quite common (Fig. 213). The pulse-rate is rapid and the patient looks very ill. The local signs vary. In nearly all the involution of the uterus is arrested or delayed. The lochial discharge varies in character—most often it is puriform and scanty, and it may be offensive.

The abdomen is usually more or less distended, but definite signs of peritonitis are uncommon. A mass in relation to the uterus may be discovered after the lapse of some time indicating cellulitis or salpingo-oöphoritis, but, as a rule, nothing definite is to be felt on vaginal examination. When thrombophlebitis exists the solidified veins may sometimes be felt as a cord-like extension from the side of the uterus. Repeated rigors are suggestive of this lesion.

The prognosis varies according to whether signs indicative of septicæmia are present or not. Symptoms of embolic infection are of the gravest possible import. In the absence of such the outlook must be judged on the patient's general condition, and especially her pulse-rate. If this habitually exceeds 120 the prognosis is grave, but if it falls to a moderate rate coincident with the pyrexial remissions the case is hopeful.

(*d*) *Abortive Cases.*—Abortive cases are not uncommon, an apparently fulminant onset being followed in a few days by a rapid fall of the temperature and recovery. It is important to recognize these as being due to puerperal sepsis for the protection of other women subsequently to be attended in their confinement by the same practitioner or nurse.

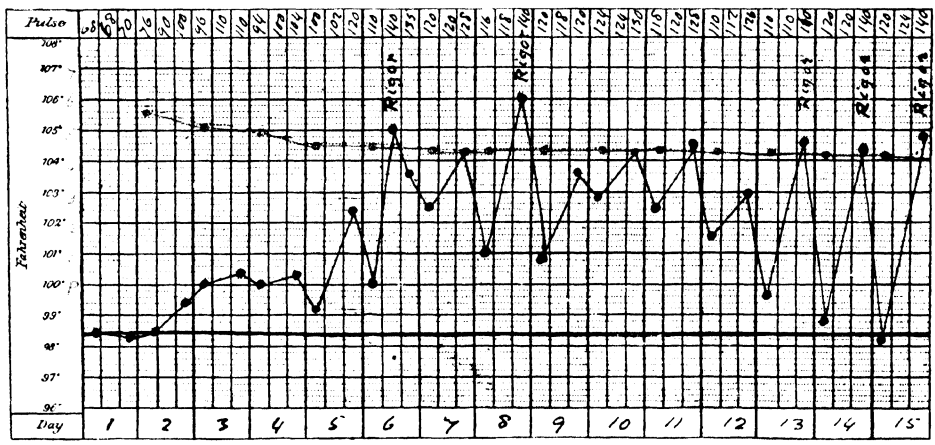


FIG. 213.—A CASE OF PUERPERAL SEPSIS OF THE "SEPTICÆMIC" TYPE, BUT IN WHICH THE PYRÆXIA ON THE THIRD, FOURTH, AND FIFTH DAYS SUGGESTED A SIMPLE TOXÆMIA ("SAPRÆMIA").

Such transition is common. Note that the involution curve is nearly horizontal, showing almost entire want of involution, and rapidity of the pulse-rate should also be noted.

GROUP 2.—CASES OF LATE ONSET

Cases in which fever does not declare itself until the second week of the puerperium fall into four categories. *viz.* those with—

1. Pelvic cellulitis.
2. Salpingo-oöphoritis with local peritonitis.
3. Femoral thrombophlebitis (phlegmasia alba dolens).
4. Superficial phlebitis.

Some or all of these conditions may complicate cases which, beginning early, run an acute and often fatal course.

The inflammation of the Fallopian tubes, the cellular tissue, and the femoral veins are then but items in the symptoms of general-

ized sepsis, and their presence may, indeed, only be discovered on post-mortem examination. In the late cases now under consideration, however, each lesion mentioned is the central feature of the clinical picture.

1. **Pelvic Cellulitis.**—This is due to a capillary lymphangitis of one or more of the tracts of cellular tissue adjacent to the uterus. The fibro-fatty tissue lying lateral to the uterus and upper part of the vagina is that most commonly involved, and, as a rule, the inflammation is limited to the left side The onset, usually in the second week, is sudden with pain and tenderness over the lower abdomen just above the groin, where in a few days a distinct swelling will be found. This swelling as it enlarges advances outwards,

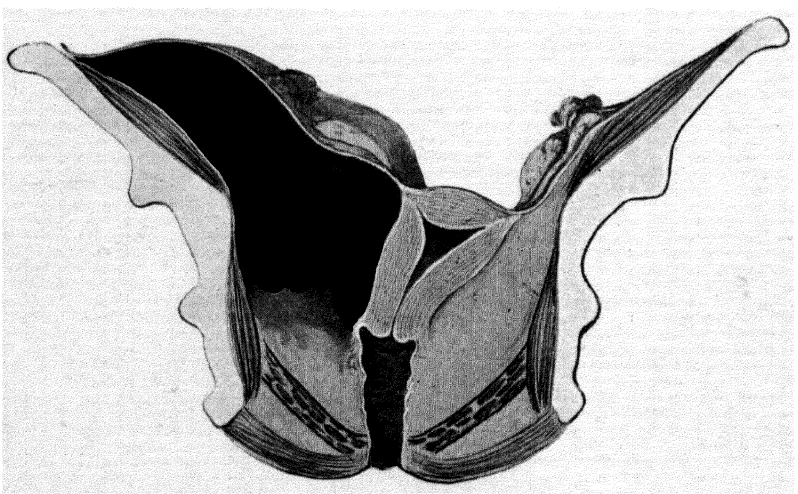


FIG. 214.—SHOWING THE AREA OCCUPIED BY A LARGE ABSCESS OF THE RIGHT BROAD LIGAMENT DUE TO PELVIC CELLULITIS, AND ITS RELATION TO THE UTERUS, VAGINA, AND PELVIC FLOOR.

and may at last occupy the entire iliac fossa (Fig. 214). On vaginal examination a tender swelling in close relation to the lateral vaginal wall and vault is early to be detected, which later on becomes indurated.

In a few cases nothing can be felt from below, the swelling being above the limits of the true pelvis, the remote parametritis described by Matthews Duncan.

The course of the cases varies; frequently suppuration occurs, the abscess pointing, as a rule, above Poupart's ligament, rarely in the thigh or buttock. The fever is prolonged and the patient becomes very anæmic and wasted: rigors are uncommon. Occasionally complete resolution quickly occurs, but, as a rule, if an abscess does not form a chronic induration remains for a long time.

Femoral thrombophlebitis not infrequently complicates the condition.

Much more rarely the cellular tissue tracts lying posterior or anterior to the vagina are alone affected, while in a few rare cases the entire pelvic cellular tissue is involved.

2. **Salpingo-Oöphoritis with Local Peritonitis.**—In these cases the lower abdomen is tender, tympanitic, and rigid. Much pain is complained of, and the pyrexia is of the suppurative type. Vomiting, constipation, and the other signs and symptoms of peritonitis are present. On vaginal examination a definite mass lying behind and

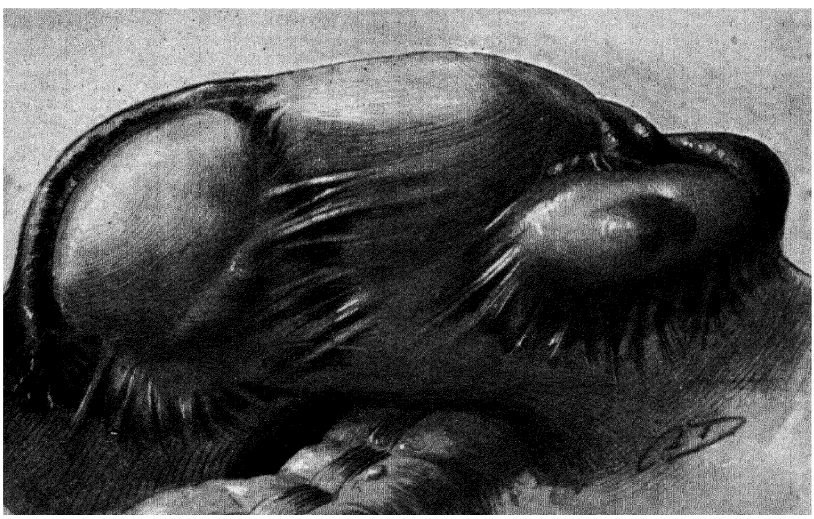


FIG. 215.—THE UTERUS AND APPENDAGES LOOKED AT FROM BEHIND.

A pyosalpinx on the right side and an ovarian abscess on the left side due to puerperal infection. The manner in which the swelling on the left side has burrowed under the left broad ligament should be noted. This is very characteristic of an ovarian abscess and causes it to simulate pelvic cellulitis.

to one or both sides of the uterus is apparent. This mass is made up of the Fallopian tube exuding pus, the swollen ovary, sometimes containing pus (Fig. 215), or a local collection of pus encysted in the peritoneal cavity.

3. **Femoral Thrombosis ("White Leg"), Phlegmasia alba dolens.**—This manifestation of puerperal sepsis begins somewhere between the tenth and twentieth day after delivery (Fig. 216). The left leg is first, and usually alone, affected.

The pathology of the condition is not completely understood. It begins as an inflammation of the wall of the main vein of the leg, usually in the upper part of the thigh, but occasionally as low as the popliteal space, and, as a result of the phlebitis, thrombosis occurs.

In many cases the inflammation appears to involve the trunk-lymphatics running with the vein, thus causing lymphatic blockage as well. The early symptoms are pain referred along the course of the vein accompanied by fever. The leg then begins to swell, the enlargement first appearing, as a rule, in the thigh. The character of the swelling varies in different cases. In the most severe the whole limb is very tense and hard, having the appearance of marble and not pitting on pressure. In slighter cases the thigh is enlarged, but not very tense, while the leg, ankle, and foot are in a condition of pitting œdema.

All gradations between the two extremes are to be observed. The duration of the fever and pain likewise varies. In cases of classical

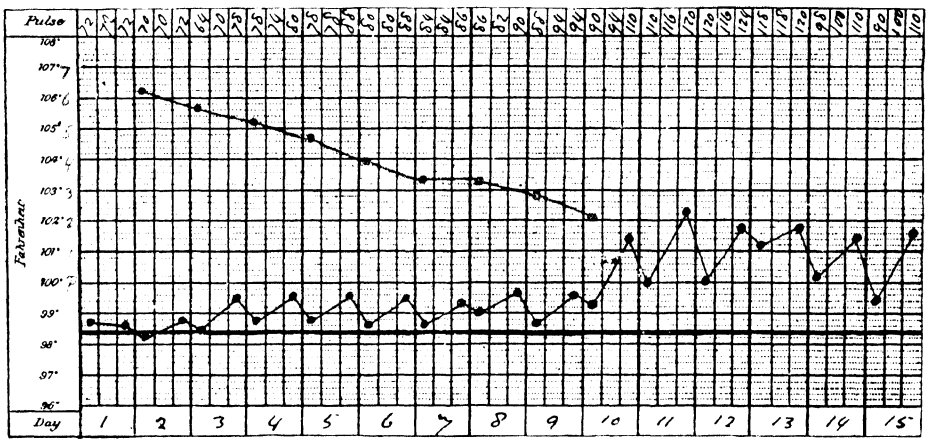


FIG. 216.—A CASE OF FEMORAL THROMBOPHLEBITIS ("PHLEGMASIA ALBA DOLENS").

Note that the pyrexia which began on the tenth day was preceded for several days by a certain slight irregularity of temperature. This is the normal course of events in such cases. The involution curve is practically normal.

"phlegmasia alba dolens" they are continued for many days and the patient is very ill, whereas in the slighter forms of simple femoral thrombosis without lymphatic blockage these symptoms may only last a day or two. The swelling of the legs takes time to disappear; indeed, in bad cases the limb may remain permanently larger than its fellow. In general, it may be said that complete recovery takes from one to two months, but it may be delayed for six months.

Superficial Phlebitis.—Inflammation of the external saphena vein, or one of its branches, is not uncommon in the second week of the puerperium, and is the more likely if the veins are already varicose. The vein becomes very tender and hard, and the skin over

it is flushed. Fever of a mild grade is usually present. The inflammation may not subside for several weeks.

It may also be noted here that hæmorrhoids (themselves varicose veins) are very apt to become inflamed after childbirth, especially if the perineum is lacerated back to the neighbourhood of the anus.

Diagnosis of Puerperal Sepsis in General

Any pyrexia occurring in the puerperium should be considered as being due to sepsis unless sure proof is forthcoming of a less serious origin. There are as a matter of fact but few other causes of fever needing consideration in this connection. In emotional women, particularly after a prolonged labour, the temperature may



Fig. 217.—Reactionary Pyrexia is shown; otherwise the Chart is normal. Note the regular fall of the involution curve and the slow pulse-rate.

rise to 100° F. or even higher for an hour or two immediately after the delivery. The term "reactionary fever" is applied to the phenomenon. It should be remembered, however, that in the acutest cases of puerperal infection the temperature also rises thus early. The tenderness and swelling of the breasts that commonly occur about the third or fourth day after delivery are stated to be capable of causing a rise of temperature, and can do so in nervous women intolerant of pain. It is, however, just at this period that septic fever is most prone to appear, nor should the fact of the temperature dropping with the establishment of a flow of milk be considered convincing evidence of a mammary origin of the pyrexia, for it has been pointed out that abortive sepsis is common. The dangerous diagnosis of "milk-fever" can rarely be justified. Emotion and constipation and such minor incidents of the puerperium are often credited with the power

of producing pyrexia. Emotional fever is certainly possible, but it is of short duration and its relation to the patient's state of mind is usually obvious.

A lying-in woman is not immune to any of the specific acute infectious fevers, but it is very rare for any of them to complicate the puerperium. On the other hand, puerperal sepsis is frequently mistakenly diagnosed as influenza, scarlatina, or measles, the latter two because scarlatiniform or morbilliform rashes are not uncommon with septic infection, and the former because in both puerperal sepsis and influenza the leading feature of the disease at the outset is fever and nothing else. Other causes of puerperal pyrexia are pyelitis, inflamed hæmorrhoids or varicose veins, and occasionally oral sepsis.

In making a diagnosis the practitioner should examine his patient very thoroughly. The state of the uterus must be investigated; undue size or tenderness suggests infection very strongly. The vagina should be inspected with special reference to the condition of lacerations and the appearance and odour of the lochial discharge. It must, however, be remembered that even when no definite physical signs can be discovered in the genital tract septic infection cannot be entirely excluded, for severe or even fatal generalized sepsis may occur without appreciable local lesions. In doubtful cases the diagnosis may be assisted or settled by undertaking a bacteriological examination of the interior of the uterus and the patient's blood. As a good general rule, it should be remembered that the likelihood of fever in the puerperium being due to septic infection of the genital tract is exceedingly great.

Prognosis

Puerperal sepsis is a serious condition, and it may be accepted that out of every 700 women confined in the British Isles one succumbs as the result of it.

The prognosis in individual cases must be founded on a consideration of the general and local conditions.

Cases in which the fever begins directly after delivery are always serious. The later the onset of the disease the better the outlook. Cases of pelvic cellulitis and femoral thrombosis nearly always recover. A continued pulse-rate of over 120 per minute is grave. The degree of the fever is of much less importance than the frequency of the pulse. Repeated rigors indicate profound septic absorption. Frequent respiration denotes septic pneumonia, and is of the worst possible significance, as are incontinence of urine and fæces and

stuporose delirium. Local signs indicating involvement of the whole peritoneum, such as marked general distension and tenderness, are of great gravity, as is absolute want of involution of the uterus after the lapse of many days. A moist tongue is a favourable sign, but if it is dry or of a brown or black colour the worst is to be expected. Persistent sleeplessness is serious, and inability to take food on account of vomiting, though this latter symptom is rare. Most of the grave cases have diarrhœa.

The presence of a simple erythematous rash does not necessarily increase the gravity of the prognosis, but a hæmorrhagic eruption and general hæmolysis indicate a fatal end, and jaundice is always of grave significance. Profound constitutional disturbance with absolutely no local physical signs is of bad import.

Treatment

Bacteriological Examination.—In all cases of suspected puerperal sepsis a bacteriological examination of the lochial discharge should be made. The most accurate method is to obtain two swabs, one of the interior of the uterus and the other of the discharge in the vagina. The passage of a swab into the uterus so as not to contaminate it with vaginal organisms is difficult except under an anæsthetic and with special apparatus.

The cervix must be exposed and swabbed with sterile saline solution as clear of all discharge as possible. A glass tube of good calibre should then be passed just through it, and through this again a smaller tube containing a swab of sterile wool fixed to a wire like a piston. The second tube having been passed to the top of the uterus, the swab should be protruded for a few moments to absorb the discharge, and then withdrawn into the tube, which itself being withdrawn should be "flammed" at its ends and plugged with sterile wool till such time as the swab inside it can be cultivated.

From the swabs immediate smear preparations should be made as well as cultures.

Exploration of the Uterus.—In all cases of puerperal sepsis the advisability of exploring the uterine cavity has to be considered.

The question is one for nice decision. It is indicated in all cases in which there is reasonable suspicion, owing to large size and tenderness of the uterus and abnormal amount and offensiveness of the lochia, that the uterus contains retained placenta, membrane, or blood-clot. On the other hand, it is useless and often dangerous when such a condition does not exist, and when signs of consecutive

lesions or generalized sepsis are already present. Sepsis after full-time labour is not nearly so often due to retention of placenta or chorion as is sepsis after miscarriage.

The operation must be performed under an anæsthetic with the usual ritual of aseptic surgery.

The patient should be placed in the lithotomy position and the vagina thoroughly douched, after which it and the cervix should

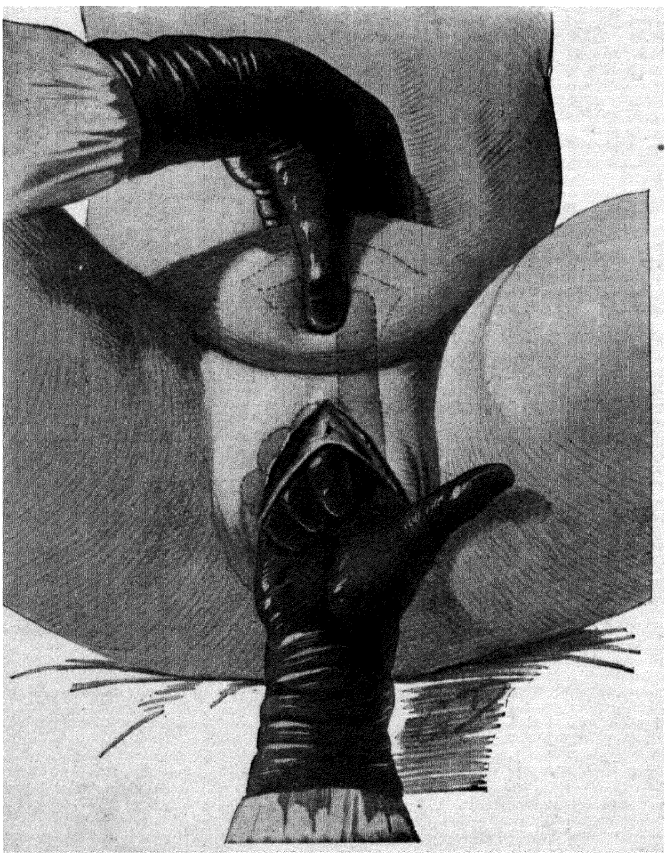


FIG. 218.—EXPLORATION OF THE UTERUS.

The index finger is first passed into the cavity. In many cases the thumb would have to be inside the vagina.

be swabbed with a 2 per cent. iodine solution. First the index finger (Fig. 218), and afterwards the middle finger, should then be introduced into the cavity, the fundus being pressed down on to the finger-tips with the left hand, so that the entire cavity may be explored. All loose fragments are then scraped away with the fingers until the operator is assured that nothing remains in the cavity (Fig. 219). This being done a double tube is introduced, and a copious intra-

uterine douche is administered (Fig. 220). The solution used should be antiseptic such as lysol ℥ i ad O i, tr. iodi ℥ ii ad O i, or biniodide or perchloride of mercury 1 in 2000. It is unnecessary and dangerous to use a curette (see p. 562). Fragments too large to be seized with the fingers should be removed by ovum-forceps.

Sera and Vaccines.—Since the infecting organism is a streptococcus in the majority of the more severe cases, polyvalent anti-

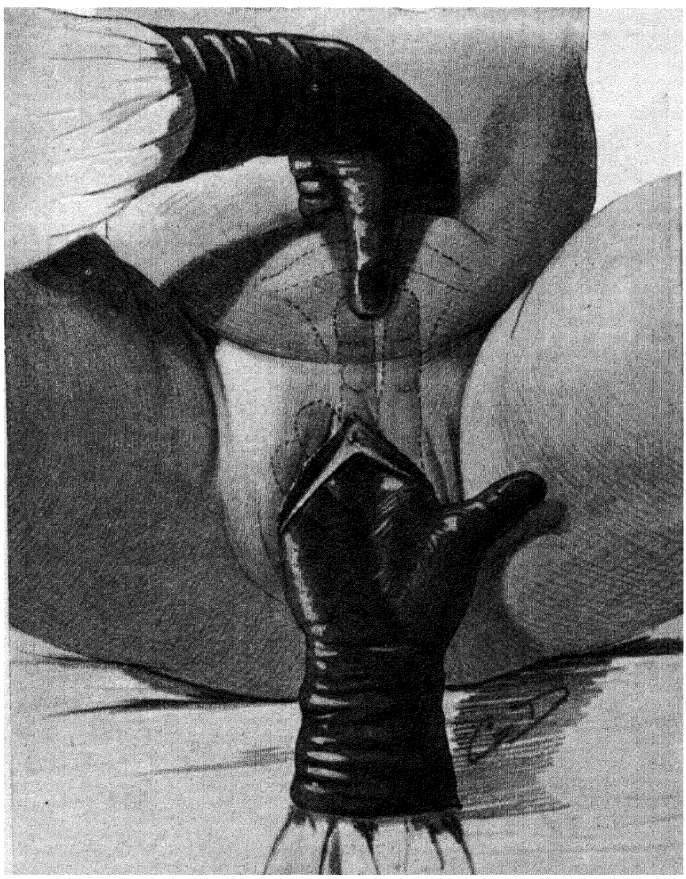


FIG. 219.—EXPLORATION OF THE UTERUS.

The position of the fingers during the evacuation of its contents.

streptococcic serum is usually indicated. It should be used freely, 50 c.c. being injected subcutaneously in three doses in twenty-four hours. It is more satisfactory to know the result of the bacteriological examination before administering the serum, but in urgent circumstances it should be administered without waiting for this because of the great probability that the infection is streptococcal. The effect of an antidotal serum is very uncertain; some cases benefit greatly,

but the result is often disappointing, though it does not appear that harm ever follows its administration. A dose of calcium lactate, 20 grs. given at the same time as the serum, may prevent troublesome rashes.

A vaccine may be used instead of, or in conjunction with, an antidotal serum; it is best to use one prepared from the particular organism isolated from the patient. A streptococcal vaccine

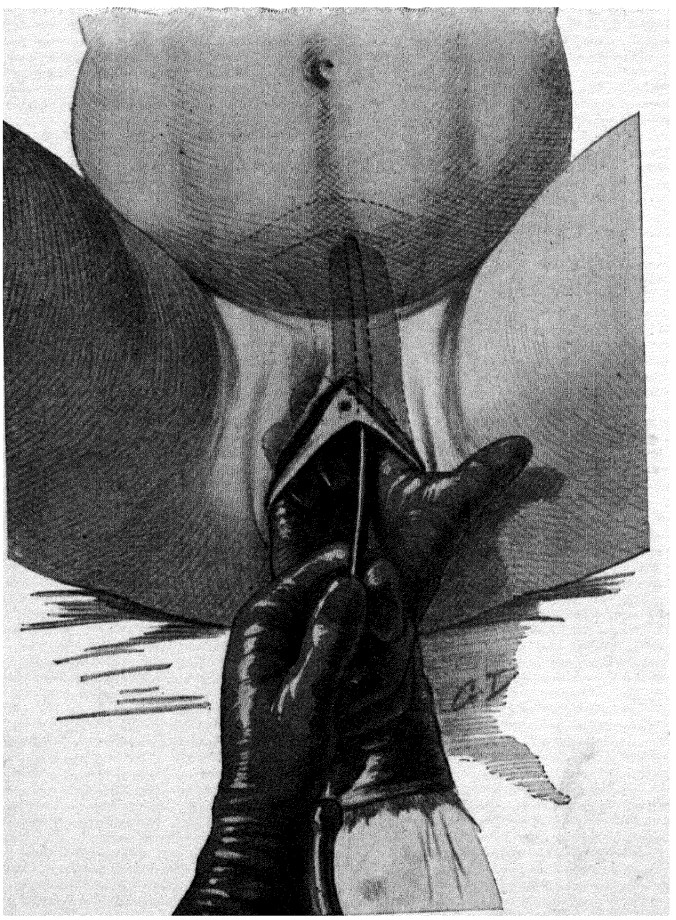


FIG. 220.—EXPLORATION OF THE UTERUS. PASSING THE INTRA-UTERINE DOUCHE TUBE.

requires great caution in its use; doses of not more than 2,000,000 should be employed to begin with, the effect on the temperature being carefully watched. The dose is usually repeated in about three days and at an hour when the temperature is as near the normal as it is likely to reach. If the dose is followed by a severe reaction and high fever it indicates that too much has been given. If on the other hand it is well borne it should be progressively increased. Lately

the use of a "sensitized" vaccine has been advised, *i.e.* a vaccine made from organisms previously treated with an immune serum. Much larger doses can be given without danger of ill effects. The method is still on trial.

Immuni-transfusion.—This method of treatment which consists in injecting into the patient the blood of the same blood group from another person who has been injected with a vaccine prepared from the organisms infecting the patient, is on its trial.

Intravenous Injection of Antiseptics.—In cases of septicæmia the injections of solutions of colloidal silver or rhodium has been advocated and some favourable results claimed. An intravenous injection of "Eusol" (chlorine in solution) combined with normal salt solution has been successfully employed. The quantity injected varies from 40 to 100 c.c.

Luker recently reported a number of cases which he had treated with anti-streptococcic serum and with intravenous and intramuscular injections of quinine bihydrochloride. He claimed much success and the treatment is worthy of trial.

Antistreptococcic serum 30 c.c.	1st day
,, ,, 30 c.c.	2nd day
,, ,, 20 c.c.	3rd day
Intravenous injection quinine bihydrochloride gr. 5	4th day
Intramuscular ,, ,, ,, ,,	5th day
Intravenous ,, ,, ,, ,,	6th day
Intramuscular ,, ,, ,, ,,	7th day
Intravenous ,, ,, ,, ,,	8th day
Intramuscular ,, ,, ,, ,,	9th day
,, ,, ,, ,, ,,	10th day
,, ,, ,, ,, ,,	11th day
,, ,, ,, ,, ,,	12th day

Douching and Intra-Uterine Applications.—Frequent vaginal irrigation is beneficial, mildly antiseptic solutions being used, such as tr. iodi ℥ ii, ad O i, or lysol ℥ i, ad O i. The question of irrigating the uterus is another matter, and in general it is not to be advised except under an anæsthetic and as a conclusion to an exploration of the uterus. The manipulation required to introduce the tube often gives much pain, and it is very questionable if the solution is distributed over the surface of the uterine cavity. Even if it is, the organisms causing the symptoms are too deeply embedded in the uterine wall to be washed away by any amount of irrigation. The application of strong antiseptics to the wall of the uterus has been advocated by certain authorities. To do it efficiently an anæsthetic is required, and the uterus should be explored

with the finger at the same time. The best antiseptics for the purpose are carbolic acid and the strong liniment of iodine. It is, however, questionable whether the harm done to the living tissues by these strong chemicals does not more than balance their effect on the organisms.

Other Operations.—Curettage of the uterus is both useless and dangerous. It is impossible to remove all the organisms from the uterine wall, and in the attempt many lymphatics and veins are opened up to fresh infection. A piece of placenta should be removed by the finger or ovum-forceps, not with a curette.

Hysterectomy is rarely justified, for experience shows that the mortality attached to the operation when carried out for puerperal sepsis is extremely high; moreover, by the time an operation of that magnitude is called for the organisms are no longer limited to the uterus.

There are, however, certain circumstances in which it may be the right thing to do, namely:—

1. When the uterus is the seat of an infected fibroid.
2. When the uterus is ruptured.
3. When an abscess has formed in the uterine wall.

Of recent years some surgeons have ligatured the uterine and ovarian veins in an attempt to prevent the entrance of septic matter from the germs of infection reaching the general circulation. The rationale of the operation is the same as that of ligature of the internal jugular vein in lateral sinus thrombosis secondary to middle ear disease. The value of the operation is doubtful. If it is employed it should be limited to cases in which the thrombosed broad ligament veins can be felt, and in which repeated rigors indicate successive escapes of septic material into the circulation (Fig. 221).

Removal of the Fallopian tubes or the ovary or ovaries may be necessary in those cases in which salpingitis or salpingo-oöphoritis is the leading clinical feature of the case. A pelvic abscess should be opened through the posterior fornix whenever this is possible.

Cases of cellulitis which have gone on to the formation of pus require operation for its evacuation. The usual position in which to effect this is just above Poupart's ligament, but some cases may require a counter opening made through the lateral vaginal wall. A large cellulitic abscess may, however, burrow into the thigh or buttock and require multiple incisions. A general anæsthetic is required, and the operator should begin by making a thorough

digital examination to satisfy himself that the swelling is really of the cellular tissue and not in the peritoneal cavity. An incision parallel to Poupart's ligament is then made, and through it a pair of Spencer Wells forceps is thrust, and search is made for the pus. When found the opening is enlarged, the cavity evacuated and thoroughly explored, and a large drainage tube is inserted.

Femoral thrombophlebitis (phlegmasia) should be treated by

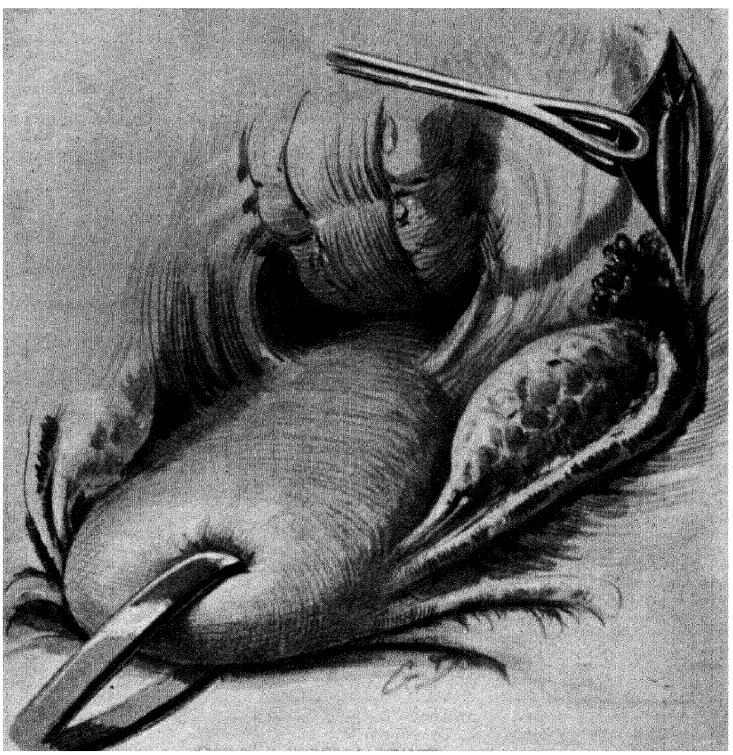


FIG. 221.—EXPOSURE OF THE LEFT OVARIAN VEIN IN THE OVARIO-PELVIC LIGAMENT.

A ligature has been placed upon the vein.

keeping the leg elevated on pillows and at absolute rest for fear of the clot becoming detached and causing pulmonary embolism.

The severe pain is relieved by painting the limb with glycerine of belladonna and applying large and frequent fomentations. Morphia may be necessary during the acute stage.

The patient should not be allowed to put her leg down until all pain and fever have disappeared, and before she does so it should first be bandaged to restrain the swelling.

General Management

It must be owned that in the bulk of the cases of puerperal sepsis the chief reliance has to be placed on the patient's own resisting powers, for at present no curative measures of assured success are known to medical science. Much therefore depends on the general care and nursing. Nourishment in an easily assimilable form should be pushed, and stimulants are often necessary or generally indicated. Prolonged cases are better nursed on a water-bed, and great attention should be paid to keeping the skin of the buttocks and back as dry and clean as possible, for in severe cases diarrhœa or even incontinence of fæces is common. Drugs have but little scope. Quinine is often given, but it is questionable if it has any beneficial effect. Antipyretics are not advisable except in sudden hyperpyrexia, which is uncommon. Cardiac and pulmonary stimulants such as strychnine, digitalis, and ammonia should be given when the heart shows signs of failing, but alcohol is probably more efficacious. Sleep is greatly to be desired, and as most septic cases sleep badly or not at all, some form of sedative or narcotic is usually demanded. Opium and morphia do not act well except when the want of rest is due to pain, which is uncommon, but acetyl-salicylic acid has an excellent effect in many cases, while a very useful sedative is chloral, bromide of potassium and cannabis indica in combination.

The Prevention of Puerperal Sepsis

Puerperal sepsis is a preventable occurrence in the large majority of cases.

This statement particularly applies to the more severe types of the disease, in which, as has been stated, the infection is usually conveyed from without.

The duty of the practitioner in this regard may be thus set forth :—

1. To find out beforehand and to treat all possible sources of intrinsic sepsis, pyorrhœa, nasal and pharyngeal sepsis, chronic vaginitis, chronic streptococcal bacteriuria, and to increase her resistance by attention to her general health.

2. To endeavour to obtain surroundings as nearly aseptic as possible in which to conduct the labour, in this connection regarding the conduct of labour in the same light as a surgical operation.

3. To ensure the initial sterility and subsequent asepticity of his hands and appliances.

4. To render the vulva and surrounding skin as free from

living organisms as possible, by the free use of strong non-irritating antiseptics.

5. As it is impossible to sterilize this area, to cover it, and particularly the anus, with sterile towels.

6. To avoid as far as may be possible the transference of organisms from the lower to the upper part of the genital tract by needless internal examination or manipulation.

7. To kill, if possible, organisms that may have been carried up during intra-vaginal manipulations, by the use of strong non-irritating antiseptics.

8. To leave the uterus empty and well retracted, and to promote free drainage from the vagina afterwards.

9. To prevent or minimize the bruising and devitalization of the soft parts from prolonged pressure during labour.

10. To take steps to prevent infection being conveyed to the woman from outside sources.

1. *To find out and treat beforehand all possible sources of intrinsic infection.*

The importance of curing before the labour all possible sources of septic infection is only slowly being realized. A woman suffering from pyorrhœa, for instance, is continually passing into her intestinal canal a peculiarly virulent type of streptococcus which, passed out on to perineal skin, may, during labour, be conveyed into the vagina. The intestinal canal of some individuals presents a flora in which streptococci predominate. Labour has extra risks in such women. Chronic streptococcal vaginitis is not at all uncommon in women apparently in good health. Labour in such a case is fraught with danger. Bacteriuria is another very common condition which may exist with few or no obvious symptoms. In some of these cases the urine contains streptococci. (See p. 80, Hygiene of Pregnancy.)

This explains the grave cases of puerperal sepsis which occur in patients on whom not a single vaginal examination has been made.

2. *To endeavour to obtain surroundings as nearly aseptic as possible in which to conduct the labour, in this connection regarding the conduct of labour in the same light as a surgical operation.*

The ideal environment for the conduct of labour is the same as for a modern surgical operation, *e.g.* the labour theatre of a modern lying-in hospital.

The circumstances in which home-conducted labour ordinarily takes place unfortunately fall very short of this, the state of the lying-in room usually ranging between utter unpreparedness and

downright disorder and dirt. Although it is a well known fact that the large majority of confinements in the worst possible surroundings are followed by a normal puerperium, it must be remembered that most of these patients had a normal labour with very few internal examinations and no internal manipulations. Every case of labour, however, carries with it a possible indication for an operation involving internal manipulations, and it is in cases in which obstetric operations are necessary in unhygienic surroundings that great danger arises. This lack of proper environment is an important factor in the continued existence of puerperal sepsis, for it is difficult for the practitioner to maintain the technique of aseptic midwifery alone and unaided amidst filthy surroundings.

It is the duty of each medical man to assist in educating the public to a clear understanding of the necessity of an aseptic environment for the safe conduct of labour. The systematic education of midwifery nurses and midwives which is the outcome of the work of the Central Midwives Board has already done much in this direction, but far more is required before it can be said that the preparation and cleanliness of the average lying-in room are satisfactory.

When the woman comes to engage the practitioner for her confinement he should take the opportunity to tell her of the things which are requisite for it, and explain the reasons for them. He should tell her that the bedroom must be cleared of all unnecessary articles and furniture, that a single bed, not a double one, should be used, and that a plentiful supply of clean water and basins should be at hand.

It may be argued that the nurse will see to these things, but, apart from the fact that not all nurses are reliable, the patient herself often objects in her ignorance to the ordinary arrangement of her bedroom being interfered with.

The articles used for the confinement should all be sterilized when this is possible. There are several firms from which a complete sterilized outfit, containing an accouchement sheet, an overall for the medical man, towels, pads, gauze, swabs, wool, and so forth can be obtained in an hermetically sealed tin. Patients in a position to afford it should be instructed to get such an outfit. Besides this there are other things very apt to be forgotten if the practitioner does not ask for them beforehand, such as a douche bath and a douche apparatus.

Many poor patients, of course, cannot afford to buy the requisites mentioned, and in attendance on them the doctor must do the best he can with what materials are available. In this connection it may be remembered that clean linen towels and sheets

fresh from the wash are probably aseptic though not sterile. In all cases besides instructing the patient the practitioner should inform the nurse of the arrangements and materials he requires.

The obstetrical outfit carried by the practitioner should contain some of the more important requisites in case the patient or nurse cannot produce them. Thus it should comprise a sterilized overall, gauze and wool, and a syphon-douche apparatus capable of being boiled. Finally, the importance of common cleanliness should be impressed on the patient. All pregnant women approaching the time of delivery should be enjoined to have a warm bath every day, special attention being paid to the external genitals. At the outset of labour, whenever possible, a similar ablution is most desirable.

In the present conditions in which confinement takes place among the poor patients the difficulties in the way of attaining an even relatively aseptic environment for the event are very great. It may well be asked whether it would not pay the State to supply the outfit to those who cannot afford them in view of the serious diminution of national fertility, both by death and by derangement of the female reproductive apparatus, of which puerperal sepsis is the cause.

3. *To ensure the initial sterility and subsequent asepticity of his hands and appliances.*

Rubber gloves should be used in the conduct of labour. They can be sterilized by boiling and, after being put on, can be re-sterilized as often as desired by immersion in a strong antiseptic solution. The skin of the hands cannot be rendered sterile, and attempts to do so by strong antiseptics only succeed in making them rough and difficult to render aseptic. It must, however, be emphasized that the use of gloves for a confinement does not make it less obligatory for the medical man to protect his hands from contamination at all other times. Their preparation for the conduct of labour should not be begun in the lying-in room, but should form part of the *régime* of daily medical practice, by strict avoidance of touching, without protection, anything capable of infecting them.

Thus, examination of the mouth, rectum, vagina, and so forth, should never be made with the uncovered finger, neither should ulcers, sinuses, or any source of pus be touched in the same dirty manner. The invariable use of soap and water after touching any patient, attention to the nails, and the avoidance and prompt treatment of all chance scratches or abrasions are points that cannot be too strongly insisted upon.

Instruments made of steel, glass, or rubber must be boiled not

only before but after use, for if they are returned to their case or bag without this first being done their repository will be infected. Next in importance to the initial sterilization of hands and instruments is their maintenance in an aseptic state during the conduct of the labour. Since the lower part of the genital tract is neither sterile nor entirely sterilizable, it is obvious that once they have touched those parts they must be regarded as being no longer sterile. This difficulty, the danger of which is the transference of vulval organisms into the uterus, must be met by carefully swabbing the region of the vulva and lower vagina with a strong antiseptic solution before passing anything through them, and by limiting the number of such introductions as much as possible. Further, the hand or instrument should be re-sterilized, after each examination, by immersion in an antiseptic solution.

A danger, however, far more serious than the transference of vulval or vaginal organisms, is the fouling of the initially sterilized hands or instruments with organisms from outside the genital area. This risk can only be obviated by excluding all but the genitals from the field of action by sterilized sheets and wrappings, in the same manner as obtains in an operation carried out on modern aseptic principles, and further by the practitioner strictly refraining from touching either with his hands or instruments anything outside that area.

It is in this matter that the aseptic ritual of home-conducted labour most often breaks down, for it is usually impossible for the practitioner, if he is working single-handed except for the assistance of a nurse, to avoid touching with his hands or even his instruments some part of the patient or objects outside the operative field.

In particular the custom of the doctor officiating both as anæsthetist and operator is a very bad one, tending to the direct transference of organisms from the patient's mouth to her genital canal.

The aseptic conduct of every obstetric operation demands the employment of an anæsthetist in addition to the operator.

4. *To render the vulva and surrounding skin as free from organisms as possible by the use of strong non-irritating antiseptics.*

Though it is impossible to sterilize the vagina and vulva, much may be done towards rendering them aseptic. To this end a warm bath, not only as a daily practice but as part of the immediate preparation for labour, is important (see p. 311). Complete evacuation of the lower bowel at the outset of labour by means of an enema, and if necessary castor-oil, is also most desirable, for the

passage of a motion during the second stage of labour is an untoward occurrence.

The external genitals themselves and particularly the perineum and anal region should be swabbed with a strong non-irritating antiseptic during the period of expulsion of the child from the vagina, and this is still more essential before passing the finger, hand, or an instrument through the vulval orifice. Before such passage the finger, hand or instrument should be dipped in a strong antiseptic so as to carry with them a dose lethal to organisms conveyed in this manner.

The hair in the neighbourhood of the vulval orifice, if long and in the way, may be clipped with scissors, and a good way to sterilize the skin in this region is to paint it with a 2 per cent. solution of iodine in spirit—as a preparation for the more deliberate operations of midwifery some such step should always be carried out. Some authorities consider that the most efficacious method is to paint this region with violet-green. If it is necessary to introduce the hand or instrument into the uterus, the vagina should always be freely swabbed out beforehand.

When previous infection of the vagina by the gonococcus or other organism has occurred, frequent daily douching should be undertaken prior to the labour (see p. 203).

The advisability of douching the vagina regularly during the puerperium is a subject on which opinions differ, but the modern tendency is to refrain from douching. No doubt the introduction of the douche-nozzle, if carried out in a careless manner, might be the means of introducing pathogenic organisms. On the other hand, this risk may be practically obviated if the nozzle is previously boiled and the external genitals freely swabbed and irrigated with an antiseptic solution before it is passed. It has to be remembered that the recumbency of the puerperium tends to the formation of a puddle of lochial discharge in the upper end of the vagina, therefore sit the patient up.

5. *To cover the skin surrounding the vulva with sterile towels.*

It is obvious that even were it possible absolutely to sterilize the perianal and perineal skin the eversion of the anus which occurs as the head is passing out of the vagina would immediately destroy that sterility. The escape of fæces or rectal mucus that occurs soils the skin and, if the bowel contains organisms of virulence, creates a possible source of most dangerous uterine infection. It is true that many individuals seem to possess a high degree of resistance to the organisms habitually resident upon them, but the obstetrician must not bank on this for it is by no means universal, nor is there any

means of distinguishing the patient who can tolerate a large dose of septic organisms from the patient who cannot. It is, therefore, most important to save the hands and instruments from any possible fouling from this source, and the only way to do this is to attach sterile towels over the skin area in question. This should always be done as a preliminary to any obstetric operation, and it is much facilitated by having the patient in the lithotomy position across the bed.

6. *To avoid as far as may be the transference of organisms from the lower to the upper part of the genital tract.*

Since sterility of the vulva and its neighbourhood is impossible of attainment, the passage of anything through the vulval orifice into the vagina carries with it the certainty of transporting organisms from the former into the latter. Similarly the introduction of anything into the uterus *viâ* the vagina necessarily infects the uterine cavity with vulval or vaginal organisms.

The gravity of the infection in either case depends upon the nature of the transported bacteria.

When the lower genital tract is healthy and has been previously treated in the manner described in the preceding section, such transportation, though undesirable, is not likely to have any serious result, for the lower tract organisms, originally only of low pathogenicity, have further been attenuated by the precautions taken.

It is otherwise, however, if the vulva or vagina are already in a septic state, from neglect, local inflammation, or expression of fæces.

As regards the uterus, it must be remembered that so long as the membranes are *in situ* they form a barrier against bacteria reaching the uterine wall, and therefore it is after their separation that the introduction of hands or instruments in the uterine cavity is most dangerous.

The risk of transferring organisms from the lower to the upper part of the genital tract has necessarily to be incurred in obstetric operations, and cannot be entirely avoided, though it can be much lessened by observing the various precautions discussed in the preceding and the immediately ensuing sections. It should never be *needlessly* incurred by making unnecessary examinations, especially of the interior of the uterus.

7. *To re-sterilize as far as may be possible that part of the genital tract to which transference has taken place, by the use of strong non-irritating antiseptics.*

Since the uterine cavity is normally sterile and the vagina and vaginal part of the cervix are normally not sterile it must be accepted

as an axiom that the passage of the hand or instruments into the uterus necessarily infects its interior.

If the membranes are still completely attached the amniotic sac is alone infected, but if the membranes have been separated, then the organisms are implanted directly on to the uterine wall. It follows, therefore, that whenever it has been necessary to perform any intra-uterine manipulation, especially manual removal of the placenta, the uterine cavity should be thoroughly washed out either with a saline solution or a strong non-irritant antiseptic solution at the conclusion of the labour and while the patient is still under anæsthesia. Some authorities consider that the most efficacious method is to use a solution of violet-green.

8. *To leave the uterus empty and well retracted, and to promote free drainage from the vagina.*

A well-retracted and empty uterus is a great safeguard against the development of intra-uterine sepsis. The maternal sinuses in the placental site and the lymphatic channels leading from it are compressed and blocked, while the complete expulsion of placenta and blood-clot removes a potential culture medium. Moreover, besides the direct introduction of organisms into the uterine cavity in the course of labour, the presence of blood-clot or placental débris acts as a strong incentive to ascending bacterial growth from the vagina and cervix.

A well-retracted and empty uterus is to be obtained by the correct management of the whole labour, and especially its third stage. Retraction of the uterus should be aided by the hypodermic administration of ergotin or pituitary extract if necessary.

Free drainage from the vagina during the puerperium should be promoted by avoiding recumbency during the puerperium as much as possible, the woman being encouraged to sit up and to move about in bed as soon as possible after the confinement. The routine adoption of early rising from bed, which is practised with much success in some lying-in hospitals, has among its chief advantages the increased drainage from the vagina which the upright posture confers.

9. *To prevent or minimize the bruising and devitalization of the soft parts during labour.*

Bruised and partially devitalized tissue invites invasion by bacteria, and once lodged in it they grow rapidly.

In prolonged obstructed labour during which great pressure is exercised on the soft tissues the effects of infection may become

apparent by fever or offensive discharge even before the child is delivered.

The early recognition of grave obstruction to the birth of the child and its appropriate treatment is the best means of avoiding sepsis provoked by tissue-bruising. Prolonged attempts at delivery by the forceps are strongly to be condemned. Delivery may indeed be eventually effected, but the risk of subsequent sepsis owing to the damaged and devitalized state of the soft parts is great; moreover, most of the children delivered by such violent methods are either born dead or die soon afterwards. It is impossible to lay down a hard-and-fast rule as to the length of time over which it is permissible to make forceps-traction, but in general it may be said that if after half an hour's fair pulling no advance has been made, the justifiability of continuing to attempt delivery by that means is very doubtful.

The superiority in power of resistance to bacteria and in readiness of healing which a clean-cut surgical wound has over a laceration is a strong argument in favour of a more frequent resort to episiotomy, *i.e.* the deliberate division of the perineum when the birth of the head is abnormally delayed by rigidity of that structure.

10. *To take steps to prevent infection from being conveyed to the woman from outside sources.*

By the rules of the Central Midwives Board, a midwife who is herself liable to be a source of infection, or who is in attendance on a patient suffering from puerperal fever or any other condition supposed to be infectious, must report the fact to the Local Supervising Authority, and must disinfect herself, her appliances, and her clothing to the satisfaction of that authority before going to any other maternity patient. It is the moral duty of a practitioner to see that midwives and maternity nurses acting under him observe this rule.

Of equal importance is the question of the course he himself is to adopt if, having already under his care a case of puerperal sepsis or other infectious fever, he is called upon to attend a confinement. The conveyance of septic infection to a parturient woman from outside sources can be absolutely guarded against by observing the rules of common cleanliness in dealing with all patients and by maintaining the tenets of aseptic surgery in the lying-in chamber.

A woman during labour or the puerperium appears to be no more liable to infection by one of the common acute specific fevers than other individuals.

The question as to whether a practitioner should take other

confinements while he is attending a case of acute puerperal sepsis is a more difficult matter to decide. It is shown conclusively that the conveyance of the disease from patient to patient is only possible by actual transport of the organisms on the person, clothes, or appliances of the obstetrician. Such conveyance is, of course, entirely preventible, and given that he preserves both ordinary and surgical cleanliness, wears rubber gloves, and sterilizes his appliances, the possibility of the disaster is out of the question.

On the other hand, he has to consider that should a second case become septic the public will be very apt to attribute the misfortune to him, whatever the real cause. Further, in the event of such a misfortune, he himself, however unreasonable the thought, may be unable to dismiss from his mind the idea that he was the agent, and thus both his reputation and peace of mind may undeservedly suffer.

It would seem that, however unreasonable temporary abstention from further obstetric practice may appear from the standpoint of pathology, the medical man will be consulting his own interests best by refusing to attend other confinements while treating a case of grave puerperal sepsis.

Finally, the medical man has to remember that puerperal fever is one of the diseases notifiable by law. Unlike the rest of them thus scheduled, it is not a single pathological entity, and hence it is impossible to define exactly the scope of the denomination from the standpoint of the Public Health Authorities. Theoretically, every case of fever, no matter how slight and transient, so long as it arose from infection of the genital canal during or after labour, should be notified. Such a literal interpretation of the law would, however, be unreasonable, and in practice it may be accepted that only those cases should be notified in which from the clinical picture and the results of the bacteriological examination it is certain that the patient is suffering from infection by a virulent organism.

CHAPTER XLVII

DISTURBANCES OF THE BREASTS

ENGORGED BREASTS

ABOUT the end of the third day the breasts become engorged with blood and begin to secrete milk, and if the child (from prematurity or any other cause) does not empty them sufficiently, the breasts rapidly become over-distended with blood. They then look large and are covered with dilated veins; the skin over them may be slightly congested. They are very tender and painful, and when touched are found to be hard and knotted. Nodules of engorged breast tissue may be palpable in the axilla. Such a condition is very painful to the patient, and may prevent her from sleeping; it occasionally passes into a mastitic abscess, and even without the formation of pus may be sufficient to cause a rise of temperature. A rise of temperature on the third day should not be attributed to engorgement of the breast unless the presence of uterine sepsis can be excluded.

TREATMENT

In the early stages the child may be able to take enough to relieve the engorgement, but once the condition is fully established, there is sufficient congestion and pressure on the ducts to prevent the flow of milk and the child from emptying the breast, so that it will be necessary to resort to more active methods of treatment. The routine treatment for such cases is first to apply fomentations for four hours over the whole breast, with the exception of the nipple, to soften it. The nurse then applies a little warm olive oil to the skin as a lubricant, and massages the breast firmly but gently with the palms of both hands, from the periphery towards the nipple. Especial care should be paid to outlying nodules of mammary tissue, which may be found in the axilla. When the massage is having a beneficial effect, milk flows from the nipples. The ducts may be emptied by the application of the breast-pump, but the latter will do little good while the breast is hard and knotty. After the condition has been relieved the child should be put to the breast

before it again becomes engorged. If the condition proves obstinate, saline purges should be used freely and fluids by the mouth should be strictly limited.

CRACKED NIPPLES

The nipple may become sore and painful from two conditions. One consists of a loss of the epithelium covering a considerable area of the nipple, with the resulting formation of a raw area which is very tender. The other is a small deep fissure situated either at the tip or the base of the nipple. The two conditions frequently exist simultaneously and are referred to as "cracked nipples".

Cause

This condition is caused by lack of care before delivery in not keeping the nipple clean and free from crusts, and also in not treating undue flatness of the nipple. After delivery a flat nipple, or one that is not kept aseptic and dry, tends to become sore. If there is not sufficient milk in the breast a hungry child will suck too vigorously, and its gums cause abrasions of the epithelium. Similarly a very potent cause of this condition is putting the child to the breast too frequently, and leaving it there too long during the first three days after delivery when the supply of milk is not established. The nipples may also become sore if, when the child is suckled, the mother does not depress the breast away from the child's nostrils with her fingers, since, if the child cannot breathe through its nose, it has to drop the nipple repeatedly and then take it up again. Thrush and syphilis are occasional causes of soreness of the nipple.

Results

There are tenderness and pain during suckling. There is also a risk of a mammary abscess forming, as the raw area acts as a means of access for infecting organisms. An important symptom is the vomiting of altered blood by the baby, as it draws maternal blood into its stomach with the milk, and since the blood usually causes vomiting, it may give rise to the idea that hæmorrhage is occurring from the wall of the infant's stomach.

Treatment

The prophylaxis of this condition consists in the treatment described on p. 540. If they are hard and inclined to crack, boric acid

ointment may be used. During the first three days the child should be put to the breast for only a few minutes, and in no circumstances allowed to sleep with the nipple in its mouth. At the end of each feed the nipple must be cleaned and dried as already described. Once it has become sore an antiseptic should be applied to it, one of the best applications being 1 in 1000 solution of perchloride of mercury, which forms a protective film of coagulated albumin on the surface of the nipple and is also an antiseptic. As this solution is poisonous the nipple must be well wiped before the child is allowed to suck again. Another popular application is Tinct. Benzoini Co., which, being non-poisonous, can be given to the mother herself to apply.

If suckling is very painful, a sterilizable nipple shield of glass or rubber may be tried. In severe cases the child should not be put to the affected breast for twenty-four hours; during that time the nipple is kept covered with 1 in 1000 perchloride of mercury, and the breast emptied when necessary by massage and the breast-pump.

ABSCESS OF THE BREAST

A mammary abscess usually results from septic infection entering through a cracked nipple, and therefore does not often occur before the second week of the puerperium. The usual classical signs of acute inflammation are present. A quadrant of the breast becomes painful, tender, œdematous, and usually reddened. The temperature is raised, the pulse is quickened, and the axillary glands become tender and enlarged. The abscess may form near the surface or in the actual substance of the breast. The latter is naturally more serious, and if neglected may burrow deeply in all directions and lead to almost total disorganization of the breast.

Treatment

The child must be taken from the breast and, if the case is at all a severe one, it is better for the opposite breast also to be bandaged, and no further attempt should be made at breast-feeding, as the continuation of the flow of milk may delay healing. The abscess should be freely opened under anæsthesia by incisions radiating from it below the nipple, if possible, in order to avoid a scar above the nipple. Free drainage should be established, and all the pockets of the abscess thoroughly opened up. If pus is coming away from the nipple and the case is a mild one, it may be possible to avoid operative interference by trying Bier's method with a powerful breast-pump.

FLUSHED BREAST

A condition which has been named "flushed breast" occasionally occurs during the first ten days of the puerperium. The patient complains of pains in the breast and her temperature may rise as high as 105° Fahr. On inspection of the breast a wedge-shaped patch of cutaneous hyperæmia can usually be seen with its apex at the nipple, which commonly persists only for a few hours, and is slightly tender. If hot fomentations are applied and the nipple dressed with some 1 in 1000 perchloride of mercury, the symptoms generally disappear in from 24 to 48 hours. Rarely a superficial abscess may form and need incision.

THE PREVENTION OF LACTATION

When the child is still-born, when the mother is suffering from some general disease (such as tuberculosis or morbis cordis), and when the mother does not desire to feed the child herself, it is necessary to arrest the secretion in the breasts. For other contra-indications see p. 587.

This treatment should be begun as soon as possible after delivery before the secretion of milk has started, since it is easier to prevent the onset of secretion than to stop it once it is fully established. A satisfactory method is to wash and powder the breasts and then to cover them with wool; the wool should be packed round the nipples so as to avoid pressing on them and so flattening them. The breasts should then be firmly bandaged; this may be done with an ordinary roller bandage or with a many-tailed bandage. The latter has the advantage that the tension can be increased or diminished by adjusting the pins, whereas a roller bandage has to be removed and re-applied in order to tighten or loosen it. The bandage should be applied within a few hours of delivery with the object of diminishing the physiological hyperæmia of the breasts which precedes and produces the flow of milk. In addition to the bandage the patient should be given as little fluid to drink as possible, and fluid may also be removed by administering saline purgatives till watery motions result. Especially in those cases in which the supply of milk is already established before treatment is begun, it may be necessary to relieve congestion by massage and the breast-pump, but the bandage should not be removed for this purpose unless the patient has considerable discomfort and a slight rise of temperature.

Belladonna, either locally or by the mouth, is generally unnecessary and undesirable; if used at all, glycerine of belladonna

painted on the breast is more acceptable to the patient than the old-fashioned plaster. Another preparation which gives considerable relief to the patient is antiphlogistine. Others prefer to leave the breasts unbandaged, and to allow the activity of the breasts to subside without adopting any local treatment.

GALACTOCELE

A galactocele is a retention cyst of one of the larger mammary ducts. Its contents are chiefly milk. It is probable that most of these swellings owe their origin to inflammatory changes in the wall of the affected duct, whereby the lumen becomes occluded. As a result the retained milk is usually mixed with more or less pus, and large droplets of free fat are often present.

Signs and Symptoms

A local fluctuating swelling can usually be observed, the skin over which is reddened. The general appearance suggests a large abscess, but the pain is much less and there is no constitutional disturbance. A galactocele when small and deeply situated may be mistaken for a carcinoma in the breast.

Treatment

The cyst should be freely incised and drained.

GALACTORRHŒA

This is a condition occasionally met with when a continuous flow of pale watery milk occurs from the nipple. The amount lost *per diem* amounts to a considerable quantity. The breast in many cases presents no external signs of great activity, indeed it is often quite flaccid. Usually only one breast is affected. The cause of the condition is unknown.

Treatment

The fluid is of little nutritive value. In many cases weaning has already been carried out. If it has not, the child should be withdrawn permanently from both breasts and artificially fed. The breasts should be very firmly bandaged, and, to effect this the more surely, the patient should be kept in bed. Before applying the bandage the breast should be painted with extract of belladonna.

Tincture of belladonna should be given by the mouth three times a day in increasing doses, a look-out being kept for the appearance of symptoms of belladonna poisoning.

CARCINOMA OF THE NURSING BREAST

Carcinoma, when it develops in the nursing breast, grows with great rapidity and is very malignant. The appearance of the breast is very characteristic; it is obviously larger than its fellow, the nipple is flattened or retracted and more or less fixed, and the skin over the tumour is in a condition of firm tumidity—the so-called "pig-skin thickening". It may present a distinct blush or even obvious capillary injection, if the growth is close to the surface.

Diagnosis

Immediate recognition is of the utmost importance. The rapidity with which the enlargement makes its appearance and the reddening of the skin over it often suggest mastitis to those who are not familiar with the true condition. The fact that the swelling has appeared without pain and is scarcely tender to palpation, should at once give a clue to the right diagnosis.

A small deep-seated galactocele may, as has already been said, resemble carcinoma, but the cyst may be made to fluctuate, and the skin over it is neither adherent nor thickened.

Treatment

The breast with the lymphatic area draining it must be removed as soon and as widely as possible.

OVARIAN TUMOURS COMPLICATING THE PUERPERIUM

An ovarian tumour may become infected during the puerperium following torsion of its pedicle, by infection spreading from puerperal sepsis or following pressure during labour. Peritonitis may result if an ovarian cyst containing irritating or infecting material has been ruptured by the passage of the child during labour and it contains pus or is a dermoid.

Symptoms and Signs

In addition to the uterus, the ovarian tumour will be felt. Any indication of pelvic peritonitis during the puerperium should lead

to an examination with a view to discovering whether it may not be due to an infected ovarian tumour. An ovarian pedicle is particularly liable to torsion during the puerperium.

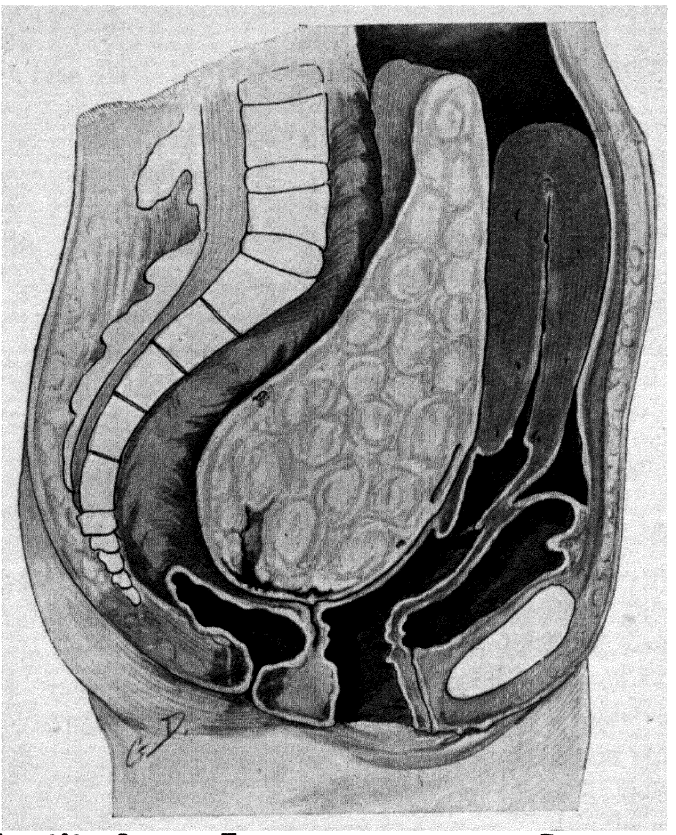


FIG. 222.—OVARIAN TUMOUR COMPLICATING THE PUERPERIUM.

The ovarian tumour which formed the obstruction lies in Douglas' Pouch and projects also up into the abdominal cavity. (Museum Royal College Surgeons.)

TREATMENT

If a patient has passed through labour and is known to have an ovarian tumour, a careful watch should be kept for any symptoms and signs denoting the occurrence of any of the above-mentioned complications, in which event immediate ovariotomy must be performed. In the absence of such complications there may not be any harm in postponing the operation for a few days.

FIBROID TUMOUR COMPLICATING THE PUERPERIUM

A fibroid may become infected during the puerperium as part of a puerperal sepsis; the pedicle of a pedunculated subperitoneal

fibroid may become twisted; the tumour may undergo necrobiosis or red degeneration, and if submucous it may gradually become extruded, this process being accompanied by severe hæmorrhage or sepsis. A fibroid may cause sub-involution and displacement of the uterus.

Treatment

If the tumour becomes septic or undergoes necrobiosis it should be extirpated by abdominal myomectomy or hysterectomy, except in the case of a submucous tumour, which, if possible, should be removed by the vaginal route.

Section IV—THE NEWBORN CHILD

CHAPTER XLVIII

MANAGEMENT AND FEEDING OF THE NEWBORN CHILD

Management

When the child is born, the retraction of the uterus prevents respiratory exchange at the placental site being maintained between the mother and the infant. This, in conjunction with the stimulus of the cold air on the infant's skin, causes the infant to make efforts at respiration. The mouth and pharynx should be carefully cleansed with moist gauze wrapped round the little finger to prevent mucus or amniotic fluid being inspired.

With the establishment of respiration marked changes take place in the passage of the blood through the heart. The blood from the pulmonary artery no longer short-circuits with the arch of the aorta *viâ* the ductus arteriosus, but goes straight on its course to maintain the pulmonary circulation. The relative pressure in the two auricles changes, and the foramen ovale, the passage between the two auricles, becomes closed by the Eustachian valve, which in a few days fuses to the margins, thus completing the interauricular septum.

The child at birth is covered with a greasy substance, called the vernix caseosa, which adheres closely to its body and forms a protection to it while lying in the amniotic fluid. This is difficult to wash off unless the child is smeared first with warm olive oil.

Care of the Eyes.—As soon as the head of the child is born and before its eyes are open, the eyelids are swabbed with a saturated solution of boric acid, a fresh piece of wool being used for each eyelid. If the mother has a vaginal discharge, or if there is the slightest suspicion of her being the subject of gonorrhœa, an antiseptic vaginal douche should be given before rupture of the membranes. If the patient has acute gonorrhœa, it is essential that the vagina should be dry-swabbed under an anæsthetic and painted with tincture of

iodine. When the mother has a purulent vaginal discharge the infant's face should be carefully washed and one or two drops of a fresh 2 per cent. solution of silver nitrate instilled into the child's conjunctiva, and then the eyes bathed in salt solution. This may cause a sharp inflammatory reaction often with the production of a purulent discharge, which, however, is free from gonococci. When the child is put aside, care should be taken that its hands are confined within the wrapper so that it cannot re-infect its eyes. The child's face must not be washed in the same water as its body. If one eye only is involved the child must lie upon the affected side to avoid pus running into the sound eye, which should be protected by cotton wool and a bandage.

Silver nitrate solution has been found a safe prophylactic, and has reduced considerably the incidence of ophthalmia neonatorum.

Care of the Umbilical Cord.—When the umbilical cord has ceased pulsating, or before if there be need for haste, it should be ligatured about 1 inch from the umbilicus with three or four strands of thread knotted at each end and sterilized. A second ligature should be tied at a short distance from the first but nearer the maternal end, to prevent the escaping blood soiling the linen, or, in the case of twins with a communicating circulation, to prevent the second twin losing blood. A careful inspection of the cord to see that there is no hernial protrusion of bowel should be made before the ligature is tied.

After the child has been washed, the cord is dusted with starch powder, a piece of sterilized gauze or linen is wrapped round it, and it is then turned up over the abdomen to prevent its being soiled by the urine. A flannel binder is placed over the gauze to keep it in position. The circulation of the distal end of the cord being cut off, it dries up and separates usually about the fifth day by a process of phagocytosis assisted by an ingrowth of epithelium, though occasionally it may remain attached even as long as a fortnight.

Stools and Urine.—For the first few days after birth the child passes motions of a dark green colour, soft and sticky in consistence, called the meconium. This is composed of varied epithelial cells cast off from different parts of the intestinal tract, and of hairs and epidermal cells which have been shed and swallowed with the amniotic fluid. Meconium owes its peculiar colour to the presence of bile pigments. At birth the contents of the intestinal canal are sterile, but within a few hours they become contaminated with the various flora which are present throughout life. Meconium may be irritating to the child's skin, and it is wise to protect the skin of the buttocks with a cream made of zinc oxide and lanolin.

The child soon after birth passes urine, though this act may be delayed for some hours. Before seeking means to overcome the presumed distension of the bladder, it is wise to examine the child to see if there is a swelling in the lower part of the abdomen, as in the absence of such swelling it may be that the urine has been passed unnoticed during birth, and the little fluid the child has taken since has not been enough to distend its bladder. In a male child the prepuce being tight may prevent urination. Before passing a catheter the bowels should be encouraged to act, when the urine may be voided at the same time; or the child may be placed in a hot bath with the end of the penis out of the water or the hand over the meatus urinarius If these means fail, it may be necessary to pass a catheter, and it will be found to be a difficult manœuvre. A very fine soft rubber or gum-elastic catheter, previously sterilized, must be used, and often the irritation of the instrument passing along the urethra will be enough to stimulate the bladder to force out its contents. Sometimes the attempt to pass a catheter will reveal the fact that the child has an impervious urethra.

The healthy child passes some three to four actions in the twenty-four hours, and urinates frequently. After about the third day the actions change to a bright yellow colour of a smooth consistence, and are not formed. It is found that a child passing three to four actions a day is, as a rule, more healthy than one having only one or two actions in the day.

The child must be taught early to have regular habits, and it is surprising how soon an infant will learn what is required of it in the hands of a skilful nurse. Great care must be exercised in changing the napkins as soon as they are soiled, otherwise the skin will become excoriated. The infant will generally give notice of this necessity by crying. The napkins used for the infant must be made of soft material; they must be carefully washed without any soda in the water, and thoroughly aired. They should not be sent to the laundry but washed at home.

The clothing for the infant should be warm and light in weight. The binder should be made of flannel and the vest of wool. All garments should be frequently changed, as apart from being stained by fæces or urine they become soiled by perspiration.

An infant should have a warm bath once a day, and be thoroughly washed at night. Great care must be taken in drying the baby and powdering the flexures.

BREAST-FEEDING

In view of its importance to the health and well-being of the nation breast-feeding is a subject which has not received the attention it merits, and our knowledge regarding lactation, normal and abnormal, and of the practical management of mother and infant is of an elementary order. More has been done on the Continent than in this country or in America, but the world-wide interest in all matters tending to the diminution of infant mortality and to the improvement of the physique of nations has given a great impetus to the study of breast-feeding. In regard to Great Britain, at any rate, it must be acknowledged that this study has rather been forced on the medical profession from outside, more especially by workers in social economics, than originated from within the profession. This neglect of the subject holds good alike for teachers, general practitioners, and even for those in the public health service. There have indeed been heard occasional voices crying in the wilderness, but the profession as a whole has not played the part it should have done in insisting strongly on the natural feeding of infants. The principle has been acclaimed, but merely with lip-service and has not been fought for with conviction. Text-books have devoted pages and even chapters to artificial feeding, but beyond expressing the pious opinion that breast-feeding is the best for mother and child nothing more is said on natural feeding except, perhaps, to give a list of the contra-indications and the methods to be adopted for arresting lactation. With such training it is not surprising that the family practitioner has either played a passive *rôle* and, without protest or with feeble demur, has fallen in with the whims of his patient or accepted the dictation of her monthly nurse, or, if he has played a more active part it has been to wean the infant from the breast because, in his ignorance of breast-feeding and infant management, it appears the easiest way out of his difficulties.

It is a curious commentary on the triumph of science in making possible the rearing of infants on a substitute for their natural food that bottle-feeding should have become so general as almost to be taken for granted among certain sections of the community. As soon, however, as the problem is approached from the point of view of the nation as a whole and the effects studied over large numbers, the evils of substitute-feeding become clear, and it is a question whether even the triumphs of science will enable a race to survive in the struggle for existence if it depends for the rearing of its young on the milk of another mammal. Its children deprived of their mothers' milk are handicapped from birth in physical development and powers of resistance to disease. Well as an individual child may do on the substitute

one can only speculate on how much better he would have done on the real thing, for substitute-feeding must always be inferior feeding.

As every practitioner of medicine should be prepared to justify the faith that is in him, some consideration of the reasons for urging natural feeding is required. The argument from physiology scarcely needs elaboration, but a few points in comparative physiology may be mentioned to illustrate the difficulty in finding a satisfactory substitute for the natural food of the infant.

The proportion of the three primary food substances in milk bears a direct relation to the rate of growth, habits, and environment of the young mammal. If growth is rapid the proteid content is high : thus in the rabbit, which doubles its weight in a week, the proteid is 8 times, in the bitch about 5 times, and in the cow 2 to 3 times that in human milk, the puppy doubling its weight in about 10 days and the calf in about 2 months instead of the 5 to 6 months taken by the baby. The variations in the other food substances are not as a rule so marked, except to meet special conditions, as for example the enormous proportion of fat, amounting to nearly 50 per cent. in the milk of the whale, to allow for the great heat-production necessary to maintain the body temperature of its young in arctic waters. Again, in cow's milk the proteid is not only more than double that in human milk but differs also in its characteristics. The proportion of caseinogen to soluble proteid is more than 4 to 1 in cow's, whereas in human milk the percentage of soluble proteid is nearly 3 times that of caseinogen (see table, p. 588). The curd of mother's milk is thin and flocculent, while the caseinogen of cow's milk forms a firm, tough curd suitable to the rumen of the calf, but trying to the digestive powers of the human baby. There are differences also in the degree of fat emulsion, which is finer in human milk, thus affecting also the ease of digestion and absorption. From the standpoint of preventive medicine the argument is equally strong. The child obtains its natural food at the body temperature, direct from the nipple, without chance of contamination and with its vital properties unimpaired. To the developing child gastro-intestinal disturbance and infections are the two chief dangers, and the greatest security against both is breast-feeding. In addition to the diminished risk of intestinal infection there is evidence to show that some degree of the immunity to infections acquired by the mother is passed on to the infant through the breast milk. The poorer physical development and lessened resistance consequent on a disturbed or infected digestive tract, though difficult of proof, are recognized as much more frequent with bottle-feeding; the increased infantile mortality is easily shown by a study of vital statistics.

Our efforts in the past have been directed too exclusively towards perfecting the substitutes for mother's milk instead of perfecting the management of breast-feeding, and have thus been along wrong lines. Although they have attained great success they cannot reach the results obtained by natural feeding, and this holds good for all mammals. The success of the she-wolf in rearing Romulus and Remus is not borne out by the almost uniformly unfortunate experience of the Zoological Society and stock-breeders in their attempts to bring up the young animal deserted by its mother on the milk of another species.

So far the importance to the growth and health of the child of its natural food has alone been considered. To the mother also there are many advantages—better and more complete involution of the uterus and hence a quicker return to the normal, as well as moral and psychological benefits, difficult to explain, especially the greater and more intimate knowledge of her infant and its needs that comes from complete motherhood.

The conditions in which breast-feeding is inadvisable for the mother's sake are rare, *e.g.* grave disturbances of nutrition, tuberculosis, renal and cardiac disease, and insanity. Syphilis of the mother does not usually call for suspension of nursing, and illnesses of short duration and mammary abscess mean only temporary cessation. Vague ill-health, in which the patient is labelled as "delicate" or "anæmic," is often given as a reason for weaning without due consideration being given to the necessity for it. In the great majority of such cases suckling could be carried out with benefit rather than harm, at any rate for sufficient time to show that there was some advantage to be gained by removing the child from the breast. The return of menstruation is no indication for weaning, but the occurrence of pregnancy is.

Physiology of Lactation.—The breast is composed of lobes, about twenty in number, which are arranged radially from the nipple and are separated from one another by a varying amount of fat. Each lobe in its turn is divided into lobules which are composed of acino-tubular glands. Each acinus is lined by a single layer of columnar epithelium richly supplied with blood-vessels. There are about twenty lobes drained by ducts each of which opens on the nipple. Fat globules, formed by the breaking down of the protoplasm of the cell itself, are seen in the cells of the glands. On the third or fourth day after labour the breasts become swollen and distended, and often give rise to considerable discomfort to the patient. This is the signal that the breasts are secreting milk. Although there is distinct tenderness, tension, and pain in the breasts, and the patient may

have a headache, this physiological secretion of milk is only exceptionally accompanied by a rise of temperature, and should fever be present for more than a few hours it is generally due to some infection of the genital tract.

The milk of the mother in bulk is bluish-white in colour, though that squeezed from the nipple may often be of a yellowish tint. It is amphoteric or slightly alkaline in reaction, and contains harmless micro-organisms probably from the lactiferous ducts. The milk consists of a solution of proteids, sugar, and salts in water, and suspended in it are fat globules. The proteins consist of lactalbumen and caseinogen; the sugar is in the form of lactose. The salts are calcium phosphate, potassium carbonate, chloride and sulphate, sodium chloride, and magnesium carbonate. The fats are glyceryl salts of olein, stearin, and palmitin.

The proportion of the constituents is as follows:—

Proteins	{caseinogen 0·4 per cent. lactalbumen 1·1 „}	1·5 per cent.
Fat		3·5 „
Sugar		6·5 „
Salts		0·1 „
Water		88·4 „

The exact composition of the milk varies in different women and in the same women at different times. The general health and nutrition, the diet, the amount of exercise taken and the mental condition of the mother all have their effect. The milk first drawn off at each suckling, the fore-milk as it is usually termed, contains less solids than the later or hind-milk, which is richer especially in fat. There are also slight variations during lactation, the sugars and fat increasing slightly and the protein diminishing as shown by the following analyses (H. Maclean):—

	Protein.	Fat.	Sugar.
Colostrum	6	2·5	3
End of first week (transition milk)	3	3	6
End of first month (early milk)	1·5	3·5	7
Six months (mid milk)	1·2	3·5	7·5
Nine months (late milk)	1·1	3·5	7·5

The most decided stimulus to secretion is the suction of a strong and hungry baby, and it will be seen that when there is deficiency in the supply our chief dependence must be placed on this reflex effect. A definite interval of rest is also necessary, as overstimulation may result in fatigue of the glands and diminution of the flow. More credit has been given to diet in influencing the milk secretion than is warranted by scientific observation; an ordinary wholesome

mixed diet, containing chiefly what the woman has found by experience to be readily digested, is best. An increased amount of fluid is necessary and purgation should be avoided. The secretion is greatly influenced by the central nervous system, and strong mental emotion may cause diminution and even suppression. Women of an anxious and emotional temperament do not make good nursing mothers.

Management in Normal Cases.—Part of our care of the pregnant woman is directed towards preparation for nursing (see pp. 80 to 86). The most important point in this connection is attention to the general hygiene, exercise in the open air, avoidance of irregularity in diet and action of the bowels, with strict observation of the hours of sleep and rest. Dental hygiene and the treatment of oral sepsis should not be overlooked. In highly-strung women in whom the emotional element is predominant especial care must be taken to avoid all mental stress and strain and to secure adequate rest. Special points regarding the breasts and nipples are mentioned elsewhere (p. 540).

After labour and after the mother has rested, *i.e.* within 12 hours of birth, the baby should be put to both breasts and afterwards at four-hourly intervals during the day for a couple of minutes at a time till lactation is established. Not more than two minutes at each breast should be allowed, as the nipple may be injured by a strongly sucking baby tugging persistently at the nipple, also it may later result in an unwillingness on the part of the baby to take the breast if he has been left long enough at the nipple during the first two days to discover the uselessness of his efforts. The chief object of this is to excite mammary activity by the stimulus of suction, and to begin the education of the child's digestive and absorptive functions. The suction empties the breasts of the colostrum or early secretion present before the true milk. Colostrum contains no caseinogen, but about 6 per cent. of soluble proteid, with some fat and broken down epithelium forming small round bodies known as colostrum corpuscles. The amount is very small, and probably not more than a drachm or so of fluid will be obtained by the child. So far as possible the giving of fluid to the baby should be avoided till the natural supply is ready. A hungry and thirsty baby is the best stimulant to excite the milk-flow, and to satisfy these wants merely results in delayed and less efficient lactation. If the child is fretful and troublesome a teaspoonful of boiled water may be given *after* sucking but not at other times. If lactation has not begun by the third day it may be necessary to increase this, or even to give a little humanized milk

diluted with 3 parts of boiled water not exceeding 1 ounce at a time, and if by the fourth day there is still no breast milk, the child should be put to the breast three-hourly during the day with no night feeds, *i.e.* 6 times in the 24 hours, and given $1\frac{1}{2}$ oz. of the above mixture after each sucking and not at any other time. If lactation is not fully established by the fifth day, partial breast and bottle-feeding must be carried out, as explained later, till an adequate milk-flow is obtained. If the breasts become full and hard it is inadvisable to rely on the baby alone to empty them, as the child may be overfed or injury done to the nipples. If it is necessary to draw off the excess of milk it is better to express by the hand or use the breast-pump.

Position for Breast-Feeding.—When the lying-in mother was kept strictly on her back the early nursing was conducted by laying the baby alongside the mother, and this position was sometimes maintained throughout lactation. Now that the advantage of sitting up, in promoting drainage of the lochia, has been recognized and a more sensible management of the puerperium adopted, it is far better that the mother should begin as she will continue and hold the baby across her body. The important point is that she should support the child's head on the arm of that side from which the nursing is being done so that there is no drag on the nipple. The mother should hold the nipple between the first and second fingers so as to keep back the surrounding breast and prevent the baby burying its nose in it, and thus causing frequent dropping of the nipple from difficulty in breathing.

Duration and Frequency.—The maximum time allowed for each feeding is 15 to 20 minutes and should never be exceeded. Naturally there is considerable variation in the rate of sucking, and often 7 to 10 minutes will suffice. Too rapid feeding may result in the regurgitation of undigested milk and should be checked by the mother compressing the base of the nipple between the fingers so as to limit the flow. If the child is sluggish and shows a tendency to go to sleep, he should be stirred into activity and trained from the start to make the most of his time. A nipple kept too long in the mouth becomes softened and macerated on the surface and liable to crack.

The question as to whether one or both breasts should be used for each feed must be decided for each case. At first it is usually best to use both, giving the baby 5 minutes at each, and as the flow increases more time is allowed for the first and less for the second, till, if the supply is ample, one breast only is used. If both are used, suckling should begin with the right and left breasts alternately; if

only one is used, each breast is used alternately. So far as possible, both breasts should be used equally, otherwise there is a tendency for one gland to be overworked while the other is insufficiently stimulated, so that failure in both may result. This is especially liable to occur as the result of the common habit of mothers carrying the baby on the left side and using the breast on that side more than the right breast.

The old system of two-hourly feeding during the day and four-hourly at night was the chief cause of difficulty with breast-feeding and thus of the great increase of artificial feeding. In the first place it resulted in the over-feeding of the infant with consequent disturbance of digestion, and in the second place it was so severe a tax on the mother that either her milk or her interest evaporated. Three-hourly feeding and no night feeds is the rule but the tendency has been to increase the interval to 4 hours, so that five feeds in the 24 hours is what is aimed at. No absolute rule can be laid down as to whether five or six feedings in the 24 hours should be adopted, but when possible the smaller number should be preferred. With the average-sized child and a good supply of breast milk the four-hourly intervals should be begun from the start; with a small child or a baby with feeble power of suction, or if there is a deficiency of breast milk, three-hourly intervals should be adopted, and the change gradually made to four-hourly intervals when the progress of the child and the milk secretion admit of it. Without making a fetish of clock-like regularity regular feeding hours save strain to the mother and thus aid mammary action; as the child quickly adapts itself to regular meal-times the sooner it is broken into habit in this way the better. The longer intervals allow time for the complete emptying of the stomach and rest for the digestive tract. For the mother the longer intervals have an undoubted preference; she has much greater freedom for exercise in the open air and social intercourse, and with no night feeding has a more complete rest to mind and body, which in itself is favourable to good motherhood. With four-hourly feeding both breasts are often required at each feed.

Care of the Nipples.—The treatment of the nipples during pregnancy has been described elsewhere (p. 540). Before suckling the nipples should be washed with warm boiled water to remove any milk which may have run out and moistened their surface, and again after suckling; they should then be dried and covered with a small absorbent pad to prevent soiling of the clothing by the escape of milk and avoid their becoming sodden and contaminated by soured

milk. Great care must be taken to avoid sore nipples, and the precautions advised with this object should be carefully followed throughout suckling.

Management of the Nursing Mother.—The nursing mother should lead as equable a life as possible in her circumstances. Excitement, evening entertainments, all worries and anxieties are detrimental to good lactation, and a quiet and somewhat uneventful round with uninterrupted sleep is highly desirable. Exercise in the open air, short of fatigue, and an easily assimilated general diet with plenty of fluid between meals are the chief requisites. Green vegetables and fruit should form part of the diet on account of their richness in vitamines (p. 603), and the chief articles to avoid are highly seasoned dishes, pickles, curry, vinegar, and such like. The woman will not go far wrong if she eats what she knows by experience she can easily digest and avoids anything found by experience to cause indigestion. The traditional saying that "milk does not make milk" has this germ of truth in it that an unwonted diet, in which a woman in bed or taking little exercise is given glasses of milk between her meals, results in flatulence and indigestion and so in unsuccessful nursing. The extra milk should be restricted to 1 pint a day. The nursing mother requires more fluid than when not nursing, and in cases of scanty breast milk some increase of the fluid intake improves the flow. Plain water up to 2 or even 3 pints a day between meals is best; once or twice in the day a cup of freshly made tea may count as part of this, but care should be taken not to allow gruel, soups, and milk to be substituted as being more "nourishing". Such additional food merely interferes with the ordinary meals and produces indigestion from overfeeding and thus defeats its object. Stout, which has acquired some reputation as a lactagogue, probably owes what special advantages it may possess to the extra fluid taken, and perhaps to the maltose and extra carbohydrate which may be helpful with some patients. Alcohol is not required by the nursing mother and generally is harmful. Beyond additional fluid, and the avoidance of indigestible and highly seasoned foods, the nursing mother need make no alteration in her ordinary diet. Indigestion and constipation are both harmful. Frequent or excessive purgation is also to be shunned.

Bed-exercises, massage, and fresh air as described on p. 538 are helpful to the lying-in mother at the beginning of lactation, and once the mother is able to resume her ordinary duties, she should lead her ordinary life, but make a point of morning and afternoon outdoor walk and merely avoid fatigue.

Management in Difficult Cases.—It is impossible to consider the difficulties in regard to the mother apart from those arising in the child; they are so dependent one on the other that maternal and infantile troubles must be considered together. For the sake of arrangement, however, it will be simpler to begin with the troubles as they affect the mother and her breast, and take the infantile troubles afterwards, although this may involve some repetition.

DEFICIENCY OF BREAST MILK

Cause

Absence or deficient development of the breasts is very rare; less rare causes are nutritional disturbance, the severer degrees of anæmia, and serious organic disease. Such conditions happily occur in a very minute fraction of child-bearing women. It is remarkable how often in the ill-nourished and in apparently the most unlikely subjects Nature's efforts to preserve reproduction result in an adequate milk-flow, sometimes in patients in whom it is undesirable to allow suckling, such as the tuberculous. The fat woman is generally a poorer nurse than the spare woman. Among the working classes failure to breast-feed is much rarer than in the well-to-do, especially if those women who do not attempt it or give it up because they go out to work are excluded. In the majority of cases failure to nurse is due to the psychological or nervous factor and not to the general nutrition or to the breast itself.

If natural feeding is to be brought back to its proper place in the rearing of children, this question of the causes of failure to suckle must be more fully considered.

Experience has proved that nearly every woman willing to do so can suckle her baby. The percentage of failures under proper supervision is very small; under 5 per cent. will fail to nurse for 6 months and under 1 per cent. for 3 or 4 months. The least hopeful case is that of the woman with little maternal instinct, whose interests and inclinations draw her elsewhere as soon as she can resume her ordinary mode of life. Among those who do not actually refuse to nurse their baby are some who grudgingly acquiesce in doing so for a month or two "to give the baby a start". They have no desire to make a success of what they regard as a needless tax on their liberty, and commonly they are only successful in proving the truth of their prophecy that they were not equipped by Nature to be a nursing mother. Suggestion plays a large part in many cases; her mother tells her she was brought up on the bottle, and her friends and

relatives have advised this or that patent food; her nurse has ordered a full bottle-feeding equipment in anticipation of the expected, and the moment the birth of her baby is announced in the papers she is flooded at every post with samples and advertisements from the patent food-mongers in which she reads such glowing accounts of how babies' lives have been saved by this substitute and that substitute, that it is not remarkable she should accept it as almost inevitable that her child should be reared artificially. Want of confidence in her own powers is a poor attitude of mind in which to start nursing. Anxiety as to whether she will succeed or not, worry as to how the baby is doing, especially if the daily or weekly weighings disappoint expectations, and any other similar cause of nervous upset, all help to produce difficulty.

Depressed or deformed nipples, cracked nipples causing pain on suckling, or a baby that cannot stimulate mammary action by good suction are also frequent causes of failure.

Consideration of these causes will suggest the remedy. The mother should be treated through her pregnancy and lying-in on sound hygienic lines and every effort made to give her confidence in her powers and to remove all suggestion of failure. Each patient will present a problem in herself. The stupid and ignorant mother and the woman who has no instinct to do her part will be the most hopeless. The nurse, husband, and relatives must not be lost sight of. The practitioner should discover and retain those nurses who are most successful with his patients and appear able to influence and help them and wipe off his list those who are either not helpful or, still more, positively antagonistic. Some monthly nurses and many more children's nurses are only too anxious to obtain that complete control of the infant which bottle-feeding gives them, and do all they can to discourage rather than assist the mother. The husband or the patient's mother may also be of the opinion that nursing is a needless burden, and their remarks constantly repeated will quickly obliterate any impression made at the occasional visit of the medical adviser. Much can be done by assuming without question that breast-feeding will be carried out and contriving that everything is arranged on that supposition, instead of exactly the reverse as is so often the case. Discussions with the nurse regarding the infant and its progress should be conducted away from the mother, and all reports given her should be as encouraging as possible. The endeavour should be to produce an atmosphere of quiet and assured success, as that, next to a strong sucking baby, is the best lactagogue.

Prematurity and feebleness of the infant, inability to suck owing to nasal catarrh, cleft palate or other cause may result in failure to

establish or maintain the flow of milk. The breast-pump does not give the same stimulus as sucking, but should be tried in such cases. The plan, easily adopted in a hospital or home where there are other patients, of borrowing a stronger infant to start the breasts into activity is not always possible.

It must not be forgotten that although lactation is usually established at the fourth day, much longer delay may occur and success yet be obtained.

If trouble shows itself in the infant, constant crying, sickness, not thriving and such-like, a careful investigation of the reason for this must be made. It is important not only for the immediate difficulty with the child but because a crying and ailing baby will be a source of worry to the mother and react on her milk supply. As these cases are the most frequent causes of failure to breast-feed they call for detailed consideration. In the first place the traditional explanation that the milk is not suiting the child must be dismissed; it may be said at once that the quality of the milk is never the cause of the child not thriving. It may give rise to temporary disturbance from nervous or digestive or other trouble in the mother, but never to more than this. In the first place, it should be determined that the crying and restlessness of the child is not due to other than digestive cause; that it is not due to overheating and overclothing or to cold; to bad management, too much handling or being exhibited to visitors, so that sleep and rest are interfered with; to some infection, if colds and influenza are in the house, and so on. In the next place, if the disturbance appears to be gastro-intestinal in origin it is nearly always due to overfeeding—*i.e.* the quantity and not the quality is to be blamed, and the frequency and duration of feeds must be investigated. In the majority of cases of digestive disturbance of the infant at the breast, especially in the first month, the trouble arises from overfeeding. Nature intended the infant to wait for a couple of days or so before receiving any food, and then to take small quantities till the digestive and absorptive machinery had learnt their duties. For the first two days nothing is taken, and on the third 6 ozs., on the fourth 9 ozs., on the fifth 12 ozs., by the end of the week 15 ozs., by the tenth day 18 ozs., and the full pint will not be reached on an average till the end of the second week. If these figures are studied it will be recognized that the average-sized baby will readily exceed them and in the majority of cases will do so without harm, but if the excess is considerable, or the digestive powers feeble, disturbance will arise. Anxiety to get back to the birth-weight has not been an unmixed blessing, and the desire to start the child gaining quickly has resulted in overfeeding, which

commonly shows itself after a few weeks in a gastro-intestinal upset. Such upset following on a rapid increase in weight is especially likely to be due to this cause. The great advantage of beginning four-hourly feeding from the start is the lessened risk of overfeeding, so common with the old two-hourly system. It is much better to err on the side of underfeeding—slight underfeeding will not produce intestinal disturbance—than on the side of overfeeding, as once digestive disturbance is set up recovery is slow. After the duration and frequency of feeding have been investigated the next thing to be discovered when the baby is not going on satisfactorily is how much milk is taken in the 24 hours, and difficulty in regard to this explains why so many doctors and nurses have preferred bottle-feeding with its known amounts to the breast with its unknown.

Drawing off the milk from the breast by expression or with a breast-pump gives such unreliable results that it is useless in cases of suspected overfeeding; test-weighing, *i.e.* weighing the baby before and after suckling, is the only satisfactory method. More delicate scales than the usual nursery spring-balance are necessary, but the ordinary grocers' scales weighing to a quarter of an ounce are quite satisfactory. The baby's clothes need not be removed. The baby is balanced on the scales before going to the breast, after nursing replaced, and the necessary weights added to balance give the amount of food taken. Should the baby's diaper be soiled after the first weighing it must not be changed till after the second weighing. A single test-feed is of no value, as the feeds vary greatly in amount, and a whole day's weighing at least must be taken. If the test-feeds show that the child is taking more than its proper allowance (*i.e.* somewhere about the figures already given for the first two weeks, 21 ozs. for the third week, 24 ozs. for the fourth week, 25 to 27 ozs. for the second month, and 27 to 30 ozs. for the third month) alteration in the frequency and duration of feeding will suffice; if the weighings show that insufficient quantity is being obtained, the feedings if previously four-hourly must be increased to three-hourly, and if that does not produce the required additional milk, mixed breast and bottle-feeding must be begun.

MIXED BREAST AND BOTTLE-FEEDING

The traditional notion that it was harmful to rear a baby by partial breast-feeding and that the two milks disagree is erroneous. Indeed Pinard has very emphatically stated that mother's milk aids the digestion of cow's milk. But the strong argument for mixed feeding is that if conducted properly the breast milk may not only be retained but increased, so that instead of the child being weaned from

its natural food, bottle-feeding becomes unnecessary. Success or failure must be judged by whether the breast-feeding is maintained or not; its complete restoration is what is to be aimed at; mixed feeding is second-best, and failure is marked by the entire cessation of breast-feeding.

Alternate bottle and breast-feeds are fatal, as not only are the number of stimuli in the shape of suckings by the baby diminished, but the baby obtaining a larger meal with less exertion from the bottle, ceases to work at the breast as he should, so that the stimuli also become less powerful. Thus early does the human animal show his characteristic instinct to get its living with the least possible exertion. Hence the bottle-feeding must supplement each breast-feeding, the supplementary food being given after the baby has done its utmost at the breast, the amount given being barely sufficient to make up the shortage, the milk not too sweet and the teat not too easy. The next point, therefore, is how this extra amount is to be calculated. For the first three weeks of life a rule of thumb method based on the requirements of the average baby will suffice. On p. 589 it was said that if lactation was not established, 1½ oz. of one part of humanized milk to 3 parts of boiled water should be given on the fourth day after each time the child was put to the breast, *i.e.* 2¼ ozs. of humanized milk in the 24 hours. In the event of the milk-flow being deficient and supplementary feeding necessary the amount of the two milks required will be as follows: on the fifth day, 6 ozs. of milk; from the fifth to the tenth days this should be increased gradually to 12 ozs., and from the tenth day to the beginning of the third week to 15 ozs. With a small baby the amounts would be somewhat less, and with a large baby slightly greater. Thus, suppose on the seventh day 6 ozs. were obtained from the breast, another 3 ozs. would be required in supplementary feeding or ½ oz. after each feed; if on the tenth day 6 ozs. were obtained from the breast, 6 ozs. of humanized milk would be needed, but if the breast milk by this time had increased to 9 ozs., only 3 ozs. of supplementary milk would be given. The humanized milk should be diluted with boiled water or 2½ per cent. lactose solution, so as to increase the fluid intake, making it increase from a total of 12 ozs. of fluid on the fifth to 18 on the tenth, and the full pint by the end of the second week.

From the beginning of the third week onwards calculation based on the caloric requirements of the infant in accordance with its weight and age will give better results, and allow for the difference in caloric value between mother's milk and humanized milk. On a milk diet the food value in calories is a simple calculation compared with a like calculation for the adult on a mixed diet. One ounce of human milk

and 1 oz. of cow's milk each provides somewhat over 20 calories, and 1 oz. of humanized cow's milk about 10 per cent. less or between 18 and 19 calories (1 oz. of proteid or carbohydrate 120, 1 oz. of fat 260 calories). From the third week to the third month the child requires about 50 calories for each lb. it weighs, and after that the required amount per lb. of body weight diminishes from 45 in the fourth month to 40 by the ninth month. Suppose the baby weighs 8 lbs. at three weeks its daily requirement will be 400 calories, *i.e.* about 20 ozs. of breast milk or 22 of humanized milk. If the test-feeds show that slightly less than 20 ozs. were obtained daily from the breasts, no supplementary feeding would be necessary, but special measures as described later would be taken to increase the flow. Suppose, for example, the test-feeds show only 12 ozs. from the breast or 240 calories, *i.e.* a deficiency for this weight of 160 calories. To make this good in humanized milk at 18 calories per oz. will require 9 ozs. daily, or 1½ oz. to supplement each feed. Experience of test-feeds shows that the first feed in the morning greatly exceeds the others, and that this feed therefore does not require supplementing unless the breast milk is very deficient. The midday feed is generally the smallest and requires supplementing more than the others. It is better to try and distribute the supplementary food in accordance with the requirements of each feed rather than evenly throughout the day without reference to the amount obtained from the breast. It is better not to give quite up to the full caloric requirement, as the child kept a little hungry will make a better effort at the breast, so this will be reduced to say 1 to 1¼ oz. after each of the 6 feeds, so that 350 to 375 instead of 400 calories will be taken. If the measures taken to increase the breast milk are successful, the extra feeding will be proportionately diminished, so as to keep the caloric value of the two foods slightly below the calculated quantity for a baby of that weight till the proper amount is obtained from the breast alone. If mixed feeding has to be continued the amount of artificial food to supplement the breast milk will be calculated in accordance with the weight and age of the baby and the amount obtained from the breast.

RESTORATION OF BREAST-FEEDING AFTER DISCONTINUANCE

Breast-feeding has occasionally to be discontinued for a time owing to temporary illness of the mother or infant, and patients are frequently seen in whom breast-feeding was abandoned because of failure to manage it properly. In many of such cases the change has only made matters worse, and advice is sought because the baby is

suffering seriously from malnutrition. Breast-feeding can often be restored in such cases after being given up for some weeks, even so long as two months if a good flow had been present in the early days of lactation. The method to be adopted is much the same as has been described above for mixed feeding together with special care of the mother.

Dr. Truby King, of Dunedin, New Zealand, who has been so successful in this way, and did so much during his stay in this country to interest and instruct the profession here in his methods, depends on no medicines or fancy treatment. The mother is managed on strictly hygienic lines, taking regular outdoor exercise morning and afternoon; at least 1½ pints of extra fluid, the greater part water, are given daily and three good meals of wholesome food, and efforts made to keep the bowels regular with the least possible use of aperients. With this object a glass of water and a raw apple are given about an hour before breakfast, and the diet made as laxative as possible by the inclusion of oatmeal porridge, brown bread, treacle and fruit. If these measures do not suffice small doses of a mild aperient, such as ext. casc. sagrad. liq. ♏ x, are given three times a day, and the dose diminished gradually as regular action of the bowels is established. Great emphasis is laid on overcoming sluggishness of the bowels, as it seems to be accompanied by a sluggish tendency in all the maternal functions. A cool or cold sponge is taken in the morning, and the breasts stimulated by massage and hot and cold sponging twice a day. The latter is carried out by having two bowls, one with cold and one with hot water, and a separate sponge or cloth in each; each breast is then bathed in turn, first from the cold and then from the hot water, changing quickly from one to the other; after five minutes' alternate bathing the breast is dried with a rough towel and rubbed from without towards the nipple, the breast being meantime supported with one hand. The nursing mother is also made to take a definite time (usually half an hour) of rest with the feet up each day after the midday meal. In addition to this, great importance must be attached to the confidence and peace of mind of the patient; she is assured of success, and everything is done to banish any idea of the possibility of failure from her mind. If admitted with her baby to the home she is sent out for her walks with a patient already cured, so that the faith that comes from cure accomplished is communicated to the one in hope of its accomplishment. This atmosphere round the patient is one not easy to produce, but undoubtedly plays an essential part in the success of the treatment—it is suggestion carried to its utmost.

Besides the general and psychological management of the mother,

the method of restoring the breast-feeding is so similar to what has been already described that perhaps the best plan will be to illustrate it by a case from Dr. Truby King's New Zealand Hospital as recorded by him.

The mother and child were admitted a month after labour. Bottle-feeding had been begun about a fortnight after birth and had been the only feeding for a week. The child was not doing well and was but 6 ozs. over birth-weight. Mother and child lived an open-air life; the mother took graduated cold baths, had a good rub down and then active walking exercise before breakfast. Strict attention was paid to the bowels, and the breasts stimulated by massage and alternate cold and hot sponging. No drugs and no special feeding were required. The child was put to the breast every three hours in the daytime with no night feeding. On the first day of admission, only a little over 1 oz. of breast milk was obtained as shown by the test-feed weighings, and 10 ozs. of humanized milk were used as supplementary: on the second day 3½ ozs. of breast milk were obtained and 11 ozs. of humanized milk given: on the third day a little over 13 ozs. of breast milk were recorded and 2½ ozs. of humanized milk given: on the fourth day 13 ozs. of breast milk and 6½ of supplementary: on the fifth day 16½ ozs. of breast milk and 3¼ of supplementary: on the sixth day 17½ ozs. of breast milk were recorded and all supplementary feeding stopped: on the seventh day 21 ozs. and by the ninth 26½ ozs. of breast milk or rather more than the average requirement. During the first week the child gained 1 oz. in the first half of the week, and by the end of the week 6 ozs., or as much as had been gained since birth.

Some points in this call for explanation. To begin with the child was given only about half its due allowance at first, but the daily allowance of fluid was kept up to the normal by adding water to the bottle-feedings—the first day being half and half. This was done because the child was suffering from malnutrition in which all its functions become sluggish; its metabolism is at low level so that it does not burn up so much and at the same time its appetite is poor and digestive capacity impaired. As the vitality of the infant improves more is required and the art in the feeding of such ill-nourished babies lies in advancing the food-allowance cautiously, so as to try to meet, but not overstep, the growing powers and requirements. All supplementary feeding was stopped on the sixth day, (although only 17½ ozs. instead of 25 ozs. were obtained from the breast), in order to induce more vigorous sucking, with the result that 21 ozs. were obtained in the succeeding twenty-four hours. The nursing was soon able to be conducted at four-hourly intervals, and at seven months

the child, fed entirely from the breast, was 3 lbs. above the average weight at that age, and the mother in excellent health.

In the case of an infant already enfeebled by malnutrition the problem of how to begin is simplified if the caloric value of the food the infant has been able to take can be calculated, as it is best to start with the equivalent in breast and humanized milk and gradually increase this by about 40 calories a day so far as its progress, judged by the character of its motions and its general condition, will permit. In this way the caloric value of the food may be increased until it actually exceeds the theoretical caloric requirement calculated on its weight by 30 to 50 per cent., which limit, however, should not be overstepped. As the weight approaches the normal line for a baby of that age the excess should be diminished, and endeavour should be made to keep the gain in weight somewhere about this normal line. It is much better to go slowly with a child that has suffered from any disturbance of digestion rather than risk another upset. The following table illustrates the method adopted for an infant of 3 weeks, suffering from under-feeding, that weighed 6¾ lbs. at birth:—

Age 3 Weeks.	Weight.	Breast Milk.	Supplementary Food in Calories.	Total Caloric Value of Food.	Theoretical Caloric Requirement.
1st day	6 lbs.	4½ ozs. = 85 cals.	nil	85	300
2nd ,,		6¼ ,, = 125 ,,	+ 45	160	
3rd ,,		7¼ ,, = 145 ,,	+ 60	205	
4th ,,		8½ ,, = 170 ,,	+ 40	210	
5th ,,		9¼ ,, = 185 ,,	+ 30	215	
6th ,,		10¼ ,, = 205 ,,	+ 30	235	
9th ,,	6 lbs. 8 ozs.	13¾ ,, = 275 ,,	+ 20	295	325
At 5 weeks old	6 ,, 12 ,,	16 ,, = 320 ,,	nil	320	336
,, 6 ,, ,,	7 ,, 0 ,,	16½ ,, = 330 ,,	,,	330	350
,, 7 ,, ,,	7 ,, 11 ,,	21¾ ,, = 436 ,,	,,	436	386
,, 8 ,, ,,	8 ,, 4 ,,	23 ,, = 460 ,,	,,	460	412

The first day was devoted to ascertaining what was obtained from the breast, and the caloric value of the food increased gradually by humanized milk supplementary feeds. As the case was one of pure starvation the baby gained on less than the theoretical requirement, which was not reached until it was over 6 weeks old. No supplementary food was needed after the child was 5 weeks old. The theoretical requirement was exceeded in the last 2 weeks as the child had made up the deficit and was the average weight for its age.

This example will indicate the possibilities opened up by a study of breast-feeding, and especially by the application of the results of test-feed weighings. Drugs are useless except for their suggestion

effects ; malt extract is perhaps the most useful, as it contains chiefly a valuable carbohydrate food, maltose, and for its laxative action.

The student while attending his midwifery cases should take every opportunity of studying the management of breast-feeding and should follow the cases in the Infant Welfare Clinic, so as to learn the management in the older infants and to see the results obtained from successful breast-feeding. The normal baby must be studied from the physiological standpoint, with the idea of observing the first signs of disordered function and remedying it before definite evidence of malnutrition is obtainable.

Wet-nurse.—If an infant is premature or puny and the mother has no milk, it may be necessary to consider the question of wet-nursing. Generally speaking, a wet-nurse should be avoided, as an infant can usually be reared artificially, but there may be exceptional cases when a wet-nurse may be the only hope of saving its life. Her antecedents must be carefully inquired into ; she should be a married woman and preferably a multiparous one. The wet-nurse and her infant must be carefully examined, and a Wassermann's test applied to mother and child. She should be free from tuberculous taint, her breasts should be active and the nipples well formed, and the infants should be about the same age. A syphilitic child must not be suckled by a wet-nurse.

Weaning.—A child should be weaned at nine months. This statement has often to be modified either for the sake of the mother or infant. A mother should give up nursing rather than drag on in indifferent health, as the quality of the milk will suffer. It is sometimes advisable for a mother to nurse her infant longer if it is recovering from an illness, or if by continuing a little longer she will avoid weaning in the summer months when diarrhœa is so prevalent. Weaning should be gradual ; one or more breast-feeds should be missed in twenty-four hours and artificial food substituted, which then gradually replaces the breast-feeding.

The Growth of the Child.—The average weight of a healthy full-time child is about 7 lbs., males being slightly heavier. Owing to the insufficiency of food supplied to the infant by its mother, and owing to the passage of meconium, urine, and perspiration, the infant generally loses some 8 ozs. of weight during the first two or three days of its life ; this loss, however, is generally regained by the end of the eighth day. The average daily gain for the first few weeks of life is nearly an ounce a day, though a gain of 4 to 6 ozs. a week may be considered as quite satisfactory.

The child at the end of five months is generally double its birth-weight, and at the end of the first year treble its birth-weight. The average gain during the first few years of life is 4 to 5 lbs. each year.

The average length of a full-time child is 20 inches. The child is generally 24 inches long at six months of age, and 27 inches long at the end of the first year.

The milk teeth, twenty in number, begin to be cut at the seventh month, the lower central incisors being the first to appear; the others follow at intervals, and the milk dentition should be completed by the end of the second year. Dentition starting as late as the tenth month is often a sign that the child is being improperly fed, and it may be of rickets.

The anterior fontanelle should close by the eighteenth month even if of large size at birth. The posterior fontanelle closes at birth.

VITAMINS

Fortunately for the future generations the output of science has outstripped the knowledge gained by what is known as experience, and the faulty metabolism exhibited by imperfectly fed infants should now be prevented by the practical application of those scientific facts which are now soundly established. The immediate and probably remote (*i.e.* dentition, etc.) effects of an inadequate diet in childhood cannot be too strongly impressed upon those responsible for the feeding of infants and growing children.

The incidence of rickets and scurvy in infants depends on the absence from its diet of certain accessory food substances which are known as vitamins. These vitamins occur in minute quantities, and their nutritional importance is out of all proportion to the amount consumed. They are probably analogous to or act in very much the same way as internal secretions and hormones. The important point is that an animal (the word is used in its widest sense) can be fed on a diet producing the requisite number of calories, but yet, without vitamins, that animal will not grow and will eventually perish.

It is essentially a disease of artificially fed infants whose diet is composed wholly of "foods" in the preparation of which no fresh milk is used, or, on the other hand, the milk mixture used has had its vitamin content destroyed by prolonged pasteurization at a temperature of 165° F.

For the successful rearing of artificially fed infants it is necessary not only to give them the requisite quantity of proteins, carbohydrates, fats, and mineral salts in the correct proportions, but, in addition, there

must be included in the food those elements known as vitamins. The exact nature of this element, or rather group of elements, is, in the present state of our knowledge, unknown. It is best to regard them simply as agents which, for some reason or other, prevent the onset of various diseases known as "deficiency diseases," among such diseases being beri-beri, palagra, scurvy, and rickets.

These vitamins are usually classified under the terms: (1) Fat-soluble A. (2) Water-soluble B. (3) Water-soluble C.

Fat-soluble A is abundantly found in milk fat (except in the case of stall-fed animals), cod liver oil, and egg yolk. It is absent in vegetable oils (with the exception of pea-nut oil) and lard. The importance of its source of supply in regulating the diet of an infant, and the avoidance of margarine as the sole source of fat in the growing child cannot be overstated. There is also evidence to show that the expectant mother should have a diet rich in vitamins for the purpose of storing up these substances for the nourishment of the infant.

Water-soluble B is contained in the germ or embryo of cereals. The advent of steam milling with the removal of the husk and delicate lining embracing the embryo brought about the incidence of beri-beri or polyneuritis in the rice-eating nations, which can be cured or prevented by the substitution of unpolished for polished rice.

Water-soluble C is found in the juices of fruits and vegetables, especially in oranges and lemons, and is an anti-scorbutic remedy.

The practical importance of vitamins in the dietetics of infants is the avoidance of a food devoid of these accessory food substances. In all cases a child should be breast-fed, if possible, and if this is impossible, the substitute should consist of fresh milk, if procurable, which should not have its vitamin-content destroyed by prolonged heating. In the event of the failure of the supply of breast milk or of cow's milk, or the inability of the infant to assimilate them, it may be necessary to use a dried preparation of milk. In these circumstances it is absolutely essential to supply vitamins preferably in the form of cod-liver oil, with or without the addition of orange juice.

CHAPTER XLIX

ARTIFICIAL FEEDING

It is most important for the student to recognize that there cannot be any standardized method of artificial feeding for infants. A baby is not an automatic machine into which can be put a certain mixture with a guarantee that the excreta will always be the same. Should artificial feeding be necessary, the first difficulty to be faced is that babies differ from one another almost as night from day. Some are large, others small, some are fat, others thin, some are weak, others strong, some are able to digest cheese and gin, if their parents are to be believed, while the digestive organs of others are so delicate that the doctor may well be at his wits' end to know how to keep them alive.

Success in the artificial feeding of infants is largely a matter of experiment, since each infant must be separately studied and prescribed for in accordance with its own tested digestive capabilities. The only sure signs that the food prescribed is really suitable for the infant are that it gains steadily in weight, is free from pain and sleeps well, that its temperature and motions are normal, and that it appears satisfied.

The following remarks on artificial feeding are therefore merely set down as a guide to the student, and the directions given and quantities of the various ingredients advised refer to what has been found by experience as suitable for the average baby, but will in the case of many infants require modification.

With the better management of breast-feeding the number of cases in which artificial feeding is necessary will be found to be small. Death of the mother and such occasional grave diseases as we mentioned on p. 587 may rarely be the reason for artificial feeding. The usual cause, however, is unwillingness on the part of the mother or lack of effort in establishing an adequate flow of breast milk. If the child cannot be fed entirely from the breast, mixed breast and artificial feeding on the lines already described should be attempted, and complete substitute feeding only adopted if this also is a failure.

The choice of these substitutes is legion, and if the advertisements are to be believed they are even better than that supplied by the mother herself. The very composition of some at once condemns them. It is found most satisfactory to use cow's milk, which can be modified and built up into a close imitation of human milk.

Cow's milk consists of the same constituents as human milk, but in very different proportions, as the accompanying table shows :—

Human Milk.		Per Cent.	Cow's Milk.		Per Cent.
Proteins	caseinogen 0·4 per cent. lactalbumen 1·1 ,,	1·5	Proteins	caseinogen 3 per cent lactalbumen 0·75 ,,	3·75
Fat		3·5	Fat		3·50
Sugar		6·5	Sugar		4·25
Salts		0·1	Salts		0·50
Water		about 88·4	Water		88·00

The differences between human milk and cow's milk have already been referred to; but emphasis may again be laid on the caseinogen as the difficult factor. This difficulty is not merely due to the difference in proportion, which can easily be altered, but in the nature which can be modified only slightly. It is this difference in the caseinogen of the two milks which must especially be kept in mind in artificial feeding. On the addition of an acid to cow's milk the curd formed from the caseinogen is solid and not flocculent like that of human milk. The reaction of cow's milk as supplied by dairies is acid and it is teeming with micro-organisms, while human milk is alkaline and relatively sterile.

The modification of cow's milk so as to make it resemble human milk in composition is effected by—

(*a*) Diluting the milk;

(*b*) Altering the formation of the curd.

(*a*) *Dilution.*—The simplest and best diluent for milk is boiled water. Dilution is carried out until the proportion of proteins in the mixture approximates to that in human milk. This will require dilution with an equal volume of water. Naturally this dilutes the other constituents, and the percentage of fat and sugar is reduced roughly to 2 per cent. To make up this deficiency cream and sugar must be added. Now, cream varies considerably in the amount of fat it contains. Centrifugalized cream contains 48 per cent. of fat, and that sold commercially necessarily contains some preservative, and so this variety should be avoided. Cream recovered by gravity, that is, by allowing the milk to stand covered in a long jug and skimming the cream off the top, contains 12 to 16 per cent. of fat, and is a very satisfactory form to use. Nursery cream can now be obtained from most of the leading dairies containing 20 per cent. of fat. Sugar should be added in the form of lactose. With a known

dilution of the milk, and the percentage of fat in the cream known, it is only a question of simple arithmetic to calculate the amount of cream which should be added. The addition of two teaspoonfuls of a 20 per cent. cream adds about 2 per cent. of fat to 3 ozs. of the mixture; the addition of a teaspoonful of lactose to the same amount adds 5 per cent. of sugar.

(*b*) *Altering the Formation of the Curd.*—This is effected by using sodium citrate or diluents other than boiled water. The diluents in common use are barley-water, oatmeal-water, and rice-water.

Citrated Milk.—The curd of milk may be rendered more flocculent by the addition of sodium citrate to milk. One grain of sodium citrate is added to each ounce of milk in the mixture.

Barley-water is prepared by taking a teaspoonful of prepared barley and making it into a thin paste with cold water. Boiling water up to half a pint is then added, and the mixture is boiled and constantly stirred for five minutes.

Barley-water contains starch, and so as an article of diet for an infant for any length of time is unsuitable.

It is thought that these diluents act to some extent as mechanical buffers to the formation of solid curds, and it is certainly found that the milk which was previously undigested becomes digested. These starchy diluents are often found useful in infants which are habitually constipated, as the granules of starch seem to act as an irritant to the intestinal tract. But they must be used with caution, as some infants have a tendency to diarrhœa with the use of starch. There are many other and better means of regulating the child's bowels than by the administration of starch.

It has been found in practice that the healthy infant does not require great dilution of cow's milk although the caseinogen is in great excess. By the addition of citrate of sodium in the proportion of 1 grain to each ounce of milk the curd becomes more broken up and so more digestible.

The following mixture will be found suitable for a healthy infant of normal weight until it is a month old:—

HUMANIZED MILK

Top milk (boiled)	9 ozs.
Lime water	1 „
Boiled water	10 „
Sugar of milk	2 tablespoons.

Pasteurize and cool rapidly.

The top milk is prepared by putting on one side in a narrow tall receptacle 30 ozs. of new milk for five hours in a cool safe.

Nine ounces are now taken off the top. This will contain about three times as much fat as cow's milk.

Humanized Milk with Whey

Boiled whole milk	9 ozs.
Fat emulsion, 50 per cent.	6 teaspoons
Lime water	1½ ozs.
Whey	10 ,,
Boiled water	9½ ,,
Sugar of milk	2 tablespoons.

The whey should be heated to 155° F. to destroy the rennin before mixing the whey, otherwise the mixture will curdle.

For the first two days nothing beyond sufficient boiled water or 2½ per cent. lactose solution to quench the thirst need be given, as in the case of natural feeding. For the third day 3 ozs. of humanized milk diluted with an equal quantity of boiled water. On the fourth day 1½ oz. of humanized milk similarly diluted. On the fifth day 2 ozs. of milk and 2 ozs. of water, and so on as described.

The most economical food for the infants of poor parents is a mixture of milk and water in equal parts, to which has been added cane sugar in the proportion of one teaspoonful to each 4 ozs. of the mixture. This should be brought to the boil and cooled rapidly by placing it in a bowl of cold water, and should be kept covered. A teaspoonful of 50 per cent. Cod Liver Oil or its equivalent (such as New Zealand or Marylebone Cream) should be added to each 5 ozs. of the mixture.

All infants, especially in the summer months, should be given some water to drink, as they often suffer from thirst which milk does not quench.

It sometimes happens that an infant cannot digest the caseinogen of cow's milk, and so it becomes necessary to prescribe a food in which caseinogen is relatively very small in quantity. This may be done by feeding the child on a cream mixture or on whey to which cream and sugar are added.

Fresh cream is obtained of known strength, and diluted with water until the percentage of cream is about 4 per cent. This dilution lowers the percentage of both proteins and sugar, so sugar must be added to bring the strength up to 7 per cent.

Whey is milk from which the casein and most of the fat have been withdrawn. To prepare whey, add one tablet of rennet ferment to a pint of milk which is warmed to body-heat, and allow to stand. When firmly set break up the curd and stir briskly, pour off the clear fluid, and just bring to the boil to stop the further action of the rennet.

Whey contains the whole of the lactalbumen of milk, the whole of the sugar, and that part of the fat which is not entangled in the curd. To make this into a food suitable for the infant, sugar and cream must be added to bring the percentage up to normal. This is often a very valuable food for children suffering from digestive disturbances. Whey is also an excellent diluent for cream mixtures.

Peptonized Milk may be used for infants with weak digestions, especially when the child has had some gastro-intestinal complaint, and it is advisable to give food in an easily assimilable form. Peptonized food should only be used as a temporary food, otherwise the glands of the stomach become inert from disuse. It is most conveniently made by using a peptonizing powder which contains a certain added amount of sugar. To a pint of milk add a quarter of a pint of water. Raise the mixture to a temperature of 120° F., and then add the peptonizing powder. Set aside in a warm place, and after ten to fifteen minutes taste, and as soon as the mixture begins to taste bitter bring to a boil for a few moments to stop the process, and cool quickly. It is important not to let the peptonizing process go too far, otherwise the milk becomes too bitter and the infant will refuse to take it. It is given in the ordinary quantities, and diluted if necessary and cream added.

Condensed Milk.—This preparation of milk as a temporary food for infants is often well borne, but owing to its composition and preparation it must not be used for any length of time, as although an infant may appear to thrive on it and get fat, it is often responsible for rickets.

There are two varieties of condensed milk which are generally used, the sweetened and the unsweetened. A good brand of condensed milk must be used, as the cheaper classes are made of skimmed milk with sugar added. The unsweetened is the more suitable, but as this turns sour more quickly the sweetened is more often used.

The proteins, fat, and milk-sugar are treble the strength that is found in fresh milk, and so it is necessary to dilute the milk with three times its volume of water to bring it to the composition of cow's milk, and then further to dilute it to reduce the caseinogen to digestible proportions. Hence it is necessary to add cream and sugar as in an ordinary mixture of cow's milk and water.

Sweetened condensed milk contains not less than 50 per cent. of sugar (chiefly cane sugar), so a dilution sufficient to reduce the sugar to normal (6 to 7 per cent.) reduces the proteid and fat far below normal.

Unsweetened condensed milk should be used and diluted not less than four times with boiled water, and two teaspoonfuls of cream

(20 per cent.) and one teaspoonful of milk-sugar should be added to each 3 ozs. of the mixture.

Delicate infants with impaired digestions will often thrive on this preparation, as they seem to be able to digest the casein in this form, but it must be remembered that this milk has lost its anti-rachitic properties in its preparation, so that any child fed on it for any length of time runs a grave risk of contracting rickets.

Dried Milks.—There are various kinds of dried milk on the market. Some are dried at a low temperature and some at a high temperature.

Those that are dried at a high temperature, have the disadvantage that they are deficient in vitamins and the fine emulsification of the fat is lost. Those that are dried at a low temperature, are not sterile, have a slight tallowy taste, and are not easily digested. On the other hand, their vitamins are but little destroyed and the fat remains in a fine emulsion.

Dried milk should only be given when fresh milk is difficult to obtain, as on long sea-voyages, or when it is difficult to keep, as in the hot summer months. When used dried milk should be modified in exactly the same way as fresh milk so as to be brought approximately to the standard of breast milk.

Dried milks have an advantage over "patent foods," that on the addition of the amount of water abstracted during the process of drying results in a mixture practically identical with cow's milk, except in a possible loss of vitamins. In many of the "patent foods" the fat is deficient and the proteids are vegetable proteids.

Patent Foods.—These foods, unless used with discrimination, are as a rule to be condemned, as they cannot provide a food for infants as good as cow's milk. Foods which contain starch are not suitable, and should not be given to a child under seven months of age, as it cannot digest starch.

Those foods in which the starch has been converted into soluble carbohydrate may be used as temporary substitutes for milk, but more properly as additions to milk. Speaking generally, it is inadvisable to add "foods" to the diet of a child under three months of age. However, the addition of a teaspoonful of a food containing starch to two or three feeds in the day for an infant that is habitually constipated is attended with the happiest results.

Albumin Water.—This is prepared from the white of a raw egg. The unboiled white is beaten up with a fork and mixed with a half-pint of cold boiled water to which a little sugar is added. This is well shaken. The strength of the solution may be increased by adding the white of one or two eggs. This forms

an excellent food for a time, as it is easily digested and can be used when a child vomits or cannot digest milk. With the addition of cream and sugar the child can be gradually accustomed again to cow's milk.

Raw Meat Juice.—Mince finely 4 ozs. of fresh lean rump-steak, place in a saucer and cover with 1 oz. of water, allow to stand for one hour, and then express all fluid possible through muslin with a lemon-squeezer. This forms a valuable addition to the diet of a puny child, as it is a fluid rich in albumin and will often be retained when other fluids are rejected. It may be given in teaspoonful doses or mixed with albumin water or whey. It should be discontinued if the motions become offensive.

Methods of Preparing Milk.—Milk as delivered by the dairy is teeming with micro-organisms. Most of the infantile disorders, such as gastro-enteritis and the specific fevers, are probably conveyed by the milk. In many cases the tubercle bacillus has been introduced by the milk of tuberculous cows. It will be seen, therefore, how important it is that the organisms should be rendered inert before the milk is given to the child.

This can be done in one of three ways:—

1. Sterilization.
2. Pasteurization.
3. Boiling.

Sterilization.—Milk is generally sterilized by the dairies with superheated steam, and domestically by immersing a bottle containing the milk in a saucepan of boiling water for an hour. This destroys all active organisms and their spores, and makes the caseinogen more digestible, but at the same time destroys the anti-rachitic properties. An infant fed for any length of time on sterilized milk is very likely to become rickety.

Pasteurization.—This consists in keeping the milk at a temperature of 160° F. for twenty minutes, which destroys most active organisms, though a few organisms in spore formation are not destroyed.

The most convenient apparatus is the Soxhlet, which consists of a saucepan in which is fitted a removable tray with a perforated shelf above to carry bottles. The tray is raised about an inch above the bottom of the pan. The lid is perforated to allow the thermometer which is in the water to project through it, and so the temperature of the water can be observed. Bottles each containing one feed are placed on the tray, and cold water poured in until it reaches the level of the milk in the bottle, and then by means of a

lamp the temperature is raised to 160° F. and kept there for twenty minutes. A rubber cap is placed on each bottle which automatically seals the bottle on cooling. After the milk is pasteurized it should be rapidly cooled, as tepid milk forms a good culture medium for any spores which may remain in the milk. When the milk is required for use the rubber cap is removed and a teat substituted, the milk brought to a temperature of 100° F., and given to the infant.

Boiling.—Simply bringing the milk up to boiling-point and then rapidly cooling it is the method most commonly employed. It destroys all active organisms and does not deprive the milk of its anti-rachitic properties.

All these precautions for the purification of milk are useless unless the greatest care is taken in cleansing the bottles. Bottles should be of the simplest possible pattern, no tubing should be

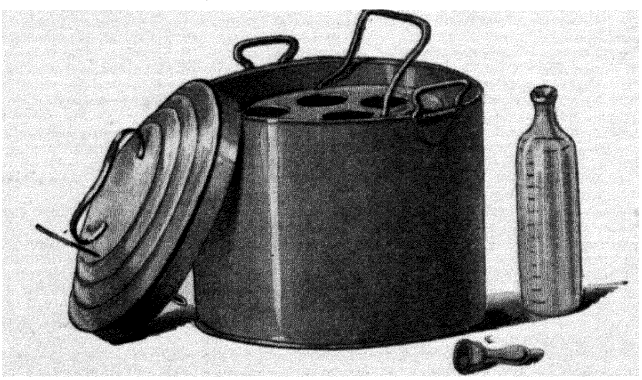


FIG. 223.—SOXHLET'S APPARATUS FOR PASTEURIZING MILK.

Shows the tin vessel to contain the water; a tin tray to hold the bottles; a bottle; a thermometer in the lid; and an indiarubber teat.

used, and the teat should be sufficiently large to be turned inside out for thorough cleansing. The bottle should be open at both ends to enable it to be properly cleansed, and when not in use the bottle and teats should be kept immersed in water to which borax has been added.

Bottle feeding must always be supervized by the nurse or mother; the bottle must not be allowed to lie on the pillow, but must be held by the nurse or mother. A child should occupy ten to fifteen minutes in taking its feed, and the rate must be regulated by the nurse. By taking a feed slowly the child will only take what it requires, and not all it can get. A pause should be made in the middle of the feed, and the baby sat up and encouraged to eructate any wind which it may have swallowed. This should also be done at the end of a feed, and it will often prevent the infant being sick.

Above all, a baby must be fed regularly, and, if necessary, awakened for its meal.

After six months the feeds may be supplemented by one of the

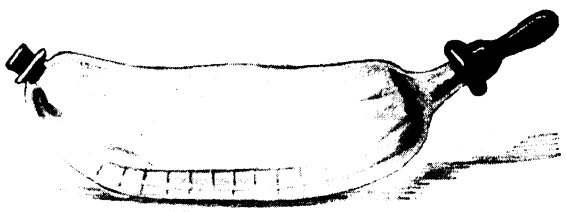


FIG. 224.—GRADUATED BOTTLE WITH VENT AT BOTH ENDS TO PERMIT OF EASY CLEANSING.

less starchy foods. Up to the age of six months a healthy child will need only milk for its food.

For the times of feeding and the amounts see pages 607 and 608.

Care of Premature Infants.—Strictly speaking, a premature child is one that is born before the fortieth week of gestation. For all practical purposes a child born after the thirty-sixth week may be treated as a full-time child provided it weighs as much as 5 lbs. Children born as early as the twenty-eighth week do not as a rule survive. The first consideration in the care of a premature child is warmth. The child should be kept in a warm, well-ventilated room. It should not be washed for three days in any case. It should be well smeared with olive oil, put in a gamgee jacket and kept in a cot with high sides to keep off all draughts; the cot should be well warmed with hot-water bottles.

A premature child will thrive better in an improvised incubator than in the poorly ventilated glass cases frequently used. A clothes-horse covered in with blankets and heated with an electric lamp forms an efficient incubating chamber. Owing to the heat and clothing the infant loses fluid by perspiration, and it is essential that this fluid should be replaced. The stomach of the premature infant is very small and cannot contain much fluid, and it may be necessary to supplement the feeding with rectal saline infusions of ½ oz. three or four times a day. As the infant begins to take sufficient fluid by the mouth the rectal salines can be discontinued.

A premature child should be fed at once and regularly. A whey mixture, a few drops at a time, should be administered with a teaspoon until the mother is able to provide it with milk. Some premature infants can suck the breast, but for those that cannot, it may be necessary to draw off the milk with a breast-pump first, and then

give it by spoon or bottle. The child should be disturbed as little as possible and not bathed. It should be kept lying on its side, as should it vomit it may inspire the vomit and be suffocated.

It is sometimes a matter of medico-legal importance to establish the fact that a child is premature. The best test is the length

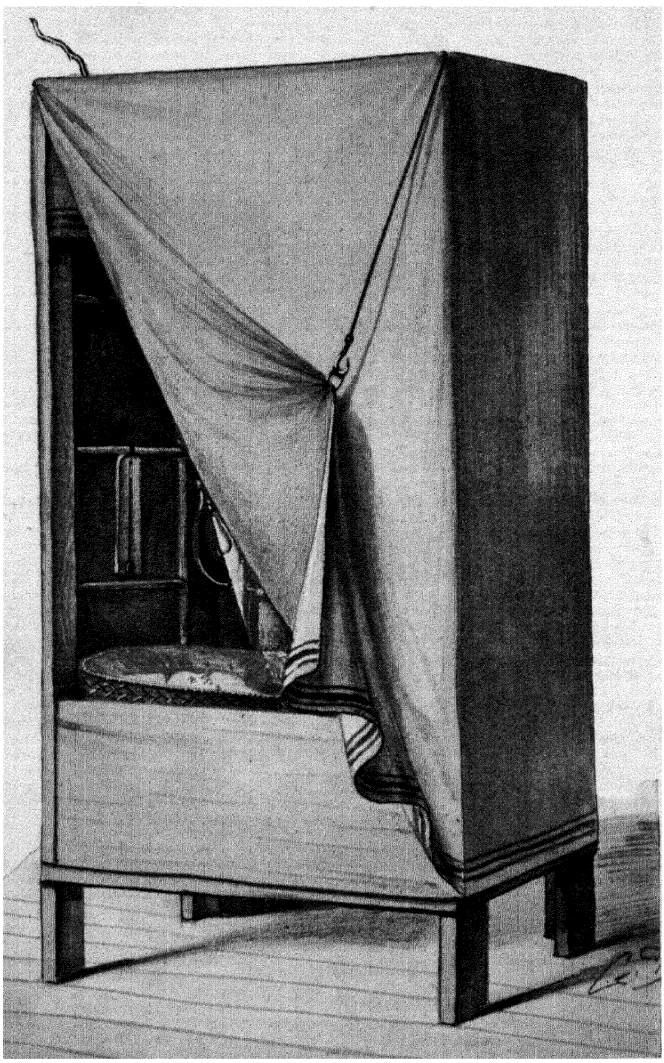


FIG. 225.—INCUBATOR FOR PREMATURE INFANT WITH ELECTRIC LAMP FOR HEATING.

of the child. A full-time child is not less than 20 inches long. The nails reach beyond the bed of the nail. The weight of a child is not a good test, as a full-time child may weigh less than 6 lbs. A premature child has very little subcutaneous fat and is often covered with lanugo. The passage of meconium is delayed in a premature infant.

CHAPTER L

DISEASES AND INJURIES OF THE NEW-BORN CHILD

ASPHYXIA NEONATORUM

THIS term is applied to infants which make no effort to breathe on being born although the heart is beating. Normally the fœtus is supplied with oxygen by the placental circulation, but when born, owing to the cutting off of the maternal circulation to the placenta by the retraction of the uterus, the child has to obtain its oxygen by its own efforts.

CAUSE

Exceptionally, owing to some interference with the placental circulation due to pressure on the umbilical cord, premature separation of the placenta, delay in the birth of the after-coming head, or tonic contraction of the uterus, the child may make efforts at respiration while still *in utero*, with the result that it draws a certain amount of amniotic fluid or mucus into its lungs. The heart at first responds to the needs of the child by an increased rapidity of beat, but when the child is saturated with the accumulation of carbon dioxide the cardio-respiratory centre becomes paralysed and the heart-beat slows and finally ceases.

Pressure exerted on the brain of the fœtus by contraction of the pelvis or a difficult forceps-delivery may cause slowing of its heart-beat, with the result that the centre becomes depressed, and the infant on birth makes no effort at breathing. Intra-cranial hæmorrhage occurring over the cerebral hemispheres causes pressure but is not incompatible with the child living. A comparatively small hæmorrhage at the base of the brain will cause death.

The importance of observing the frequency of the heart-beat during labour cannot be overstated. The temporary check to the maternal circulation to the placenta during a contraction causes the

heart-beat to slow, but it regains its frequency during an interval. In time this intermittent deprivation of oxygen will affect the child, and the heart will not regain its frequency between the contractions. It may be taken as a working rule that if the heart-beat sinks to 100 beats per minute, the birth of the child must be accelerated by the forceps or other aid to delivery if the condition of the mother allows, otherwise the child will perish.

Another important sign of the impending asphyxiation of the child is the passage of meconium or meconium-stained liquor amnii in a vertex presentation. In breech cases the passage of meconium is unimportant, as it is simply the effect of the pressure of the thighs on the abdomen. In difficult vertex cases and in breech cases when there may be delay with the after-coming head, remedies should be ready at hand for the treatment of the asphyxia.

The degree of asphyxia varies. Owing to the interference with the placental circulation, the child first passes through a phase of suffocation, and then if the suffocation is not relieved it passes into a state of syncope.

For descriptive purposes asphyxia is generally divided into:—

1. Blue asphyxia, or asphyxia livida, in which the respiratory function is chiefly at fault.
2. White asphyxia, or asphyxia pallida, in which the cardiac function is at fault.

Signs

Blue Asphyxia, or Asphyxia Livida.—Asphyxia livida is characterized by the cyanotic or blue colour of the child. The heart, as a rule, is beating strongly, the muscles are firm, and the cutaneous reflexes are present. This type may, if untreated, pass into the second variety.

White Asphyxia, or Asphyxia Pallida.—In this form the child is suffering from heart failure. The child is pale and cold, the extremities are limp, and the heart is beating slowly and feebly and the pupils are dilated. There is loss of reflex and muscle-tone, and paralysis of the respiratory centre.

White asphyxia occurs after prolonged labour with the possibility of head injuries, or after morphia-scopolamine administration or prolonged chloroform anæsthesia.

Prognosis

Most cases of blue asphyxia readily recover with appropriate treatment. The prognosis in white asphyxia is always grave.

Many cases never respond to treatment, or may respond only feebly and succumb in a few hours. Others recover temporarily, but die later from convulsions due to injury to the brain.

Treatment

When born the child should be laid on its side, and its mouth and pharynx completely cleansed with a piece of gauze wrapped round the little finger. The two varieties of asphyxia have to be treated very differently, as the "blue baby" has only to be made to breathe, while the pallid or "white baby" has to be treated for heart failure.

Asphyxia Livida.—After clearing out the air-passages the child should be stimulated by slapping the buttocks or by sprinkling a few drops of cold water on the face or chest. If it does not make efforts at respiration, it should be held up by the feet, over the bed in case it should slip from the grasp, and the spine rubbed briskly with a towel. These methods generally are sufficient to

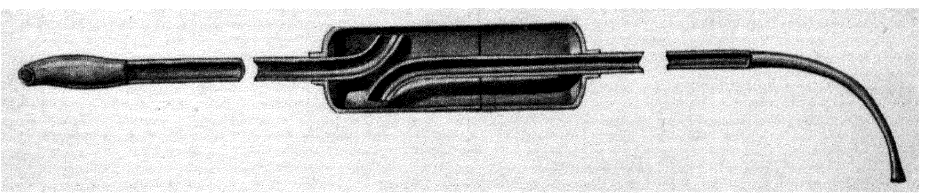


Fig. 226.—Catheter for Withdrawing Mucus or Fluid from the Larynx of the Newborn Infant.

cause the child to cry. Should they be unavailing or the pulsation feeble, artificial respiration should be employed.

Asphyxia Pallida.—A child born in this condition must be treated with the greatest gentleness and care, as any strong measures would kill it. Many children born in this condition are over-treated. The air-passages should be cleared from any mucus present and the umbilical cord cut and tied. The body heat of the child should be maintained by a hot bath (105° F.). It will often happen that the strength and frequency of the heart-beat will immediately improve, and the pulse can again be felt in the cord. If the pulse-rate is improving keep the child in the bath, and in a short time respirations, at first shallow and infrequent, will be noticed, which will be succeeded by a cry. If the bath is not enough to establish respiration, it is necessary to resort to artificial respiration at once.

Before practising methods of artificial respiration it is necessary to make sure that the air-passages are free from mucus. This is

effected by means of a catheter passed into the larynx. The catheter is passed guided by the left index finger, which is placed

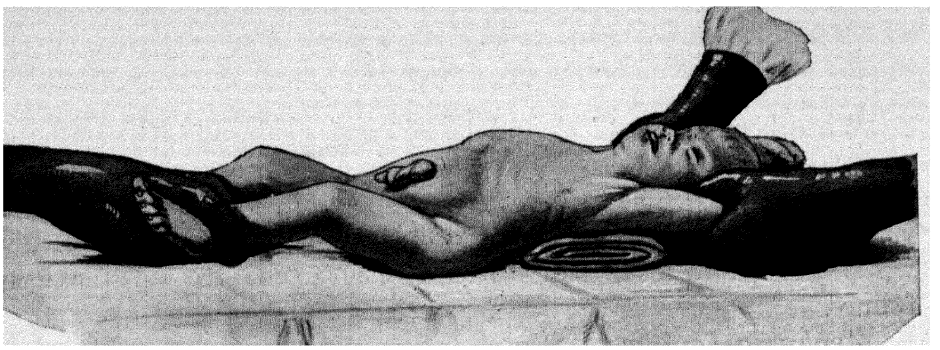


FIG. 227.—SYLVESTER'S METHOD OF ARTIFICIAL RESPIRATION ILLUSTRATING THE FIRST MOVEMENT OR INSPIRATION.

Note the pull on the arms lifting up and increasing the capacity of the chest, and the folded towel under the shoulders. In practice the child would be warmly covered up.

behind the tongue, and mucus drawn up by the mouth. The disadvantages of the ordinary catheter is that mucus is drawn into the operator's mouth. This is avoided by using one of the pattern

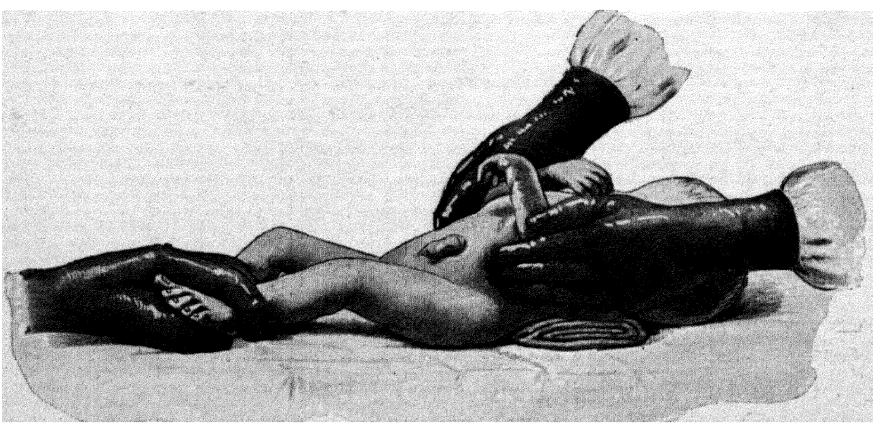


FIG. 228.—SYLVESTER'S METHOD OF ARTIFICIAL RESPIRATION REPRESENTING THE SECOND MOVEMENT OR EXPIRATION.

illustrated (see Fig. 226), which has a receptacle into which the mucus is drawn. The following are the chief methods of artificial respiration.

METHODS OF ARTIFICIAL RESPIRATION

Sylvester's Method.—After the air-passages are thoroughly cleansed, the child is laid on a warm blanket with the head sup-

ported midway between extension and flexion. The feet being held steady by an assistant, the arms are elevated above the child's head and slightly everted; by this means traction is made on the child's pectoral muscles, and the chest is in a position of inspiration. The second movement consists in pressing the child's arms against the sides and lower part of the chest, thus tending to empty the lungs and imitating expiration. These movements should be repeated about 15-20 times a minute. There should be a pause while the chest is in the position of inspiration, and the whole movement must not be hurried. The disadvantage of Sylvester's method is

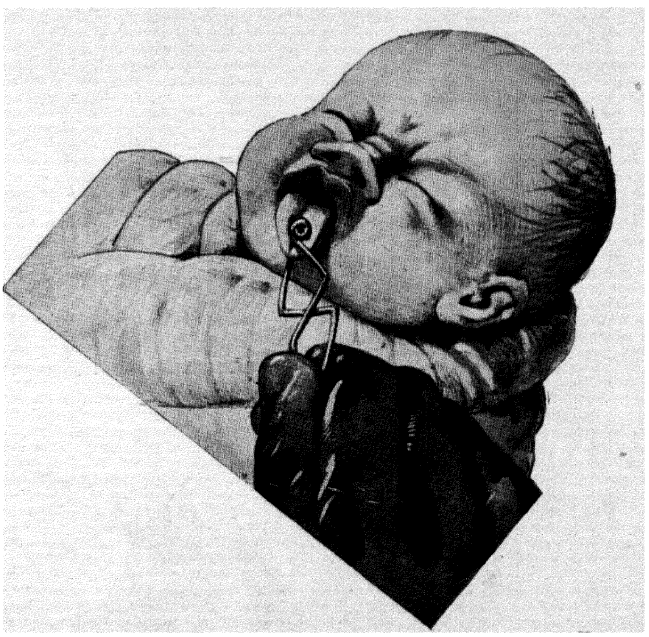


FIG. 229.—LABORDE'S METHOD OF ARTIFICIAL RESPIRATION BY PULLING ON THE TONGUE OF THE INFANT WITH FORCEPS.

that it requires two people to carry it out, and that it cannot be efficiently performed in a bath (Figs. 227, 228).

Byrd's Method.—The simplest method of performing artificial respiration in a bath is Byrd's method. This consists in producing alternate flexion and extension of the trunk by one hand applied to the shoulders and the other hand to the buttocks.

Laborde's Method.—This method can be carried out while the infant is in the hot bath, and consists of catching hold of the child's tongue with a handkerchief or pair of forceps and drawing the tongue out to its full extent and then allowing it to go back. The movement should be repeated about 15 times a minute. This method proves a very strong stimulus to the plexus of nerves which are

situated at the base of the tongue and communicate with the phrenic nerves (Fig. 229).

Marshall Hall's Method.—This consists in placing the child in the dorsal position on the outstretched palm and allowing its arms

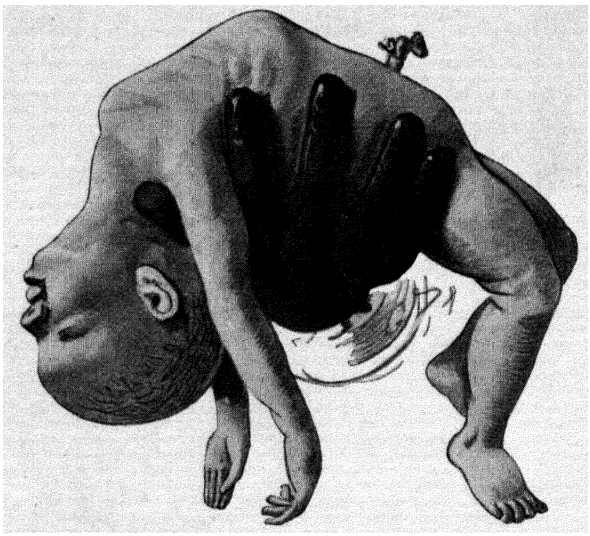


FIG. 230.—MARSHALL HALL'S METHOD OF ARTIFICIAL RESPIRATION. FIRST MOVE-

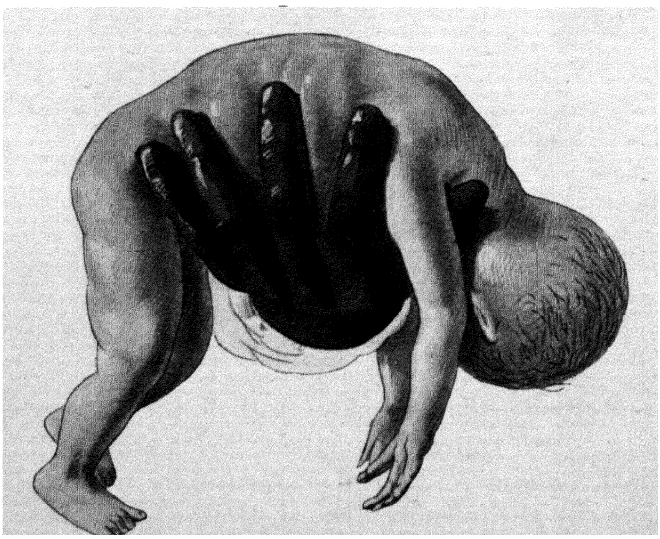


FIG. 231.—MARSHALL HALL'S METHOD OF ARTIFICIAL RESPIRATION. SECOND MOVEMENT, EXPIRATION.

and legs to hang. This increases the capacity of the chest and encourages inspiration. The child is then turned over, chest downwards, on the other palm, and the air pressed out of the chest. This forms an efficient and single-handed method, but is only suitable for blue asphyxia (Figs. 230, 231).

Mouth to Mouth Respiration.—This method, if done with skill and judgment, will often convey that extra stimulus to the lungs which is needed to initiate respiration. Care must be taken that the air is not blown in under too great pressure, else the alveoli may be ruptured. The infant can be in a hot bath while the method is practised. The tongue is held with a piece of gauze and drawn forward, the nostrils are pinched with the other hand, and the air blown direct into the trachea. A hand placed over the epigastrium will to a certain extent prevent air entering the stomach.

Artificial respiration should be kept up as long as fœtal heart-sounds can be heard by auscultation. This may entail operations lasting for as long as an hour, and it must be borne in mind that during the whole of this time the child must be kept warm.

The efficacy of artificial respiration is shown by the fact that the lungs of infants that have been "stillborn," may float when cut up and placed in water.

Other aids to the stimulation of the infant are the hypodermic injection of pituitary extract ♏ ii to iv, and the administration of brandy rubbed on the gums.

It is often found that the infant is born rather feeble after the mother has been subjected to prolonged chloroform anæsthesia, or when drugs such as morphia-scopolamine have been used. The reason of this is that the baby itself is under the influence of these drugs, which act as cardiac depressors. It is usually quite sufficient to put these infants in a hot bath, but sometimes in addition it is necessary to perform artificial respiration.

Atelectasis Pulmonum.—Atelectasis or collapse of the lung is a condition met with after birth. It may affect a whole lobe, but more frequently it is patchy in its distribution. The favourite sites are the anterior margins of the lungs, the edges of the lower lobes and the middle lobe of the right lung. The child is usually puny and of feeble build, with a weak whining cry and cyanotic appearance. The chest movements are shallow, and on percussion there is a lack of resonance without marked tubular breathing. The condition is serious, and must be treated with hot baths and stimulation to cause the infant to cry and expand the lungs.

STILLBIRTH AND STILLBORN

A "stillbirth" is the birth of a stillborn child. A "stillborn" child means a child whose body at birth measures not less than 13 inches, or 32 centimetres in length, from the crown of the head to the sole of the feet, and who, when completely born

(the head, body, and limbs of the child, but not necessarily the after-birth, being extruded from the body of the mother), exhibits no sign of life—that is to say, whose heart has ceased to function, as demonstrated by the absence of pulsation in the umbilical cord at its attachment to the body of the child, and the absence of any heart sounds or impulses.

Crying and breathing being secondary signs of life, manifested only when the heart is acting, can be taken as signs of life, but the absence of either or both is not to be held proof of absence of life in the child.

INJURIES OF THE FŒTUS DURING BIRTH

The most important injuries of the child are those which affect the skull.

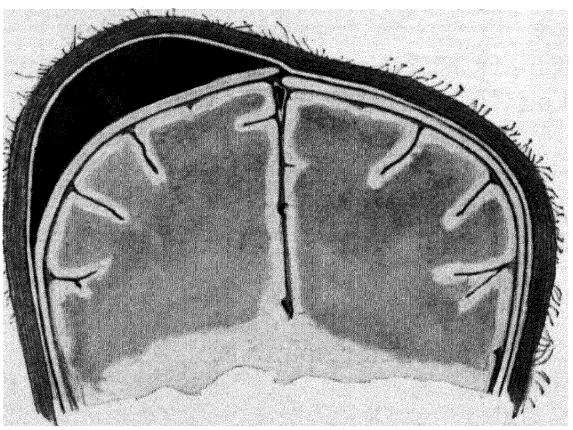


FIG. 232.—CEPHALHÆMATOMA.

The swelling is seen to consist of blood lying between the pericranium and the skull and limited to the bone on which it started by the attachment of the pericranium to the suture.

Cephalhæmatoma.—The commonest form of injury is that known as the "cephalhæmatoma". It is formed by an effusion of blood which strips up the pericranium and lies between it and the skull. Owing to the fact that the pericranium is attached to the edges of the sutures, this effusion is limited to one bone, which thus distinguishes it from the caput succedaneum, which is a more brawny swelling overlapping the sutures and disappearing some twenty-four hours or so after birth. In some cases the effusion of blood also takes place between the skull and the dura mater. The parietal bone is the usual seat of the swelling. The swelling is not usually present at birth, may only be noticed a day or two after birth,

and varies in size from that of a walnut to a hen's egg. The swelling is at first fluid and fluctuating, but in a few weeks the edges become hard and raised owing to bony formation, and the centre gives the impression of being depressed and may lead to a suspicion of fracture.



FIG. 233.—CEPHALHÆMATOMA.

The swelling is sharply defined and does not cross a suture.

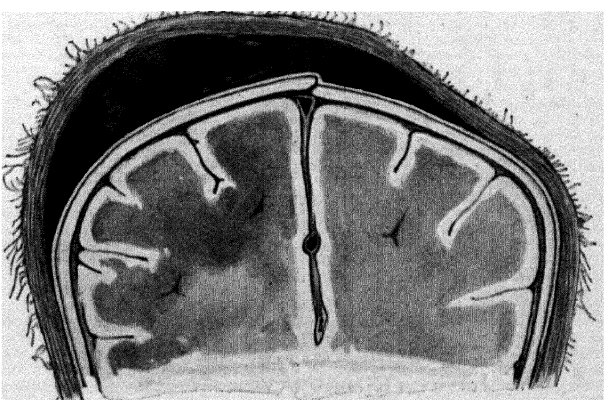


FIG. 234.—CAPUT SUCCEDANEUM.

The swelling is formed by œdema of the structures lying superficial to the pericranium. Note that it is not limited to one bone. Compare with Fig. 232.

There is increased bony formation all over the area of the swelling, but this to a large extent is absorbed, and the shape of the head becomes normal (Figs. 232, 233, 234).

Cephalhæmatoma more frequently follows labour associated with

a contracted pelvis, more especially a flat pelvis, or from a forceps-delivery. On the other hand, it may be seen after an easy and normal delivery.

The swelling usually subsides, but occasionally it may suppurate. Treatment is only needed if the swelling suppurates. It is inadvisable to puncture it.

Depressions of the Skull.—Local depressions of the skull are generally due to the pressure of the promontory of the sacrum. The depression is either spoon-shaped or in the form of a groove. It is usually situated near the anterior border of the parietal bone, and if the head flexes as it passes the superior strait the groove often crosses the coronal suture and comes to lie on the frontal



FIG. 235.—DEPRESSED FRACTURE OF THE TEMPORAL AND PARIETAL BONES FOLLOWING LABOUR WITH CONTRACTED PELVIS.

bone. These depressions of the skull occur in cases of flattened pelvis and as a rule disappear during the first week of life. Sometimes they are associated with fissures and fractures of the cranial bones, and some operative procedure may be necessary to relieve the pressure on the brain (Fig. 235).

Fracture of the Skull.—This condition generally follows a difficult delivery of a vertex with the forceps or a difficult extraction of the after-coming head. It is usually associated with a flat pelvis, and the fracture is caused by dragging the head past the promontory. It is very often accompanied by intra-cranial hæmorrhage.

The infant in these cases is usually born asphyxiated. If it can be revived, it may suffer from paralysis with subsequent con-

traction of the limbs and impaired intelligence. Repeated and severe convulsions occurring soon after birth are generally due to some damage to the brain or intra-cranial hæmorrhage.

Intra-cranial Hæmorrhage.—Injury to the brain of the newborn child occurs during labour with contraction of the pelvis, which has usually required the forceps for its completion. Unaided delivery may injure the infant's brain if the pelvis is contracted, especially when the conjugate diameter is contracted as in a flat pelvis.

Strong traction in the delivery of the after-coming head may injure the lateral and cavernous sinuses, leading to thrombosis. (see p. 375).

The injury to the brain may involve one or both cerebral hemispheres, with laceration of the vessels of the membranes or meninges. It need not be accompanied by any visible damage to the cranial vault.

Signs and Symptoms

The infant the subject of intra-cranial injury is often born dead or in a state of suspended animation. The heart may be beating and there is no effort at respiration. These infants may be revived with appropriate treatment, only to succumb in the course of a few hours or days.

After a few hours there may be twitching of the limbs or even paralysis limited to a certain area. The twitching may become general and end in a convulsion. On the other hand, the signs may point to an irritation of the brain with vomiting and incessant screaming, rigidity of the limbs, and inturning of the thumbs. If the infant recovers, there may be permanent impairment of the mental powers and contractures of the limbs.

Treatment

If a depressed fracture or middle meningeal hæmorrhage is diagnosed sufficiently early, operative measures in selected cases may relieve the condition, but the injury is usually fatal.

INJURIES TO NERVES

Facial Nerve.—The commonest nerve to be injured is the facial nerve. The converging blades of the forceps are very liable to compress this nerve, as it crosses the ramus of the jaw. As a rule the resulting paralysis is unilateral and produces a well-marked paresis of the orbicularis oris muscle, which is very noticeable when the infant cries. Fortunately the paralysis usually passes off in a few days, though cases are on record in which the paralysis has

been permanent. Especial care must be taken in cleansing the baby's mouth after feeding, as curds are liable to collect and, becoming sour, lead to stomatitis. Active treatment is as a rule not necessary (Fig. 236).

Cervical or Brachial Plexus.—Occasionally, owing to the large size of the child's shoulders or delay in their birth, it is necessary to put traction on the child's neck to draw the anterior shoulder down. This may lead to rupture of the lower cords of the cervical plexus or the upper cords of the brachial plexus, or to rupture of some nerve fibres running in these cords. The same accident may happen in the delivery of the after-coming head by the Prague method.

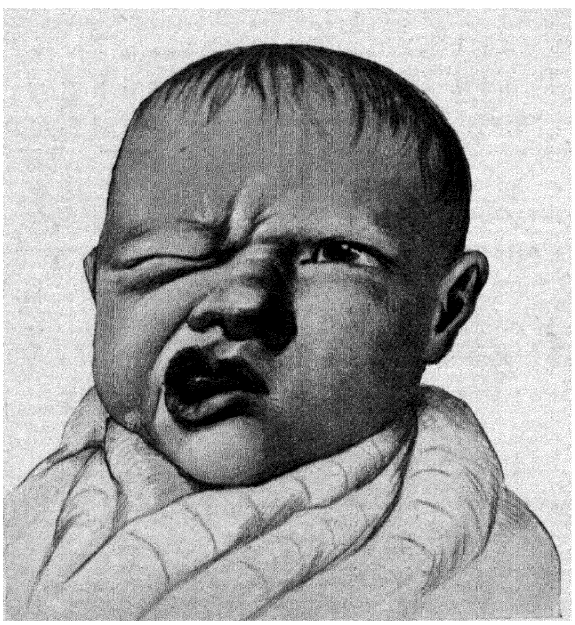


FIG. 236.—FACIAL PARALYSIS FOLLOWING APPLICATION OF THE FORCEPS.

If the rupture of the cord is complete, the paralysis resulting may be permanent, but if only a few fibres are torn through, the damaged fibres will generally recover, as the sheath, not being torn through, acts as a splint to the growing axis cylinder.

TREATMENT

Brachial palsy, or Erb's paralysis, is likely to be permanent if the arm is allowed to hang down. The arm should be lightly bandaged to the chest over cotton-wool—as for a fractured clavicle—for the first fortnight. Then passive movements and gentle massage should be begun. As a rule, when this is done no lasting weakness results.

Hæmatoma of the Sterno-mastoid.—Occasionally, owing to strong traction applied to the after-coming head, or to the fore-coming head when the shoulders are impacted, some fibres of the sterno-mastoid muscle may be torn through, with the result that there is hæmorrhage and the formation of a hæmatoma. This is recognized by a swelling forming in the substance of the muscle (Fig. 237). The blood is usually absorbed without resulting deformity, but fibrosis may take place with shortening of the muscle and the production of torticollis.

Injury to the Clavicle.—A fracture of the clavicle is not at all an uncommon accident in the extraction of a breech with the

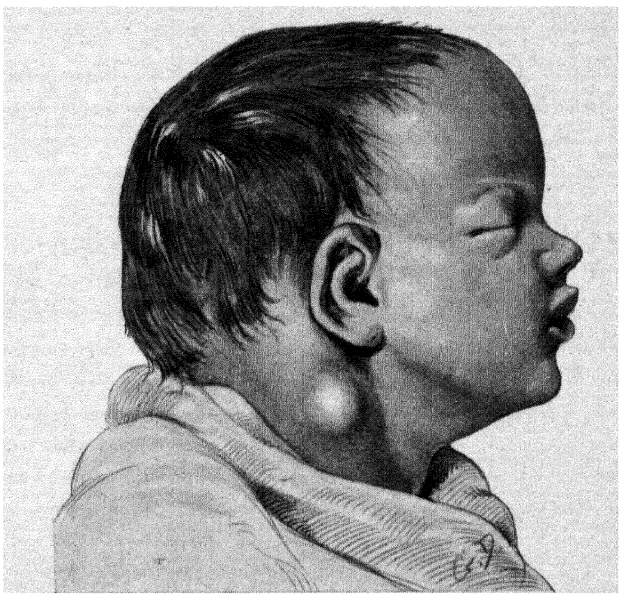


FIG. 237.—HÆMATOMA OF THE STERNO-MASTOID.

arms extended. In bringing down the first arm in a case of contracted pelvis, it is sometimes a question of sacrificing the child or the clavicle, as very often the arm appears quite impacted until the clavicle snaps. In some cases of impaction of the shoulders it is necessary to fracture or divide the clavicles before the child can be delivered.

TREATMENT

The forearm should be flexed on the arm, and the hand brought as near the opposite shoulder as possible, and the whole arm should then be bound to the chest by a broad flannel binder and left in position for ten days. The axilla of the injured side should be well powdered and guarded by a small pad of wool.

Injury to the Humerus.—The humerus is occasionally fractured in the same way as the clavicle, and must be put up in a small poroplastic or "kettle-holder" splint and bandaged to the chest.

Injury to the Femur.—Injuries to the lower limbs are rare, but a fracture of the neck or shaft of the femur may be caused by a blunt hook or finger pulling on an impacted breech. This is most efficiently treated with a gallows splint.

Injury of the Lower Jaw.—Occasionally, owing to delay in the birth of the after-coming head, the lower jaw may be fractured by the fingers on the rami exerting too great pressure.

TREATMENT

It is difficult to immobilize the bone, as the infant must be fed and the mouth must be kept clean. The most convenient apparatus is a poroplastic splint which will allow some movement without disturbing the fracture.

Injury to the Abdominal and Thoracic Organs.—Injuries to the abdominal and thoracic organs may be caused by the hand introduced too roughly and along the ventral surface of the child to extract a limb, and the lung may be perforated by a fractured rib. It is particularly likely to occur in difficult breech deliveries, by gripping the child's abdomen.

Dislocations of Joints.—The shoulder, hip, jaw, or neck may be dislocated during delivery. Dislocation of the neck is usually incompatible with life. Dislocation of the hip is generally congenital and bilateral, and associated with deformity and maldevelopment of the acetabulum.

TREATMENT

The dislocation must be reduced with care, for fear of separating the epiphysis.

OPHTHALMIA NEONATORUM

CAUSE

This is a disease occurring in the newly-born and due to infection of the eyes during the passage of the head through the vagina. It is frequently due to the *diplococcus gonorrhœæ;* other organisms are sometimes found, chiefly the pyogenic cocci, the colon bacillus and the bacillus of diphtheria.

A purulent discharge from the eyes starting as late as a week after birth is generally due to pyogenic organisms, but such a discharge should be examined for gonococci, as cultural methods are the only means of distinguishing the infecting organism. It should be remembered that apart from birth-infection the gonococcus may be conveyed from another case by the fingers of the nurse or by towels or sponges. Such accidents are particularly liable to occur in institutions.

Signs

The period of incubation is short, and twenty-four hours after birth, or sometimes as long as three days, the eyelids become puffy and stick together; soon after the conjunctivæ become inflamed, and there is a purulent exudate. This conjunctivitis is soon followed by inflammation of the cornea, which may lead to ulceration, with sloughing, perforation, and destruction of the eyeball. The infection may affect one or both eyes.

Prognosis

Ophthalmia neonatorum is a grave calamity which must be treated promptly and energetically, otherwise it will lead to permanent blindness, or at best the child will have impaired vision, with opacities on the cornea. Fifty per cent. of the blind owe their loss of sight to gonorrhœal ophthalmia in infancy.

Treatment

Prophylaxis.—Since the adoption of Credé's method of treatment in all cases in which a vaginal discharge is present, the incidence of ophthalmia has fallen to less than 1 per cent. The treatment consists in wiping the eyelids of the child, before it is wholly born and before the eyes are opened, with a sterile swab, using a separate swab for each eye. When the child is born, one or two drops of a fresh 1 per cent. solution of nitrate of silver are instilled into each conjunctival sac, and then the eyes washed with normal saline solution.

This is often followed by a reactionary conjunctivitis, which soon passes off and does not affect the cornea. Not only has Credé's method reduced the incidence, but it has almost abolished total blindness following this infection. This routine treatment is now commonly used in lying-in hospitals, and modern treatment suggests that a 2 per cent. solution of silver nitrate gives even better results, but it cannot be used generally in private practice, though

it must be carried out when there is the faintest suspicion of gonorrhœa being present.

Care must be taken that the baby is not re-infected after this treatment, as this may be done by the child rubbing its unwashed hands over its eyes, or by the nurse bathing the child's face in the same water in which the body is being washed. Care, too, must be taken that the mother does not contaminate the child's eyes with her discharges.

If, during the first stage of labour, it is found that the patient has a purulent vaginal discharge, the vagina should be thoroughly dry-swabbed with sterile wool and painted with tincture of iodine. This swabbing out is more efficiently performed if the patient is under an anæsthetic.

Treatment.—Since the disease is so serious, expert advice should be called in if possible. If the child has a purulent discharge treatment must be started at once. The child is placed on the nurse's lap with its head between the doctor's knees, and a few drops of a 2 per cent. solution of silver nitrate are dropped into the eye and gently massaged into the conjunctiva, and then washed out with saline solution. Care must be taken that the pus, which may be at some tension, does not squirt into the operator's face on separating the eyelids. After the instillation of the silver nitrate the edges of the eyelids may be painted with castor oil to prevent sticking. The nurse must be warned of the dangers of this discharge and instructed to wear gloves, and to wash out the eyelids as often as possible, and at a not longer interval than two hours day and night, with a saturated solution of boric acid diluted with equal parts of hot water. Energetic measures will generally cut short the attack and prevent any permanent damage to the eyes.

Should only one eye be affected the sound eye must be guarded from infection, and the child laid on the side which is affected so that the discharge does not run over into the other eye. The affected eye should not be bandaged up, but the discharge allowed to escape freely.

ICTERUS NEONATORUM

It is not at all an uncommon thing for a newly-born child to become jaundiced. This is especially the case in children which are premature or born after a difficult confinement. A child is born with an excess of red blood-cells, and in a very few days these are reduced to the normal number. This suggests that there is a great destruction of red cells going on, with the formation probably

of excess of bile pigments. This variety of jaundice, beyond causing some sleepiness, is not accompanied by symptoms.

A second variety of jaundice met with in the newly-born is the catarrhal form, probably due to some gastro-intestinal infection at birth. The intestine of the child at birth is sterile; within a short time of birth it is teeming with micro-organisms, which, in many infants, give rise to some transient enteritis which may affect the bile ducts and cause obstruction to the discharge of bile with consequent jaundice. It is more severe in form, and the conjunctivæ are tinged with yellow, the urine stains the diapers, and the stools are clay-coloured. A small dose of hydrargyrum c. cretâ (gr. 1) with sugar of milk, followed in three hours by a teaspoonful of castor oil and olive oil, will usually help to clear up the jaundice. There is no rise of temperature with these two varieties of jaundice.

A third variety, and the most serious type of jaundice met with, is that known as icterus gravis, or malignant jaundice. This is due to sepsis starting in the stump of the umbilical cord. The umbilicus is red and inflamed, and round its margin is seen some purulent exudate. The organisms spread and grow up the clot occupying the obliterated umbilical vein, and finally reach the liver and give rise to pyæmia. The child is very ill with high fever and jaundice, and almost invariably dies.

A fourth variety of jaundice due to developmental defects in the bile-ducts is occasionally met with. In this variety the stools are not coloured with bile, and the infant is deeply jaundiced. The condition is fatal, though not incompatible with some weeks or months of life.

Congenital syphilis may give rise to jaundice, owing to hepatitis. Other evidences of syphilis will be present, and must be treated with anti-syphilitic remedies.*

CONGENITAL SYPHILIS

Congenital syphilis is one of the most common causes of intra-uterine death. So important is this that a systematic examination should be made of the organs and placentæ of dead or premature children for the presence of the *spirochæta pallida.*

Speaking generally, a pregnant woman suffering from recent syphilis will give birth to a premature or stillborn child. If syphilis is acquired later in the pregnancy, the child may show no signs of active syphilis at birth. The virulence of the virus of syphilis appears to diminish after a few years, and the woman may

* For Familial Jaundice, see p. 643.

give birth to a live child which may be apparently healthy until about puberty, when it will develop tertiary symptoms.

It is comparatively rare for a child to be born alive and show active signs of syphilis at birth. It is more usual for signs and symptoms to develop about the fourth to sixth week.

Signs

A child exhibiting symptoms of syphilis at birth is usually small and shrivelled up, the face wrinkled like an old man's; the cry is feeble and the skin like parchment. The lips may be fissured, the anus ulcerated, and the palms of the hands and soles of the feet covered with a bullous rash called syphilitic pemphigus. These infants are usually feeble and die.

More commonly the child is born to all appearances healthy, but at about the end of the third week it develops "snuffles" and does not thrive. It next develops a coppery-coloured rash with scaly surface on the trunk, and finally an eruption—condylomata—on the buttocks, and mucous patches on the mouth. Until the appearance of the rash a child must not be deemed syphilitic, as many children appear "snuffly" when there is merely catarrh of the upper air-passages. A positive Wassermann reaction clinches the diagnosis in a doubtful case. Children born dead without obvious cause should be examined for the presence of the spirochæte in the liver with a view to treatment of the parents.

Treatment

As soon as the diagnosis is certain, active treatment should be begun. An injection of salvarsan may be given, followed by a course of mercurial treatment. Infants tolerate mercury well, and it may be given in the form of grey powder, gr. $\frac{1}{6}$, mixed with sugar of milk, three times a day, or a piece of unguentum hydrargyri the size of a pea may be rubbed into the skin of the thighs or abdomen, or applied on lint under the abdominal binder.

Condylomata should be kept very clean and bathed with lotio nigra. The mother must be treated at the same time, and may be allowed to nurse her infant except in the rare cases in which syphilis has been acquired during the last few weeks of pregnancy. In view of future pregnancies the father must also be treated.

SKIN RASHES

Rashes other than syphilitic occur in newborn children. The most frequent is a sudaminal rash—sometimes called red gum or

strophulus—due to the child being too warmly clothed and sweating profusely. It occurs most commonly on the neck and forehead. and the papules may develop into pustules. Keeping the child cooler and dusting with zinc oxide and starch powder soon effects a cure. Occasionally a few days after vaccination a roseolous rash appears, which as a rule is transitory and does not develop into true vaccinia. A variety of pemphigus, called epidemic pemphigus, is liable to be mistaken for syphilitic pemphigus, but is more general in its distribution. It is a manifestation of septicæmia, the result of a pyogenic infection of the umbilicus, and is, therefore, of very grave import. A papular rash liable to be mistaken for measles is sometimes present in disorders of the gastro-intestinal tract. An urticarial rash may appear after prolonged use of soap suppositories.

VARIATIONS IN THE STOOLS OF INFANTS

In place of the smooth, semi-solid yellow stool which is usually passed by the infant, the stool may become too hard or too loose, and may contain curds. An infant passing stools containing curds generally suffers from flatulence or indigestion. Curds are seen more frequently with artificially fed children, owing to the proportion of caseinogen or fat in the milk being too high. This must be lowered, or the caseinogen made more digestible by the addition of citrate of soda.

The stool may be green in colour owing to fermentation in the bowel, and is usually watery and offensive. Green motions rarely occur in a breast-fed baby; in a bottle-fed baby great care must be taken in the preparation of the food and the sterilization of the bottles.

The onset of green diarrhœa in an infant is a matter of grave moment, and unless treated efficiently and expeditiously the child will often die. A sign that the diarrhœa is grave is depression of the anterior fontanelle. Whenever the anterior fontanelle is depressed it signifies that the infant is being drained of fluid which is necessary to maintain its circulation. After seeing that all sources of infection are eliminated the infant must be treated. A teaspoonful of castor oil should be given, and all ordinary feeds should be suspended and hot water and albumin-water substituted. No breast-feeds or cow's milk should be given for twenty-four to forty-eight hours. Raw meat juice may be given, and will be a sufficient diet for the baby for twenty-four hours. If vomiting is complicating the case, it is often necessary to run 5 to 10 ounces

of saline solution into the cellular tissue, and in some grave cases to wash out the stomach with a catheter. If the diarrhœa persists in spite of withholding all ordinary diet, bismuth subnitrate may be given three times a day in 5-grain doses, or the following prescription may be found useful:—

Saloli	gr. viii.
Olei ricini	℥ i
Mucilaginis acaciæ	q.s.
Aquæ calcis	℥ iv.
Aquam anethi	ad. ℥ i.

Sig. ½ part to be given three times a day.

When the diarrhœa has been overcome, and the stools are again of normal colour and consistence, it is necessary to start feeding the infant on some form of milk. If the infant is breast-fed it should begin with small four-hourly feeds, with hot water and albumin-water in the intervals. If artificially fed it should be given peptonized milk in small feeds or condensed milk suitably diluted. If the infant tolerates this well, the interval of feeding may be reduced to three hours and gradually brought up to normal proportions and quantity. It is very important that the baby should have plenty of fresh air and sunlight.

Melæna Neonatorum.—Occasionally the actions are very dark in colour and contain altered blood—a condition known as "melæna neonatorum". When this is present a diagnosis must be made of the origin of the blood. The mother's nipples must be examined and cracks looked for, and, if present, it is probable that the infant has sucked the blood from the mother. If this is so, breast-feeding without a breast-shield must be discontinued for a time.

If the nipples are sound and the baby is pale and exhausted, the hæmorrhage in all probability has come from the gastro-intestinal tract of the child. This is a very serious complaint, and must be treated at once. The mortality is high; in only a few cases has any lesion been found in the mucous membrane post-mortem. The administration of human or horse serum seems the most hopeful form of treatment (dose 10-20 c.c. subcutaneously or *per rectum*), or lactate of calcium gr. iii three times a day.

THRUSH

Thrush is a disease due to a fungus called *Oidium albicans* growing on the mucous membrane of the mouth (Fig. 238). It is due wholly to neglect in cleaning out the baby's mouth after feeding or from using an imperfectly cleaned bottle, and occurs chiefly in weakly

infants or those with facial paralysis. Little white patches are seen on the cheeks and soft palate, closely adherent to the mucous membrane. In a severe case it extends down the œsophagus, stomach, and intestines. It gives rise to great disorder of nutrition, and the child is wasted and suffers from green watery stools. The revision of the diet and the local application of glycerine and borax generally suffice to cure the condition. If this plan is not successful, a half-strength solution of sulphurous acid may be tried as a local application.

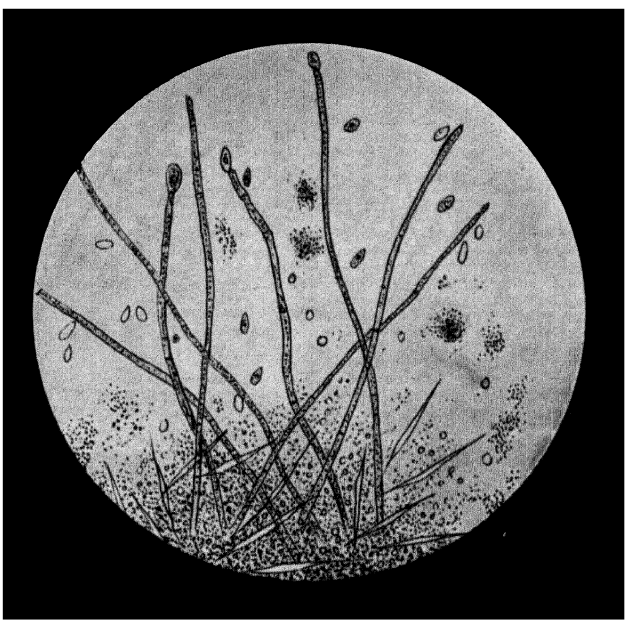


FIG. 238.—OIDIUM ALBICANS, THE VEGETABLE PARASITE CAUSING THRUSH.

SORE BUTTOCKS

Sore buttocks are generally due to lack of cleanliness, or to the irritating nature of the stools, or to the napkins being washed in soda.

For the first few days of life the buttocks should be protected from the meconium by ointment, and subsequently the changing of the napkin, when soiled, will prevent the buttocks being chafed.

When the actions are green or when the baby is suffering from thrush or diarrhœa, the buttocks are likely to get red, and if not kept dry the skin will break and the buttocks become sore.

Treatment

If the skin on the buttocks is broken the application of water or soap and water for cleansing purposes must be discontinued. The buttocks must be cleansed with olive oil, and when clean must be protected with a zinc cream made up of zinc ointment and olive oil, and above all, the feeding of the child must be carefully inquired into, and detailed instructions given to the nurse or mother regarding it. A good alternative application is a saturated solution of picric acid.

HÆMORRHAGE FROM THE UMBILICAL CORD

Hæmorrhage from the cord may be primary or secondary.

Cause

Primary Hæmorrhage.—This is due to the ligature slipping from being tied too loosely, or cutting through the cord from being tied too tightly.

Treatment.—Re-ligature.

Secondary Hæmorrhage.—Secondary hæmorrhage is usually due to sepsis or may be associated with Buhl's disease, syphilis, or hæmophilia. This complication is very fatal, and usually occurs at the end of the first week when slow oozing from the umbilicus follows separation of the cord.

Treatment

If the hæmorrhage is associated with sepsis of a grave nature, accompanied by jaundice, vomiting, and diarrhœa, the prognosis is especially hopeless. The umbilicus should be transfixed with a needle, and compressed by winding silk round it in a figure of eight.

SEPSIS OF THE CORD

Occasionally, even with the greatest care, but more often owing to want of cleanliness, the cord may become septic. The junction of the cord and umbilicus is first noticed to be moist and red, and later exudes a thin purulent fluid. If this is not checked at once, the inflammation will spread up the umbilical vein and set up pylephlebitis and jaundice.

Signs and Symptoms

The infant becomes ill, with raised temperature, jaundice, vomiting, and diarrhœa, and soon dies from septicæmia.

Treatment

If the cord becomes red and moist, it must be bathed in an antiseptic lotion or hydrogen peroxide, and dried and dusted with zinc and starch powder. Care must be taken that the cord is not pulled on, as this may give rise to secondary hæmorrhage.

CONSTIPATION

Many breast-fed babies are constipated. This may be due to a deficiency in fats or fluid. A few teaspoonfuls of hot water during the twenty-four hours will sometimes correct it. If it is due to an insufficient amount of fat, a ½ drachm of cod-liver oil during the day is a simple way of supplying the deficiency. These measures are not always successful, and some stronger stimulus may be needed. Purgatives regularly given should be avoided if possible. Castor oil given frequently is a most constipating drug. If drugs are necessary syrup of figs or senna may be given, but it is better to encourage the bowels to act naturally than by an irritating drug. The nurse should be instructed to massage the infant's abdomen along the course of the large intestine. A small enema (2 to 3 ounces) of soap and water may be used occasionally, and liquid paraffin in 20-minim doses two or three times a day is well tolerated and often efficient.

It cannot be too strongly emphasized that resort to purgatives, enemata, and especially the habitual use of soap suppositories is vicious and likely to lead to habitual constipation which may persist throughout life. The proper treatment of constipation of the infant is regulation, massage, and training in regular habits.

CONVULSIONS

Convulsions are not at all uncommon in early infant life. They may occur within the first few days of life or later. It may be taken as a working rule that convulsions ensuing within the first three days of life are generally due to some damage to the brain which has occurred during a difficult delivery, and the history of the confinement may confirm this. The lesion responsible may be situated in the cortex in the case of vertex confinements, and more usually in the base of the brain in breech deliveries. The convulsions are usually generally distributed, though, if due to a localized lesion of the cortex, they may be of the Jacksonian type.

Convulsions occurring later, in the first or second weeks of infant life, are commonly due to some gastro-intestinal irritation, and

it will be found on investigation that the infant has green undigested stools with or without diarrhœa.

Symptoms

Convulsions may take the form of simple twitching of the face and upper limbs, or general convulsions of the whole body. With the more severe type, the infant will cease breathing and become black in the face with spasmodic contraction of the muscles. With appropriate treatment this passes off, and the infant lies in a collapsed condition. Even with convulsions caused by digestive disturbances, there may be retraction of the head suggesting a cranial origin.

Treatment

The immediate treatment is the control of the convulsions. The infant's clothing should be loosened and removed, the tongue drawn forward, and the infant placed in a hot bath. A handkerchief wrung out in cold water should be placed on the head. If the infant makes no attempt at breathing, traction on the tongue should be made or artificial respiration carried out while it is in the bath. If the convulsions follow one another rapidly, a few whiffs of chloroform may be tried. When the convulsions have ceased, the cause must be investigated. If the child is suffering from green diarrhœa a dose of castor oil must be given, and if the child is collapsed and the anterior fontanelle depressed fluid must be run into the cellular tissue, as in all probability it will not be retained by the mouth or rectum. Chloral and bromide in 1-grain doses should be given every hour while the convulsions continue, and three times a day until there is no sign of recurrence.

The return to a normal diet must be slow and cautious. For the first few hours it is best to give only water, then if progress is satisfactory albumin-water or whey, to which soon there may be added cream and sugar. If this is well borne and the colour of the stools is normal, milk may be added to the diet until the infant again takes the normal amount. Minute instructions must be given to the nurse or mother as to the preparation of the food and the care and sterilization of the feeding utensils.

COLIC

Colic is an indication that the food does not agree with the infant, and that there is too great a production of gas. It is recognized by the fretful cry of the infant, accompanied with drawing up of the legs and intestinal rumblings.

Treatment

If the pain is acute, warm flannels may be applied to the abdomen and a dose of castor oil given. The method of preparation and the nature of the food must be investigated, and, if necessary, altered.

TETANUS NEONATORUM

Fortunately tetanus neonatorum is now a very rare disease. Since the introduction of asepsis and antisepsis in the care of the umbilical cord the disease is almost unknown. Formerly, owing to some contamination either by the fingers of the midwife or by the dressing applied, the stump of the cord was inoculated with the tetanus bacillus, the result being nearly always fatal.

Signs

The signs are spasmodic rigidity of the muscles of the jaw, trunk, and limbs, occurring about the end of the first week.

Treatment

The treatment is chiefly prophylactic in treating the cord aseptically. Should infection occur, the spasm must be overcome by chloroform and bromides and injection of anti-toxin.

MASTITIS

Inflammation of the breasts of the newly born occurs not infrequently in either sex, and may be accompanied with a certain amount of secretion.

Treatment

If the swelling is large, fomentations may be applied. On no account should the breasts be squeezed.

UTERINE HÆMORRHAGE

Occasionally, and often associated with mastitis, there may be hæmorrhage from the uterus of the infant. It is usually slight in amount and ceases in a few days.

EXCESSIVE SIZE OF THE CHILD

Infants are sometimes born of excessive size, although the pregnancy has not exceeded the normal time. Provided the mother is of good physique, the large size of the child may prove no impediment to a successful termination to the pregnancy. Age to some extent has an influence on the weight of a child, as mothers of 25-30 years

of age bear their heaviest children. The age of the father has perhaps some influence, though his build does not seem to be a determining factor.

Occasionally pregnancy may be prolonged beyond the fortieth week of gestation, and post-mature infants are notoriously large and well developed, though the subcutaneous fat may not be excessive, and it may be noted here that they often die before and during labour. At term it is sometimes found that the infant is abnormally large, weighing 11 pounds or more, in which case, although the mother's pelvis may be of normal size, the course of labour will be prolonged. The delay in the descent of the head will often need, after dilatation of the cervix, the application of the forceps and strong traction for its delivery. In addition to the large size of the head, the increased bulk of the shoulders, and their difficulty

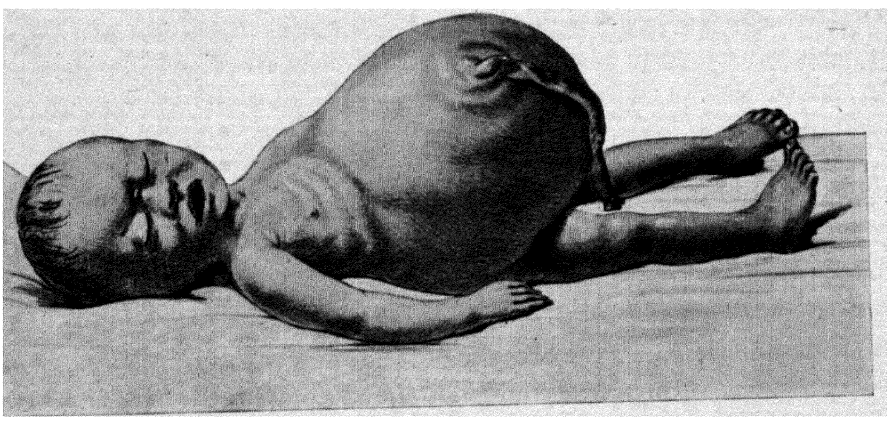


FIG. 239.—FŒTAL ASCITES.

The enormously distended abdomen usually gives rise to delay in birth and generally requires tapping.

in entering the brim as the head is being born, make the birth of the body difficult. Traction from below on the axillæ, pressure from above, and possibly cleidotomy, may be necessary before the trunk can be born.

CONGENITAL DEFORMITIES OF THE CHILD

Meningocele and **Hydrocephalus** (see pp. 462, 463).

Enlarged Thyroid.—The thyroid gland may be greatly hypertrophied, and by preventing flexion of the head cause a face presentation. It rarely gives rise to obstruction from its size.

Hare Lip and Cleft Palate.—Infants with this malformation are difficult to rear, having to be fed artificially, often with a spoon.

TREATMENT

A plastic operation should be performed as soon as the infant is able to stand it.

Distension of the Abdomen.—The abdomen may be enormously distended by tumours of the kidneys, spleen, liver, or ovaries, by ascites, or by the distension of the bladder due to an imperforate urethra.

The course of labour will depend upon the size and consistence of the swelling. Usually the condition will not be recognized until there is delay after the birth of the head, when an examination reveals the condition. In a breech presentation the condition is recognized owing to delay after birth of the legs.

TREATMENT

If the swelling is cystic it must be evacuated by tapping. If the swelling is solid evisceration must be performed.

Spina Bifida.—Owing to deficient ossification of the laminæ of the vertebræ, the spinal cord and membranes may only be covered by the integuments, and this may give rise to a swelling sometimes of considerable size, but since the swelling is fluid it does not give rise to obstruction. This swelling is known as a syringo-myelocele. It is often associated with hydrocephalus and deformity of the feet, and if large is incompatible with prolonged life. A small spinal meningocele in the lumbo-sacral region is not uncommon and does not endanger life.

Monsters.—Monsters may be single or double. A single monster is generally associated with anencephaly in which there is absence of the vault of the skull with the exception of the orbital plates of the frontal bone. The cerebral hemispheres are not developed, but there are parts of the base of the brain present. The cervical vertebræ are usually ill developed and fused together. The fœtus presents generally by the face, as there is no vertex, and after birth of the small head there is delay with the shoulders, which are usually well developed. This condition is fortunately incompatible with life, though a few cases have been reported to have lived a few days.

There are four chief varieties of double monsters:—

1. Thoracopagus. Two children joined by the thorax.
2. Ischiopagus. Two children joined by the sacrum.
3. Dicephalus. Two heads with one body.
4. Syncephalus. One head with two bodies.

If these double monsters are small or premature they may be born spontaneously, though there is always the risk that they may give rise to obstructed labour. The first two varieties generally present by the feet. If the bodies are not too large to be born, the posterior head usually enters the pelvis first, and on flexing the bodies over the mother's abdomen the first head is born and the second one engages and is born. If there is any obstruction the band uniting the bodies must be cut through, as there is no object in risking the mother's life for the sake of delivering a living freak.

Dicephalic monsters, unless very small, give rise to obstruction and necessitate delivery by perforation. Syncephalic monsters are best delivered by craniotomy.

Extroversion of the Viscera (Exomphalos).—In these cases there is absence of some part of the abdominal wall, usually in the neighbourhood of the umbilicus. The viscera are covered only by the amnion.

TREATMENT

If the absence of the abdominal wall is limited in extent the case can be dealt with by operation.

Ectopia Vesicæ.—This distressing congenital deformity occurs through failure of the fusion of the lower ventral somites and with want of development of the anterior wall of the bladder. It is often associated with absence of the symphysis pubis. It is not incompatible with life and sometimes lends itself to surgical treatment.

Imperforate Anus.—In the simplest form there is a membrane separating the rectum from the anal canal. In the more severe forms there is partial or complete absence of the rectum. The nature of the case may not be suspected for some hours after birth, and then an examination, made because the child does not pass meconium, reveals that the anus is imperforate.

TREATMENT

Imperforate anus should be treated immediately a diagnosis is made. In the minor degrees of deformity it may be possible to establish communication between the anus and the rectum. In the more severe forms it may be necessary to perform colostomy.

Imperforate Meatus Urinarius.—This is usually associated with distension and hypertrophy of the bladder and dilatation of the ureters and pelvis of the kidneys. The infants are generally born

Phimosis.—The foreskin may be so tight as to cause retention of urine or great straining at micturition with the risk of hernia.

TREATMENT.—Circumcision.

Umbilical Hernia.—This may be congenital or acquired. In the congenital variety there may be a mass of bowel protruding into the umbilical cord. The case should be treated by immediate operation (Fig. 242).

In the acquired variety, the hernia must be protected by a firm pad and an abdominal binder, and the cause of the straining, usually phimosis, remedied. This will in all probability effect a cure.

Grave Familial Jaundice in the Newborn.—This is a disease resembling physiological jaundice in its onset, and in which there is no gross post-mortem appearances to account for the jaundice.

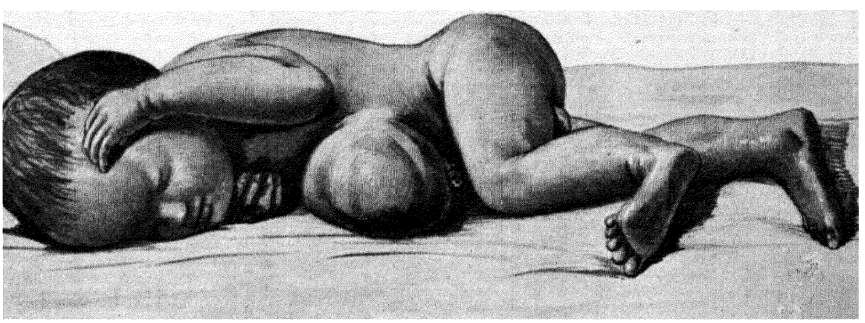


FIG. 240.—CONGENITAL UMBILICAL HERNIA.

The sac is covered only by amnion through which the contents of the sac may be seen.

It occurs in successive infants a few hours to a day after birth, and 77 per cent. of the babies die in convulsions within a fortnight.

The cause is not known, but it has been attributed to maternal toxæmia, because in several of the reported cases the mother has had jaundice and severe attacks of vomiting. In the majority of the cases the mothers have had large families and the first two children have escaped.

On the assumption that the jaundice is of toxæmic origin Rolleston recommends that the mother's diet should be carefully regulated, and that she should be given such intestinal and biliary antiseptics as hexamine, salicylate of soda, calomel.

The child should be reared artificially, and should be given small doses of calomel.

Congenital Hypertrophy of the Pylorus.—Although this condition is styled congenital it does not as a rule manifest itself before the infant is 3 to 4 weeks old.

This disorder is characterized by vomiting which is persistent, though not necessarily frequent, occurring only once or twice in the twenty-four hours. The type of vomiting is characteristic for it is copious and forcible and the material vomited is shot out some foot or more and in quantity as much as the infant is taking in two or more feeds. This indicates that the stomach is dilated and not passing its contents into the small intestine. With this state of affairs the infant wastes and suffers from constipation. Although the above clinical picture is very suggestive of hypertrophic stenosis of the pylorus, yet the diagnosis is not certain unless the two cardinal signs —visible and marked peristalsis of the stomach and a palpable pyloric tumour can be appreciated. This peristaltic wave is not necessarily invariably present when looked for, but will be brought into evidence by giving the infant a feed, when the peristaltic waves will be seen and the thickened pylorus felt.

Treatment must be undertaken as soon as the diagnosis is certain, and a decision made as to whether the case is a suitable one for medical or surgical intervention. For the details of treatment of this, by no means rare, condition the student is referred to text books dealing especially with disorders of childhood.

Section V—OPERATIVE PROCEDURES AND ANÆSTHESIA

CHAPTER LI

ANÆSTHESIA IN OBSTETRIC PRACTICE

Chloroform, ether, stovaine, morphia and hyoscine combinations, novocaine, quinine, and urea hydrochloride may be used for anæsthetic purposes in obstetric practice, either to produce unconsciousness with insensibility to pain, as in general anæsthesia, or insensibility to pain with little or no loss of consciousness, as in partial anæsthesia or analgesia.

General Anæsthesia

General anæsthesia is in most cases indicated for all operations on a patient who is pregnant, in labour, or during her puerperium. Such anæsthesia should be induced by a practitioner who is able to give the whole of his attention to the administration of the anæsthetic. Unfortunately, from necessity, the practitioner has often first to anæsthetize the patient and then to hand over the further administration to the nurse, when performing such operations as delivery by the forceps or by version, the removal of an adherent placenta, or the repair of a lacerated perineum. In many cases the practitioner will even attempt such operations without anæsthetizing the patient at all. The former method results in the patient being anæsthetized too deeply or not sufficiently, and there are obvious dangers associated with either result. To hand over the administration of the anæsthetic to the nurse certainly deprives the doctor of assistance of which he may be in urgent need, and the fact that he has to attend alternately to the anæsthetic and the operation is a serious handicap and must increase the danger of infection.

To deliver, or to attempt to deliver, a child with the forceps or by version or to remove an adherent placenta, or suture a seriously ruptured perineum without an anæsthetic renders the task more difficult and introduces an additional element of danger which an

anæsthetic avoids, that of injury to the genital tract from the struggles of the patient.

CHLOROFORM

By the careful use of chloroform, the severity of the labour pains may be markedly diminished without making the patient totally unconscious—commonly termed anæsthesia to the obstetrical degree. Its use is therefore particularly indicated in the second stage of labour when the increased strength of the uterine contractions may be a source of great distress to the patient. For this purpose it is best given with a Junker's inhaler, the bellows of which the patient herself, or the nurse, can work without any fear of an overdose resulting.

Chloroform analgesia has the same contra-indications as chloroform anæsthesia, and should never be employed when operative procedures are necessary, since the partial loss of consciousness and consequent loss of control are a distinct hindrance and danger.

For inducing general anæsthesia during labour, chloroform is the usual anæsthetic. Parturient women have a peculiar tolerance for this drug, which encourages relaxation of the uterus without increasing the risk of subsequent hæmorrhage, unless the drug has been administered over an unduly long period. Chloroform has this disadvantage, that if the patient is suffering from some form of pregnancy-toxæmia due to the kidney of pregnancy, pernicious vomiting, acute yellow atrophy of the liver, or diabetes, it is apt to cause degeneration in the liver tissues, producing symptoms known as delayed chloroform poisoning.

ETHER

Ether should be the anæsthetic chosen if there is reason to suppose that the patient is suffering from any form of toxæmia. An injection of atropine should be given first. Ether is also indicated if the patient requires stimulating or is suffering from shock, and is best used for operations during pregnancy or the puerperium. It is contra-indicated if there are moist *râles* or bubbling on inspiration.

STOVAINE

As a method of inducing anæsthesia in the genital organs and lower part of the body, without making the patient unconscious, the intra-thecal injection of stovaine has a distinct place in obstetric practice. After the spinal injection has been made it

takes up to twenty minutes for anæsthesia to be complete. This lasts about an hour. Stovaine is best given with glucose, and is put up thus combined in ampoules containing one dose. Spinal anæsthesia is indicated in patients suffering from severe pulmonary or cardiac disease or from one of the toxæmias, when the administration of a general anæsthetic is contra-indicated. Owing also to the fact that the injection acts as a "block" to peripheral impulses, this method has advantages when it is necessary to operate upon a patient who is suffering from severe shock. Occasionally there is an idiosyncrasy for the drug and the patient becomes profoundly collapsed.

MORPHIA AND MORPHIA HYOSCINE COMBINATIONS

The administration of morphia, either alone or followed by a general anæsthetic, in order to diminish uterine spasm and irritability and to assist relaxation, has been mentioned in the treatment of difficult labour (rigid cervix, irritated uterus), but a more general consideration of the use of morphia in labour is called for, as it, or some similarly acting opium derivative, is the chief constituent of the various preparations recommended for the production of the so-called "painless labours".

For over ten years a combination of morphia with scopolamine (hyoscine) has been in use in ordinary surgical work, as a partial anæsthetic or as a preliminary to general anæsthesia, and in obstetrics for the production of what its advocates in the Freiburg Clinic called "twilight-sleep," *i.e.* a degree of semi-consciousness which prevents the feeling of acute pain. Experience in the former direction has led to a very considerable restriction in its administration, as serious consequences (cardiac failure, collapse) have been ascribed to it, and its routine adoption is no longer advocated by anæsthetists. Reports of its use in midwifery practice have reached the lay press, and, from articles in the daily papers and illustrated monthly magazines, and even books written specially for the general public and for the most part of transatlantic origin, patients have eaten of the tree of knowledge and have learned that the curse of Eve can be exorcized by the potions and charms of ultra-modern medicine. So far is this the case that a widely-read patient, when arranging for attendance at her confinement, will stipulate that her labour shall be managed on the lines laid down by some book or article she may have studied. It is, therefore, essential that every one professing obstetrics in these days of an omniscient press and an omnivorous public, should have some idea of the *pros* and *cons*

in regard to "twilight-sleep" and "painless labour". The former term was applied to the scopolamine-morphia narcosis, and that combination will be taken for consideration here, though various highly-vaunted patent preparations have been put on the market for the same purpose by enterprising drug manufacturers with a business eye to the public demand. It is unnecessary to advertise them by name, and, as they are almost all opium derivatives with morphia as the active agent, they do not call for special mention.

The combination most commonly adopted is from $\frac{1}{6}$ to $\frac{1}{4}$ gr. of morphia, with $\frac{1}{150}$ gr. of scopolamine given hypodermically. The second dose is given one hour after the first and consists of $\frac{1}{450}$ gr. of scopolamine only. Subsequent doses of $\frac{1}{450}$ gr. of scopolamine are given every hour according to the condition of the patient. This is ascertained by applying a memory test by showing the patient some easily recognizable object. When it is apparent that the memory is returning another dose of scopolamine is given, and so on. As many as thirty doses have thus been given with no apparent harm to the patient, though as a rule six to eight doses are sufficient. In successful cases the patient becomes drowsy and unconscious, dozing between pains, rousing slightly and perhaps moaning with them, and waking up after the labour is over without any clear recollection of anything that has happened, even the birth of the child. But its action is uncertain and patients react in different degrees. On some it will act like a charm and do all that its advocates claim for it, and nearly as much as the writer in the illustrated magazine paints for his wondering readers; occasionally restlessness, violent excitement, and even delirium may follow the treatment, so that the patient may have to be held down by two or three nurses; and on others the morphia must be repeated to obtain any effect. Constant watchfulness is necessary and the patient ought not to be left unattended for a moment. A strong pain may cause her to wake up suddenly, and she may, in a drowsy and semi-conscious condition, wander about the room or house and do strange and extraordinary things. As an example of this semi-conscious activity aroused by uterine contraction, a case may be mentioned in which the patient, left for a few moments in a state of apparently deep drowsiness, was found on the floor on her hands and knees as if hunting for something she had lost; she resisted being put back to bed, for she said she wanted to find the Crown Prince of Germany, who, she was convinced, was hiding in the room. There is some risk of self-infection or self-injury, as the hands readily find their way to the vulval region. Troublesome after-effects occasionally occur. Headache, sickness, severe thirst, vertigo, dim-

ness of vision, and excitement may follow and continue for several days, but it is rare in obstetric practice to meet with the more serious effects which have been ascribed to scopolamine-morphia when used in general surgical work.

No drug which can so far abolish sensation as to make labour painless can be given to this degree without affecting considerably the normal processes of labour. Narcotism sufficient to abolish painful stimuli will check reflex activity and possibly also interfere with the nervous mechanism governing labour, and therefore a tendency to produce prolongation would be expected. It is doubtless true that the effect of the bag of membranes and the fœtal head in increasing uterine contraction by reflex stimulation of the cervix and distension of the birth-canal is diminished. On the other hand, in cases in which the pain is severe and the patient is anxious and worried, the analgesia and mental quietude produced by the narcotic prevent inhibition of the uterine contractions from emotion, and the labour is hastened. The first stage of labour takes about the normal time, the second stage is usually prolonged, and the necessity for terminating labour by forceps-delivery is nearly doubled. Spontaneous delivery of the placenta is frequently delayed or interfered with, and many authorities have noted a tendency to increased hæmorrhage. The child may be born drowsy, sometimes to a degree which makes the establishment of respiration difficult, and still-birth has been ascribed to the effect of the drug on the infant. Certainly the child may be born apnœic, and the usual methods of exciting respiration by reflex stimulation may be ineffective, so that a hot bath and artificial respiration may be required before natural breathing is established, but it is rare for these remedial measures to fail when there is no other reason to account for the fœtal asphyxia. The effect on the child is naturally the more marked the greater the narcotization of the mother by morphia, and the shorter the time after it was induced that birth occurs. Small feeble infants are more likely to be affected than big strong children.

The chief indication for the administration of morphia, scopolamine-morphia, or allied preparations during labour is feeble and ineffective uterine action during the first stage, especially if the patient is nervous and hyperæsthetic or suffering from exhaustion or fatigue. The inhibiting effect of emotion—fear, anxiety, or excitement—and of severe pain has already been mentioned, and all such conditions are greatly alleviated by the mental and physical rest produced by these drugs. Rigidity of the cervix and slow dilatation which often accompany poor pains afford another indication. In difficult labours in which time is required for moulding,

exhaustion is avoided. These injections are helpful in easing the pain and discomfort following many manipulative procedures, *e.g.* plugging the vagina or the insertion of the Champetier de Ribes's bag, and in many complications, such as antepartum hæmorrhage or eclampsia, in which mental and bodily rest and diminished nervous excitability are advantageous. Reference has, however, been made to these indications, and nothing further need be said. In very favourable cases it may be possible to perform minor operations as low forceps-delivery and perineal suture under such partial anæsthesia as these narcotics give, but generally speaking, a small quantity of chloroform is required, as the patient is liable to move and wake up and is not fully under control.

The dosage has already been mentioned. The first injection should not be given till strong and regular uterine action is established and dilatation has begun, and the cervix will admit two fingers; inefficient primary pains are a contra-indication unless due to emotion or fatigue. In the second stage of labour, especially if the head is low in the pelvis, morphia is inadvisable, as the child might be born drowsy. Pituitary extract with just sufficient chloroform to control the severity of the pains is better, as the forceps can be used at once to effect delivery if there is still delay. Frequency of the pulse-rate and slow or shallow breathing are signs of overdosage, and the fœtal heart must be auscultated from time to time to ascertain the condition of the child, as if the heart-beat becomes slower or quicker than normal the child's life is being endangered. The condition of semi-sleep may be extended over days in special circumstances, but these repeated injections are not free from risk. It is inadvisable to exceed $\frac{3}{4}$ gr. of morphia in twenty-four hours. In order to obtain the proper effect of the injection the patient must be kept absolutely undisturbed in a quiet and darkened room with her ears plugged; twilight-sleep cannot be maintained if the patient is roused by frequent visits or examinations.

The routine administration of powerful narcotic drugs in normal cases to obtain "painless labour" cannot be defended on medical grounds. Its general adoption, if pushed to a degree sufficient to cause analgesia and amnesia, must occasionally lead to serious consequences to mother or child, and in any case will require more careful watching and attention than can be given by a busy family practitioner with other calls on his services. Rapid dilatation and expulsion may follow an injection, or a long quiescent interval may elapse before strong pains recur, or the patient may become restless and difficult to control. It is imperative that the nurse should be

experienced and that she should be able to obtain further assistance if necessary, while many authorities maintain that the practitioner should be in constant attendance. If this is impossible he should certainly be within easy reach. A further objection to its routine use in general practice is that the amnesic effect may cause the patient to make unjust complaints of neglect; for instance, she may assert very positively that the doctor was not present at the birth, or that he gave her an injection and did not visit her again, and so on. Morphia and its combinations are valuable drugs in midwifery, as in other realms of medicine, but the cases in which they are used must be selected with judgment, and their wholesale use is wrong. Should the prospective mother, primed with the highly coloured stories of the blissfulness of twilight-sleep, try to make its induction a condition in engaging her attendant, the most diplomatic way out of the difficulty would seem to be the demand for a greatly increased professional fee to compensate for the additional time and worry which the proper induction of twilight-sleep demands.

The following statistics from a London lying-in hospital and from the lying-in ward of a general hospital in 100 normal cases, in which a single narcotic injection was given, carefully observed at each institution, are appended:—

LYING-IN HOSPITAL.

Without injection—

	Multiparæ.	*Primiparæ.*
Stage 1 . . .	11 hrs. 24 mins.	18 hrs. 20 mins.
Stage 2 . . .	29 mins.	1 hr. 17 mins.
Stage 3 . . .	19 mins.	21 mins.

With injection (morphine gr. $\frac{1}{6}$; atropine gr. $\frac{1}{150}$)—

	Multiparæ.	*Primiparæ.*
Stage 1 . . .	10 hrs. 48 mins.	17 hrs. 33 mins.
Stage 2 . . .	26 mins.	1 hr. 8 mins.
Stage 3 . . .	22 mins.	20 mins.

LYING-IN WARD, GENERAL HOSPITAL.

Primiparæ	1st stage.	2nd stage.	3rd stage.	Total.
No injection . .	20 hrs.	1 hr.	20 mins.	21 hrs. 20 mins.
Injection (morph. hyd. gr. $\frac{1}{4}$; atropin sulph. gr. $\frac{1}{120}$; hyoscine gr. $\frac{1}{150}$)	11 hrs.	1 hr. 30 mins.	30 mins.	13 hrs.
Injection (omnopon hyoscine 1 c.c.)	12 hrs. 30 mins.	1 hr. 20 mins.	25 mins.	14 hrs. 15 mins.

1. With both injections 1st stage is reduced nearly 50 per cent.
2. With both injections 2nd and 3rd stage slightly prolonged.
3. Several cases, especially after omnopon, had to be terminated artificially by the forceps.
4. Omnopon has a more marked effect upon the child, several children being born asphyxiated, but all recovered with

treatment. No cases occurred with fatal results to the child which could not be accounted due to other causes.

In a number of cases the patient fell asleep immediately after the injection and only woke at the end of the first stage of labour.

In a few cases the injection was repeated, but only after an interval of six hours.

In three cases the injection appeared to have no effect at all.

Multiparæ.	1st stage.	2nd stage.	3rd stage.	Total.
No injection	10 hrs.	45 mins.	15 mins.	11 hrs.
Injection, morphia, etc.	11 hrs.	30 mins.	15 mins.	11 hrs. 45 mins.
Injection omnopon	8 hrs. 45 mins.	25 mins.	12 mins.	9 hrs. 22 mins.

Injection of omnopon reduced the 1st stage by just over an hour and the 2nd or 3rd stages slightly, while morphia prolonged labour.

Only normal cases are included; normal pelvis and L.O.A. or R.O.A. positions are taken.

In primiparæ morphia gave best results.

In multiparæ omnopon gave best results.

CHAPTER LII

THE USE OF PITUITARY EXTRACT IN LABOUR

UNTIL the action of extracts of the posterior lobe of the pituitary gland upon the uterus was discovered, there was no drug in the pharmacopœia which could be relied upon to excite and maintain normal uterine contractions. The preparations of ergot have long been used for the purpose, but have not always had the desired effect, owing to their tendency to produce tetanic spasm of the uterus. The effect of ergot makes its use in the second stage of labour undesirable and sometimes harmful. Pituitary extract, injected intramuscularly, has the effect of increasing both the strength and the frequency of the uterine contractions in a person who is obviously in labour. It will not, however, excite uterine contractions before labour has begun, and cannot, therefore, be used actually to induce labour. It is, however, in the later part of the second stage of labour that pituitary extract has proved to be most useful. In the common cases in which the uterine contractions are weak and infrequent, and, although quite regular, seem to be unable to complete the delivery, pituitary extract will, as a rule, increase the strength and frequency of the "pains" to such an extent that spontaneous delivery follows very rapidly. These are the cases in which the low forceps operation is most frequently required. By the use of pituitary extract a considerable proportion of such cases will be delivered without the use of the forceps. Certain precautions are to be observed before using pituitary extract in these cases: there must be no pelvic contraction; the patient must be in the second stage of labour with the fœtal head in the pelvic cavity; it must be clearly recognized that delivery must be completed in 15 to 20 minutes, so that the effect of the drug shall not have passed off before this is brought about. The dose of the drug depends upon the particular preparations used, that of "infundin" is ½ c.c., and it should be injected into the gluteal muscles, not merely hypodermically. It is advisable to give one dose only, and to have the forceps prepared, so that they may be used if the child is not spontaneously delivered within half an hour

of giving the drug. The dose has been repeated in some cases with good effect, but in most instances one dose is enough.

The effect of the drug does not show itself in the second stage only, but also influences the third stage. In cases in which delivery has been completed within half an hour of giving the extract, the placenta separates very rapidly and is usually in the vagina within a few minutes of the child being born. The uterus then remains firmly contracted, and the danger of postpartum hæmorrhage, which is very real in these cases, is averted. Another point of interest in this connection is that the effect upon the third stage is far better when the drug is given before the birth of the child, than when given between it and the separation of the placenta. Retention of the placenta above the contracted internal os does not occur in the first case but has been known in the second.

If pituitary extract has not been given before the birth of the placenta, it may be used afterwards as a means of securing powerful uterine contraction and retraction, and so preventing or stopping postpartum hæmorrhage. Naturally, however, the drug does not act instantaneously, so that some minutes must elapse before the full effect is reached.

The effect of pituitary extract in the second stage of labour is often so powerful as to suggest that the uterus might rupture if the dose was given too early in labour before the os uteri was dilated. This danger should never be incurred in ordinary circumstances, as the first stage of labour can usually be left to take care of itself. In certain cases of antepartum hæmorrhage, however, in which formerly ergot would have been given, pituitary extract has been used with very good effect. This is particularly so in some cases of accidental hæmorrhage.

In Cæsarean section, pituitary extract may be given as a means of preventing hæmorrhage. It is best to have the hypodermic syringe ready filled, and inject the dose just after the child has been extracted from the uterus. The effect is not so powerful if the dose is given before incising the uterus.

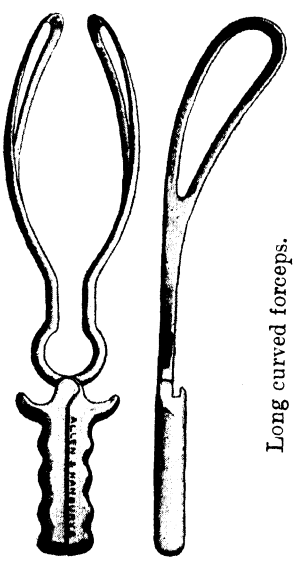
CHAPTER LIII

OBSTETRIC OPERATIONS

DELIVERY WITH THE FORCEPS

AMONG the innumerable patterns of the obstetric forceps that have been constructed since 1601 when Chamberlen first invented it, three main types appear—the short straight forceps, the long curved forceps, and the axis-traction forceps.

Short Straight Forceps.—The short straight forceps is not long enough to apply to the head when it is situated at or above the brim of the pelvis, and owing to the absence in this variety of forceps of a pelvic curve the head cannot be grasped at its centre even when it has passed the brim. The line of traction must therefore be exerted in the wrong direction.



Long curved forceps.

FIG. 241.

The short straight forceps, though now out of date and very rarely used, is nevertheless the most useful instrument for rotating the head in persistent occipito-posterior positions, if manual rotation has failed; since owing to the fact that it has no pelvic curve it is less likely to injure the vaginal walls. In addition, if it is thought desirable to deliver the head, after rotation, with the forceps, the instrument need not be removed and re-applied, as it must be when the long curved forceps is used. These advantages, however, are not of sufficient importance to make it worth while to carry an extra pair of forceps solely for them.

Long Curved Forceps.—The long curved forceps is an improvement on the short straight forceps in two very important particulars. By the addition of a shank between the blades and the lock the

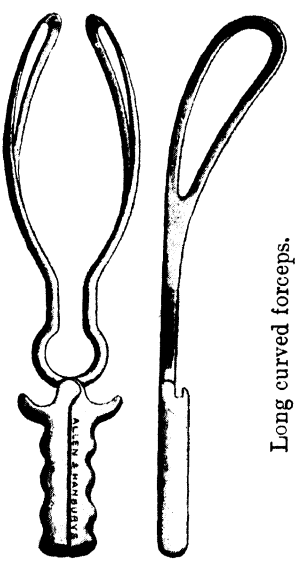
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Long Curved Forceps.—The long curved forceps is an improvement on the short straight forceps in two very important particulars. By the addition of a shank between the blades and the lock the

length of the forceps is increased by 2½″, so that the head can be grasped above the brim, and by the addition of a pelvic curve the blades can be applied in the correct position to the head when it is situated at or above the brim (Fig. 241).

The long curved forceps, however, has still the same drawback as the short straight forceps when the efficiency of the traction is considered, since in this case also the line of traction cannot be maintained—as it should be—in the axis of the genital canal, but must be directed more forwards. To enable the operator to exert traction in the best possible direction, more especially when the head is above the brim, the axis-traction forceps was invented, and, as its use is to-day almost universal, it alone will be described.

Axis-traction Forceps.—Each half of the instrument consists of six parts, the blade, shank, lock, handle, fixation-screw, traction-rod, and a seventh part, the traction-handle, is common to both halves.

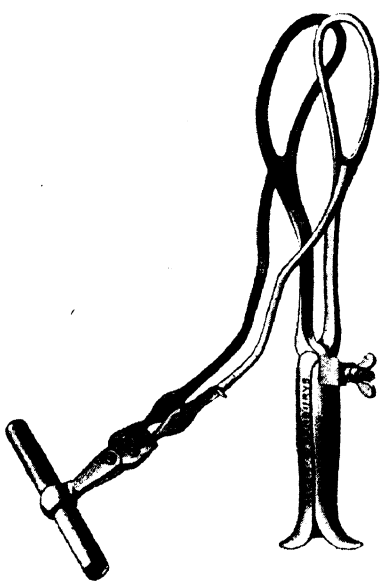


FIG. 242.

Blade. The blade, which is fenestrated, has two curves, one on the flat, the cranial curve, and the other on the edge, the pelvic curve. The shape and size of the curve is the same in both, *i.e.* it forms part of a circle whose radius is 4½″. When the blades of the forceps are locked the distance between them at the widest point should be 3⅜″, and between their tips it should be 1″.

Shank. The shank, that part of the instrument between the lock and the blade, should be 2½″ long. It must be of sufficient strength to prevent the blades being bent to any appreciable extent when the handles are locked.

Lock. The best type of lock is that known as the English lock.

Handle. The handle should be 5″ long, and, so that it can be grasped without slipping, it should have large ribs on its outer surface, since if the instrument is being used in a case in which the head is low down on the perineum the delivery of the head can be more effectively controlled by making traction with the application handles than with the traction rods.

Fixation-screw. The fixation-screw is attached by a swivel to the handle of the left or lower blade, and fits into a slot in the

handle of the right or upper blade. To prevent the blades being separated when traction is made with the traction-handle, the screw is tightened after they are locked.

Axis-traction rod. To each blade is attached an axis-traction rod, the upper end of which fits into a slot in the lower part of the fenestrum of the blade. The rod is so fashioned that it lies in contact with the shank as far as the lock and then curves backwards so that its lower end is 3½″ from the handle.

Traction-handle. The traction-handle contains a ball and socket joint. It is attached to the traction-rods after the forceps is in position and the fixation-screw has been tightened (Fig. 242).

The axis-traction forceps has the following advantages :—

1. Its blades are fixed by a screw, and therefore, as they cannot tilt, their edges are not likely to injure the head.
2. As the blades are fixed to the head, the handles by indicating the position of the head will show in which direction the operator should use traction.
3. Traction can be made in the correct axis of the pelvic brim, because the lower part of the traction-rods is curved or bent backwards over the perineum.
4. The upper end of the traction-rods being attached to the blades of the forceps, traction, when the head has passed the brim, can be applied in the true axis of the genital canal, and so to the greatest possible advantage of the mother and child, the amount of force required for delivery being much reduced.
5. The ball and socket joint of the traction-handle allows the head to rotate during traction. This is especially valuable in occipito-posterior positions, when manual rotation has failed and it is deemed advisable to deliver by the forceps.
6. One hand can be used for traction, leaving the other to make counter-pressure on the buttocks of the mother if the operator so wishes.

The chief disadvantage of the axis-traction forceps is that it is more difficult to sterilize owing to the number of parts of which it is composed.

Action of the Obstetric Forceps.—The obstetric forceps can be used as a tractor, rotator, compressor or lever.

Of these its use as a tractor is by far the most important. Rotation may rarely be indicated in cases of persistent occipito-posterior position of the vertex if other and better methods of delivery have failed. The use of the forceps to lessen the size of the child's

head is to be deprecated strongly. To avoid serious laceration of the maternal tissues when using the forceps as a lever, by the pendulum or side-to-side movement of the handles, requires great experience, and the possible advantages are not proportionate to the increased risk to the mother. The forceps is indicated when the natural powers of labour are insufficient to effect delivery within a reasonable time without injury to the mother or child, or when labour has to be terminated quickly in the interests of the mother or child. The circumstances in which this instrument may be used can be thus classified:—

Indications for the use of the Obstetric Forceps.—1. When the pains are not strong enough to effect delivery.
2. When there is delay due to disproportion between the head of the child and pelvis of the mother.
3. When the direction of the uterine force is abnormal.
4. When the soft parts of the mother are hindering delivery.
5. When it is necessary to deliver the mother quickly.
6. When it is necessary to extract the child quickly.
7. When the birth of the child is delayed by certain malpositions of the head.

1. *When the uterine pains are not strong enough to effect delivery.*

The forceps is most frequently used to assist the contractions of the uterus when they are insufficient and the birth of the child is delayed. The term sluggish uterus most accurately describes the actual state of affairs. The condition known as exhausted uterus is best treated in its earlier stages by the timely application of the forceps whenever the operator sees that the pains are becoming weaker and the head does not make any advance. It is most important to remember that when the exhaustion has once been established, that is, when the uterine pains have disappeared, the child must on no account be delivered until such time as they return (see p. 451).

2. *When there is delay due to disproportion between the pelvis of the mother and the head of the child.*

Difficulty owing to disproportion between the head and the pelvis is more often due to a decrease in the size of the pelvis than to an increase in the size of the head. It is impossible to measure accurately the size of the child's head before birth, and it will suffice, therefore, if we now deal with difficulty due to the maternal pelvis only.

If the child's head is of normal size the smallest true conjugate

diameter in which it is desirable to use the forceps is $3\frac{1}{2}''$. Very rarely extraction may be attempted past a true conjugate of $3\frac{1}{4}''$, but below $3\frac{1}{2}''$ the fœtal mortality increases from 10 per cent. to 30 per cent., and the danger to the mother is distinctly increased. With a generally contracted pelvis $3\frac{3}{4}''$ is the safest lower limit. Above $3\frac{1}{2}''$ in a flattened pelvis and $3\frac{3}{4}''$ in a generally contracted pelvis it is safer for the child to be delivered spontaneously, assistance with the forceps being given if the mother is becoming exhausted, if the pains commence to fail, or if the child shows signs of distress, since the fœtal mortality for spontaneous delivery, as quoted by Munro Kerr, averages 2·45 per cent., while that for instrumental delivery averages 44 per cent.

The above figures serve only as a rough guide, and the student must remember that the question is not one so much of inches as of the relative sizes of the child's head and the maternal pelvis.

The head of the child may be delayed above the brim of the pelvis, in the brim, or in the pelvic cavity.

Delay of the head of the child above the brim of the pelvis.—In cases of disproportion, if the head is free above the brim of the pelvis and cannot be pushed into the brim from above, the forceps is not indicated, since the risk of lacerating the genital canal is considerable and the chances of killing the child are very great, a large number of the children being born dead or dying soon after delivery from meningeal or cerebral hæmorrhage due to the great compression of the head. The practice of pulling or trying to pull the head of the child past the brim of the pelvis when the delay in labour is due to disproportion is therefore an extremely bad one.

Delay of the head in the brim of the pelvis.—The treatment now depends upon the shape of the pelvis. In a *flat* pelvis the long diameter of the head should be in the transverse diameter of the pelvis, the anterior fontantelle and the sagittal suture should be nearer to the promontory of the sacrum than to the symphysis pubis (anterior parietal presentation).

If a posterior parietal presentation is diagnosed the head will probably have to be perforated unless version can be performed. In a scolio-rachitic pelvis, where the flattening is associated with a lateral spinal curvature, there will be more room on one side of the pelvis than the other. If the occiput of the child is entering the pelvis on the side where there is less room the forceps must not be used, but the child should be delivered by version, the leg of the child which corresponds to the side where there is more room being pulled upon. Thus the occiput is rotated into this quarter of the pelvis. In a generally contracted pelvis the

head must be very well flexed. When the head is delayed in the pelvic brim sufficient time must be given for it to be moulded, the patient should be delivered in Walcher's position, and the traction must be gentle and not prolonged.

Delay of the head in the pelvic cavity.—The forceps is most often used when the head has passed the brim of the pelvis and entered the pelvic cavity. In such a case when the delay is due to disproportion the head does not recede in the interval between the pains, while the caput succedaneum increasingly enlarges beyond the normal. Prolonged or strong efforts at extraction should not be made.

The forceps should not be used if, owing to obstruction, the uterus has become tonically contracted, if the vagina and vulva are swollen from the impaction, or if the child is dead. In all such cases perforation of the head of the child is the proper treatment, as it may be also if the head cannot be extracted with the forceps, although an alternative treatment to this if other conditions were suitable would be symphysiotomy or pubiotomy (see pp. 720-722).

3. *When the direction of the uterine force is abnormal.*

With a marked lateral obliquity of the uterus or with an anterior obliquity, best seen in cases of "pendulous belly," the uterine pains will not act in the axis of the brim, and the head of the child may consequently fail to engage. If the obliquity is not due to disproportion between the head of the child and the mother's pelvis, and if it cannot be corrected by varying the position of the patient, then, other contra-indications being absent, the head should be pushed from above into the brim and the forceps applied.

4. *When the soft parts of the mother are hindering delivery.*

In the rare event of spasmodic rigidity of the cervix not responding to the usual method of treatment (see p. 454), the cervix having been sufficiently dilated the forceps may be used.

It sometimes happens that during labour the anterior lip of the cervix becomes nipped between the head of the child and the brim of the pelvis. This causes that portion of the cervix to swell, with the result that the birth of the child may be delayed. Such a condition can nearly always be remedied by pushing the swollen lip above the head; rarely, when this is impossible, the forceps should be applied to the head, and while traction is being employed the cervix should be pushed up.

When prolapse of the vaginal walls has not been treated during

pregnancy the pressure during labour causes them to become swollen, and they may thus obstruct the advance of the child. Delivery should be effected by the forceps, as a long delay of the head at the outlet may produce great œdema of the vaginal walls.

In some women the perineum is more rigid than in others, and the lower part of the genital canal fails to dilate as easily and as rapidly as it should. The head of the child, therefore, is somewhat delayed, and the prolonged pressure increases the danger of the perineum being ruptured. In such cases it is good treatment to deliver the head of the child with the forceps during an interval between the uterine pains.

A rare complication of labour is due to the rupture of a varicose vein in the vulva or vagina. A hard, tender, and dark swelling at once appears, and the child must be delivered as soon as possible with the forceps (see p. 480).

5. *When it is necessary to deliver the mother quickly.*

If the case is otherwise suitable for forceps-delivery extraction of the child by this method is indicated when uterine exhaustion is supervening (see p. 452) in certain cases of accidental and unavoidable hæmorrhage (see pp. 490, 503), in certain cases of eclampsia (see p. 135), and in cardiac (see p. 226) and pulmonary disease, to avoid the bearing-down efforts of the patient when the right side of her heart is becoming over-distended.

6. *When it is necessary to extract the child quickly.*

If the signs of fœtal distress are present, that is to say, if meconium is escaping through the vulva, if the movements of the child are excessive, or if between the pains the pulse-rate of the child rises to 150 or over or falls to 100 beats in the minute, rapid delivery is called for. If the use of the forceps is not contra-indicated, the child should at once be delivered by this instrument, since the signs noted above are an indication that its life is in serious peril.

In prolapse of the umbilical cord it may be necessary to deliver the child with the forceps (see p. 415).

7. *When the birth of the child is delayed by certain malpositions of its head.*

In persistent occipito-posterior position, see p. 329, in mento-anterior positions when delayed, see p. 347, in certain cases of brow presentation, see p. 353, in delay of the after-coming head, see p. 372,

in delay of the fore-coming head owing to prolapse of an arm, see p. 393, and in certain cases of locked twins, see p. 407, the use of the forceps may be indicated.

The operation of forceps-delivery is divided into three parts:—

1. The preparation necessary for the application of the forceps.
2. The application of the forceps.
3. The extraction with the forceps.

Preparation necessary for the application of the obstetric forceps.

(*a*) The instrument should be sterilized in boiling water for ten minutes and then immersed in an aseptic solution.

(*b*) A soap and water enema should be administered if the rectum has not been previously emptied.

(*c*) The vulva should be swabbed with tincture of iodine or thoroughly washed with soap and water, afterwards with plain water, and finally with a solution of biniodide of mercury 1 in 2000. The vulval hairs if long should be cut.

(*d*) The bladder must be catheterized.

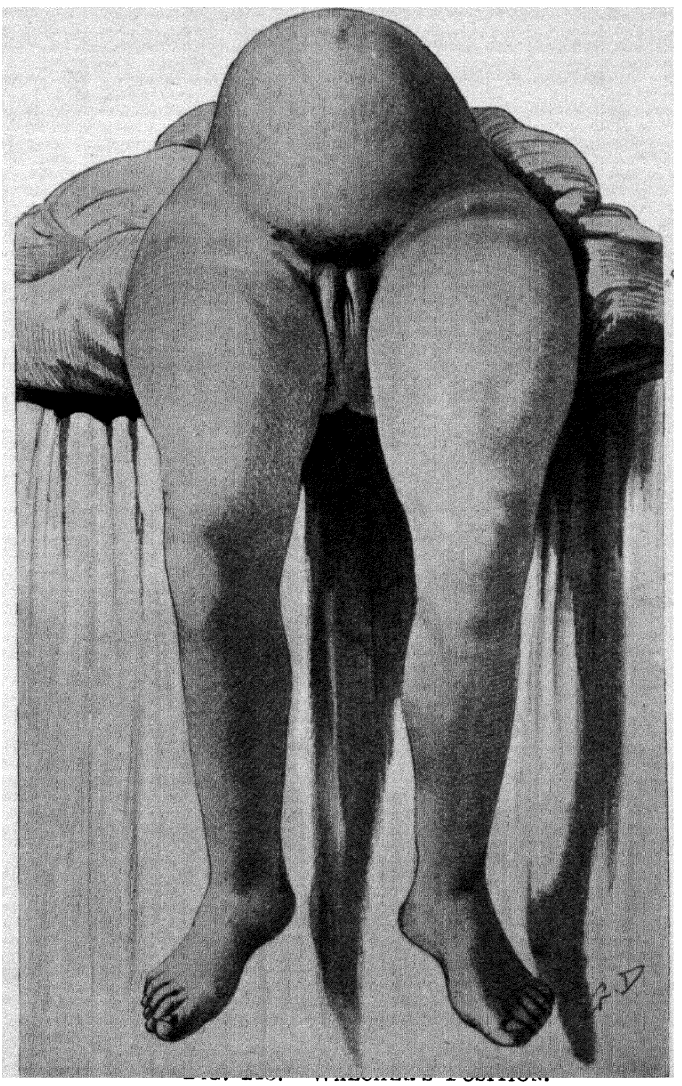
(*e*) The operator, having rendered his hands and forearms as aseptic as possible, should put on a sterilized overall, and lastly sterilized gloves.

(*f*) The true position of the head of the child must be ascertained by passing the hand into the vagina and making a thorough examination before deciding to use the forceps, and again also just before it is applied, since the presentation may have changed during the necessary preparation.

(*g*) The patient must be placed in position. In England that most generally employed is the left lateral position. If the forceps has been applied to the head at the brim (see p. 660), the patient after its application should be turned on her back across the bed or a table, which must be high enough for the feet to hang free of the floor when the buttocks are projecting over the edge of the bed or table. In this position, which is known as "Walcher's position," the symphysis pubis is rotated downwards and forwards and the true conjugate is thereby increased by a quarter of an inch or rather more. As the head of the child is being pulled past the brim the operator will have to sit on a low stool. When the head has entered the pelvic cavity the legs of the woman must be held up in the lithotomy position, or she may be placed in the left lateral position, since Walcher's position, while increasing the size of the conjugate, diminishes the antero-posterior diameter of the outlet of the pelvis. The patient should be resting on a clean and if possible sterilized

sheet, her labour petticoat should be drawn up, and her legs and buttocks covered with clean and if possible sterilized sheets or towels.

(*h*) The question whether a vaginal or intra-uterine douche should be given after the hands and forceps have been in the vagina



The buttocks projecting over the edge of the table and the feet hanging free of the floor.

or uterus is an open one. Some authorities contend that such a douche should be given as a prophylactic against sepsis, others are equally insistent that it should not be given, as with its use there is a greater risk of sepsis. If a douche is used it should contain some non-poisonous antiseptic, and be injected at a temperature

of 110° F. It is most important that an anæsthetic should be administered, as by its employment the risk of injury and infection is markedly lessened.

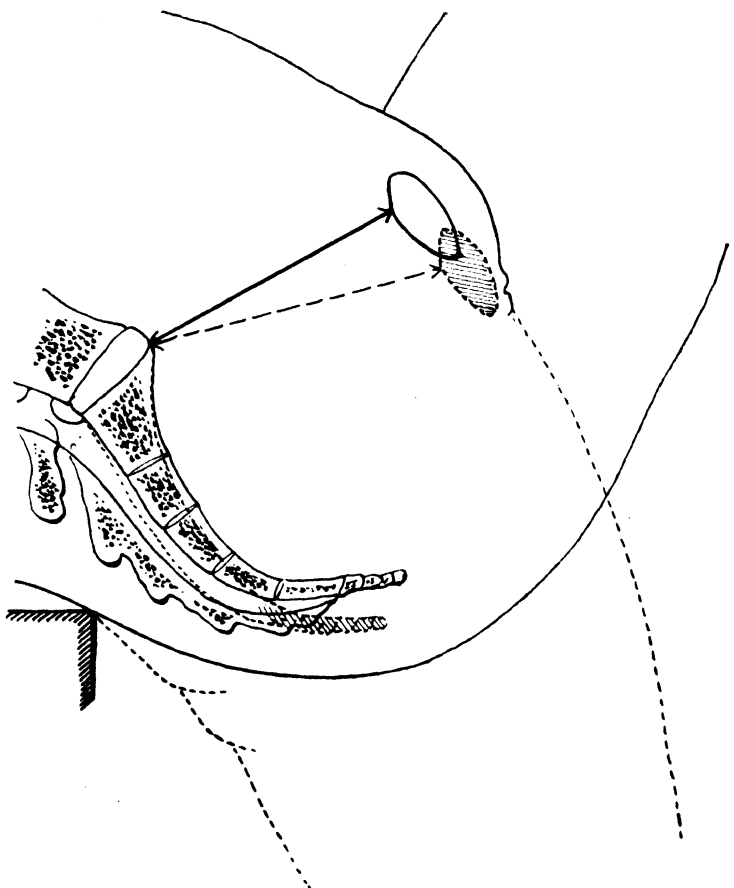


FIG. 244.—DIAGRAM OF WALCHER'S POSITION.

Showing the true conjugate indicated by the black line when the legs are flexed, increased in length, as indicated by the dotted line, when the legs are extended. With the patient in Walcher's position the true conjugate is increased in length ¼ inch, by the rotation forwards of the symphysis pubis.

Contra-indications to the use of the forceps.

The forceps should not be used—

(*a*) Unless the membranes are ruptured.
(*b*) Unless the cervix is fully dilated.
(*c*) If the uterus is in tonic contraction.
(*d*) If the child is dead and there is any difficulty in delivery.
(*e*) If the head is free above the brim of a contracted pelvis.

(*f*) When there is marked disproportion between the head and the pelvis.

(*g*) On any part of the child except the head.

The above contra-indications require but little comment. If the cervix is not sufficiently dilated it will be torn and the tear may extend up into the lower uterine segment, such injury perhaps resulting in death from hæmorrhage or sepsis later. The greatest danger connected with the use of the forceps is without doubt that of dragging the head through an insufficiently dilated cervix, and in spite of all teaching to the contrary this serious error is still persisted in. If the cervix is nearly fully dilated and is dilatable forceps-extraction may be employed in cases of urgency. In this case the head should be held steady with the forceps, the cervix should be pushed up over the head, traction being exerted only when the head is free.

When the uterus is in tonic contraction the child will be dead or its chances of survival reduced to a minimum. The proper treatment being to deliver the patient as quickly as possible with the least amount of risk, the head of the child should be perforated. In any case, the method of delivery which entails the least risk to the mother should be adopted if the child is dead. Therefore, unless the head is low down and can be delivered quite easily by the forceps, it should be perforated.

The dangers of forceps-delivery.—(*a*) The soft parts, lower uterine segment, cervix, vagina, vulva, perineum, or bladder, may be lacerated.

(*b*) Postpartum hæmorrhage may follow too rapid delivery or delivery in the interval between pains.

(*c*) The skull of the child may be fractured or its scalp may be torn.

(*d*) Meningeal or cerebral hæmorrhage in the child may occur.

(*e*) The face of the child may be paralysed.

(*f*) The eye of the child may be injured.

(*g*) Septic infection may occur.

The Application of the Obstetric Forceps.—The lower or left blade is introduced first, otherwise the handles will not lock.

The left hand of the operator is passed into the vagina with its palmar surface upwards, the ends of the fingers being inserted between the head of the child and the cervix or vagina according to the level at which the head lies. The operator next, holding the handle of the lower or left blade lightly in his right hand with its end raised and pointing forwards and the traction-rod in close contact

with it, passes the lower blade gently over the left hand till the head of the child is encountered. By describing part of a circle with the right hand the handle is now directed upwards, and then backwards and downwards, and the lower blade should slide between the head of the child and the mother's soft parts. If this half of the instrument is in the proper position, the lower blade should be lying against the left side of the pelvis, the shank should be in contact with the perineum, and the outer or roughened surface of the handle should be directed upwards (Fig. 245).



FIG. 245.—APPLICATION OF THE LOWER OR LEFT BLADE OF THE AXIS-TRACTION FORCEPS.

Fingers of the left hand, palmar surface upwards, introduced into the vagina. The right hand should also be holding the traction-rod, which is drawn free to indicate its position more distinctly. Towels have been omitted for the sake of clearness.

The left hand is now held with its palmar surface downwards, the fingers again being inserted between the head of the child and the soft parts of the mother. The operator then, holding the handle of the upper or right blade lightly in his right hand with its end lowered and pointing forwards and the traction-rod in close contact with it, passes the upper blade gently under the left hand till the head of the child is encountered. By describing part of a circle with the right hand the handle is now directed downwards, and then backwards

and upwards, and the upper blade should slide between the head of the child and the soft parts of the mother. If this half of the instrument is in its proper position, the upper blade should be lying against the right side of the pelvis, the upper handle should be in contact with the lower handle, and its outer or rough surface should be downwards (Fig. 246).

The traction-rods should be held well back, and the handles can

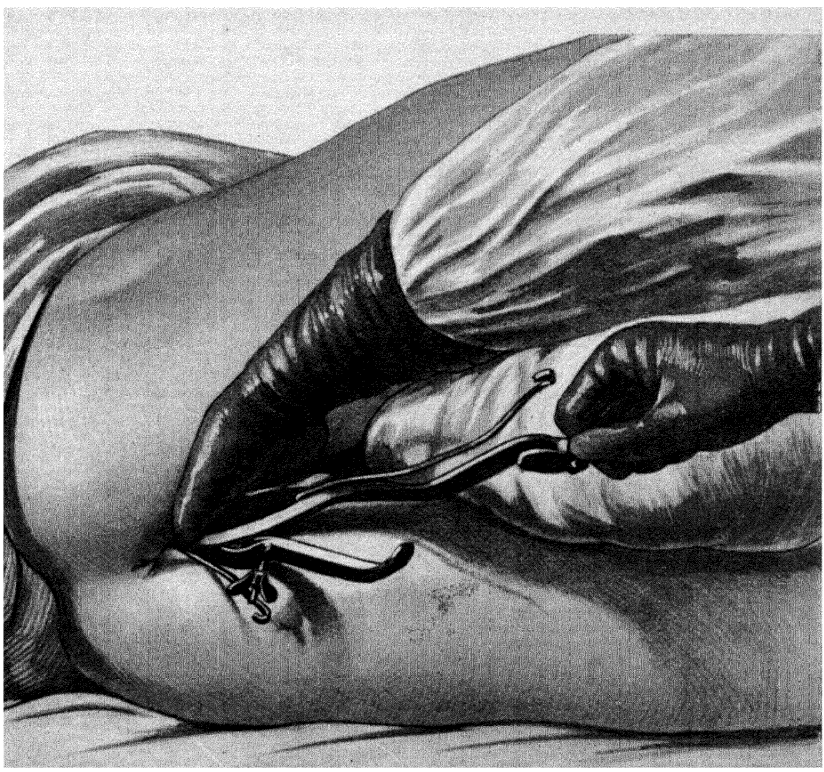


FIG. 246.—APPLICATION OF THE UPPER OR RIGHT BLADE OF THE AXIS-TRACTION FORCEPS.

Fingers of the left hand, palmar surface downwards, introduced into the vagina. The traction-rod should also be held by the right hand, but it is drawn free to indicate its position more distinctly. Towels have been omitted for the sake of clearness.

then be locked without any trouble; a further examination should be made to ensure that the head of the child only is grasped by the forceps and the fixation-screw should then be adjusted. After this the two traction-rods are pulled well behind the perineum, the traction-handle is applied, and the operator is now ready to extract the child (Fig. 247).

Occasionally difficulty may be experienced in locking the forceps owing to the fact that both blades have not been passed the

same distance, or that one blade has rotated after its introduction. In the first case one blade may be a little retracted or the other advanced. In the second case an attempt may be made to remedy the faulty position by gentle rotation; both handles may be carried back against the perineum, or, these methods failing, the forceps will have to be removed and reapplied.

Application of the forceps to the face.—If the head is delayed in the pelvic cavity and the chin is pointing forwards, and there is

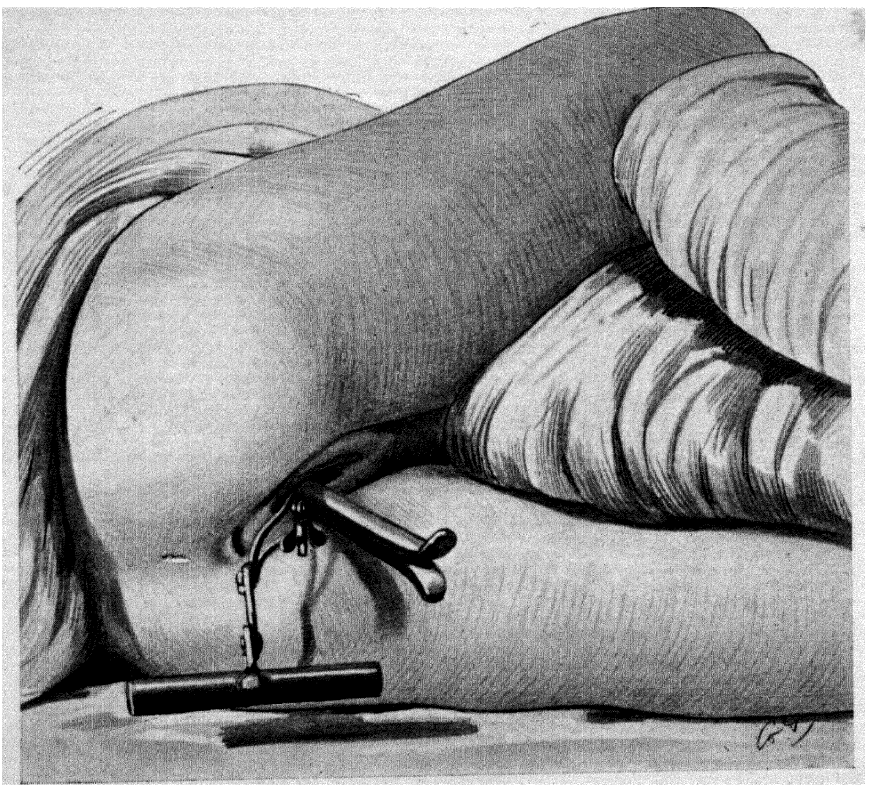


FIG. 247.—APPLICATION OF THE AXIS-TRACTION FORCEPS.

The handles are locked, the fixation-screw tightened, and the traction-handle is attached to the traction-rod. Towels have been omitted for the sake of clearness.

no contra-indication to its use, the forceps may be used to assist delivery of the child. The method of application is the same as that already described, but the handles should be kept well forward in order to avoid the blades grasping the neck. If the chin is pointing backwards, the forceps may be used after the face has been rotated. If the face cannot be rotated and the condition of the mother is good it is best to wait to see whether rotation will not occur naturally. If after a reasonable time has been given rotation does not occur, it is good practice to apply the forceps and pull in the hope

that when the chin has descended a little it will rotate to the front. If this happens the forceps should be removed and reapplied. It must be understood that non-rotation with a large head usually means perforation.

Application of the forceps to the brow.—If the brow is arrested in the pelvic cavity, a gentle trial may be given to delivery with the forceps supposing there is no contra-indication to its use. The method of application is the same as that already described.

Relation of the blade of the forceps to the head of the child.—When applying the forceps by the method described, the blades have been passed so that they lie in relation with the sides of the

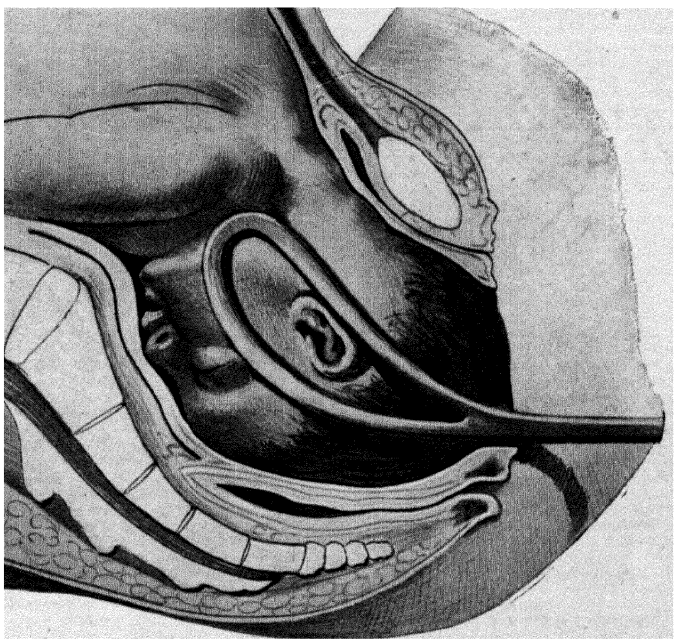


FIG. 248.—POSITION OF THE BLADES OF THE FORCEPS DURING EXTRACTION OF A FIRST VERTEX.

The blades of the forceps lie in the submento-vertical diameter and grasp the biparietal diameter.

mother's pelvis without any particular regard to the position of the head of the child. As far as the head of the child is concerned the proper diameter to be grasped is the biparietal. In the majority of cases in which delivery by the forceps is necessary this is the diameter that is grasped, since the forceps is most often used after the long diameter has rotated into the antero-posterior diameter of the cavity (Fig. 248). If the head is lying transversely, as for instance when it is engaged in a flattened pelvis, a slightly oblique diameter or the occipito-frontal will be grasped. As soon as internal rotation

has occurred the forceps should be taken off and reapplied. If the head is lying diagonally, an oblique diameter stretching between a point a little in front of one parietal eminence to a little behind the other will not be grasped as firmly as it should be, and as a result the forceps will at times slip when traction is applied or as the head rotates. To obviate this disadvantage some authorities contend that the forceps should always be applied so as to grasp the biparietal diameter of the head irrespective of the position of the blades to the pelvis. By this teaching, therefore, if the head is lying transversely

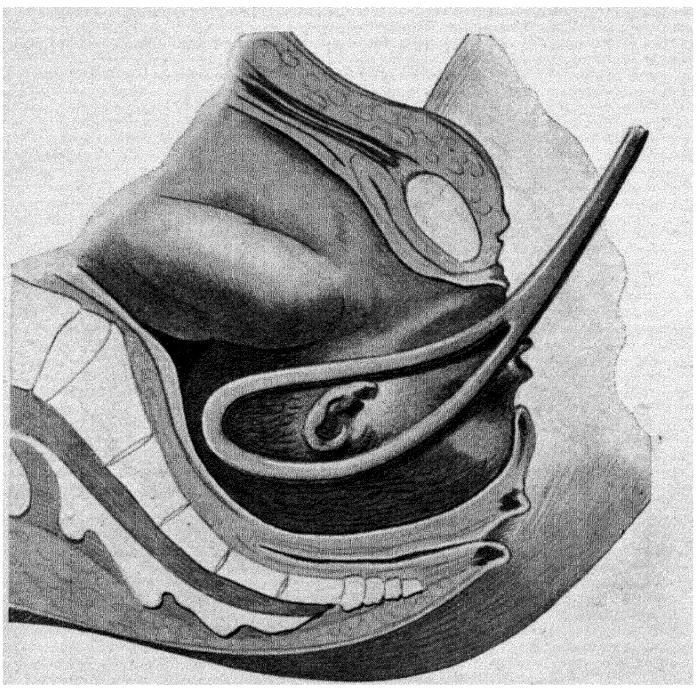


FIG. 249.—POSITION OF THE BLADES OF THE FORCEPS DURING EXTRACTION OF MENTO-ANTERIOR POSITION.

The blades of the forceps lie in the occipito-mental diameter and grasp the head in the bi-zygomatic diameter.

one blade of the forceps should lie between the promontory of the sacrum and the head, and the other between the symphysis pubis and the head. Such a method of application should not be employed, owing to the increased danger of injury to the mother. If the head is lying in one oblique diameter, the biparietal diameter may be grasped by applying the forceps so that the blades lie in the other oblique diameter, one blade lying against the sacro-iliac synchondrosis and the other over the ilio-pectineal eminence.

When the forceps is applied to the face above the brim the blades rest against the sides of the head in a diameter approaching the

occipito-mental (Fig. 249). When the forceps is applied to the after-coming head the blades grasp the biparietal diameter (Fig. 250).

Extraction with the Forceps.—The traction-handle is held lightly with the fingers of the right hand, counter-pressure if necessary being made with the left hand.

The direction of the traction will, of course, vary according to the position of the head of the child, and since the blades of the forceps, owing to the fixation-screw, are firmly attached to the head the handles of the forceps will always indicate its position. All the operator has to do, therefore, is, when pulling, to keep the traction-rods in contact with the shanks of the forceps. The direction of the traction, which at first should be as far backwards as possible,

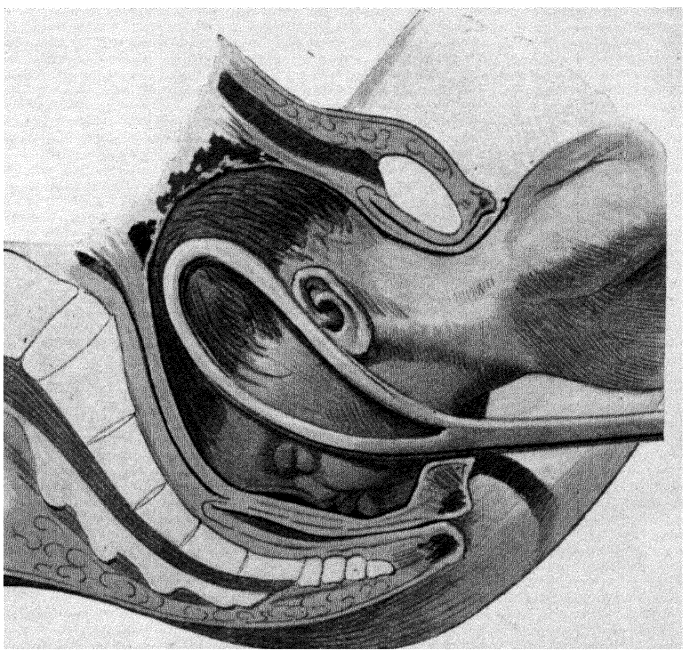


FIG. 250.—POSITION OF THE BLADES OF THE FORCEPS DURING EXTRACTION OF THE AFTER-COMING HEAD.

The blades lie in the submento-vertical diameter and grasp the head in the biparietal diameter.

is gradually shifted forwards as the head descends until the outlet of the vagina is approached, when it should be forwards and upwards. It is better as a general rule to remove the forceps when the head of the child is crowned, since the danger of rupturing the perineum will thereby be lessened (Fig. 251).

To enable the traction in this direction to be applied properly the operator should drop the traction-handle and take hold of the shanks of the forceps with his right hand, the thumb being directed

forwards, and the forceps is now pushed forwards and upwards till the head of the child is crowned or born.

Precautions to be taken during the extraction.

(*a*) The direction must be correct.
(*b*) The strength of the pull must be regulated.
(*c*) Traction should be made with the pains.
(*d*) The fixation-screw must be loosened between the pains.

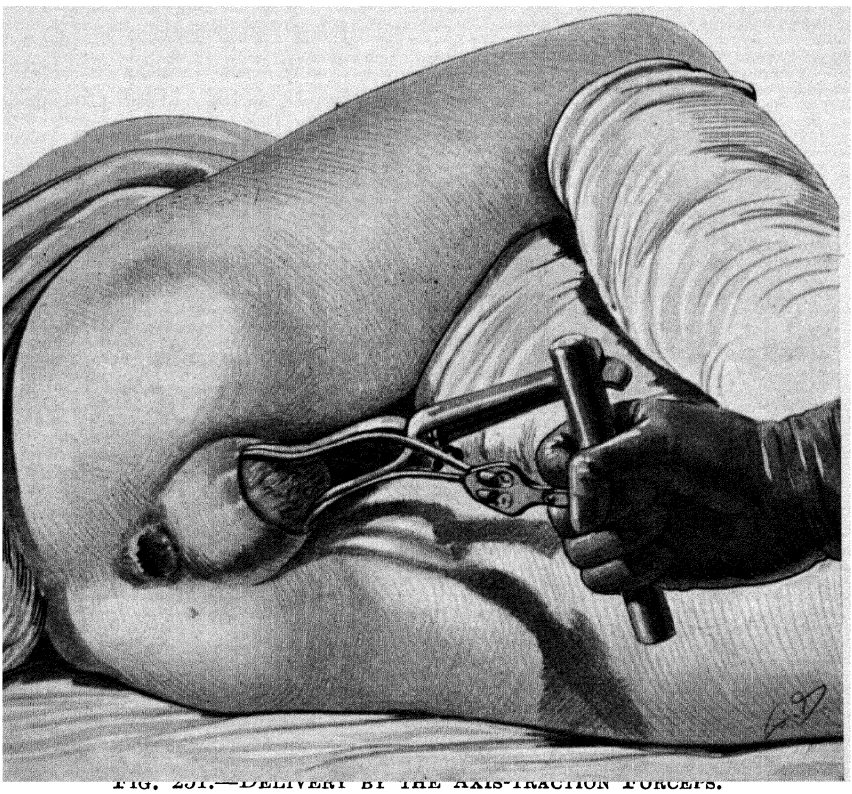


FIG. 251.—DELIVERY BY THE AXIS-TRACTION FORCEPS.

The operator is pulling with the traction-rods parallel with the shanks of the forceps. As a rule, it is better, when the head is born as far as is shown in the picture, to continue the traction with the handles of the forceps, as by so doing there is less risk of rupturing the perineum, since if the traction-rods are pulled on their bulging will often lacerate the perineum. Towels have been omitted for the sake of clearness.

The direction of the traction has already been dealt with. When using the axis-traction forceps but very little strength is required in delivering the child. The common practice of using great force if the head is not moving easily is most reprehensible, and is an indication that the operator either is trying to deliver too quickly or has not correctly diagnosed the cause of the delay and should not be using the forceps at all. If the use of the forceps is persisted

in, even if in the end the head is extracted, the mother runs a great risk of being seriously torn, and the child will almost certainly be dead. Rather more force is required when delivering with the long curved forceps, but certainly not more than can be exerted with the forearms alone. Although on occasions it may be necessary, in the interests of the mother or child, to deliver as quickly as possible without regard to the uterine contractions, yet in the general run of cases it is important to pull only with the pain, since if the child is delivered in an interval between pains postpartum hæmorrhage may result. Directly the traction is discontinued the fixation-screw must be loosened to reduce the pressure of the blades on the head of the child.

Application of the Forceps to the After-coming Head.—Occasionally in breech presentation the head, having entered the pelvic cavity, is somewhat extended and its birth is thereby delayed. Other methods of delivery having failed, the forceps may be tried. Before the forceps is applied, the body of the child must be drawn forward if the occiput is in front or *vice versâ*, and when the instrument is applied its handles should be in relation with the abdomen of the child. If the after-coming head is delayed above the brim and cannot be released by the ordinary methods (see p. 373), the delay is due to disproportion between the fœtus and pelvis, and the forceps should not be used, any more than it should be—as already insisted upon—if the fore-coming head is delayed by disproportion.

VERSION

By version or turning is meant the alteration of the lie or presentation of the child so that the head or breech presents instead of the part that originally presented.

In the operation of turning, the presenting part of the child is changed. The operation is termed *cephalic* version if the head is made to present, and *podalic* version if the breech is made to present.

Indications for Cephalic Version.—Cephalic Version is indicated when—

The lie of the child is transverse and the pelvis of the mother is normal.

The presentation of the child is a breech the mother a primigravida and her pelvis normal.

Indications for Podalic Version.—Podalic Version may be indicated for—

Malposition of the child.
Antepartum hæmorrhage.
Flattened pelvis.
Prolapse of the umbilical cord.
Double monsters.
Hastening delivery.

Malposition of the child.

1. The lie of the child is transverse, the pelvis of the mother is normal, and cephalic version has failed.
2. The face of the child is presenting and will not enter the brim, and there is no extreme degree of pelvic contraction.
3. The brow of the child is presenting and has not entered the brim, and there is no extreme degree of pelvic contraction.
4. The arm of the child is prolapsed, its vertex or face is presenting, and reposition of the arm or forceps extraction has failed.
5. The arm of the child is displaced behind its neck—dorsal displacement—and reposition has failed.
6. The umbilical cord is prolapsed, reposition has failed, and the cervix is not large enough to allow of forceps-extraction, or the vertex or face is delayed above the brim.

In cases in which the cervix is not sufficiently dilated version will not as a rule save the life of the child, since the head will be delayed.

7. The children in twin pregnancy are locked, one being in a transverse lie and the other in a longitudinal lie.

Antepartum hœmorrhage.

1. In *unavoidable* hæmorrhage, podalic version, as far as the mother is concerned, is one of the most efficient methods of treatment. It has the distinct disadvantage that fœtal mortality is high.
2. In *accidental* hæmorrhage when rapid delivery is indicated and the cervix is not quite large enough for the safe application of the forceps.

Flattened Pelvis.

1. As an alternative to the forceps in a simple flat pelvis when the conjugate diameter is not less than $3\frac{1}{4}$ inches and the other diameters are normal or larger than normal. The fœtal mortality is, however, higher with this method of delivery.

2. In a scolio-rachitic pelvis with more room on one side of the promontory than the other, if the head is entering the brim and the occiput is directed to that side on which there is less room.
3. In a posterior parietal presentation, the head not being fixed in the brim.
4. When in addition to flattening of the pelvis of slight degree unavoidable hæmorrhage is present.
5. In cases of prolapse of the umbilical cord, when the child is alive, when the cord cannot be replaced and the head is not being born quickly.

Double Monsters.

Double monsters are extremely rare. When their birth is delayed podalic version may be the best treatment.

It may be necessary to deliver the child quickly in the interest of the mother, and if the cervix is fairly dilated, but not sufficiently dilated for the safe use of the forceps, podalic version may be indicated the after-coming head being perforated if necessary.

To hasten delivery.

Delivery in such a case may be indicated—

1. In eclampsia.
2. In heart disease.
3. In pulmonary disease.

Contra-indications to Version.—1. When the uterus is tonically contracted.

2. If the head or breech has entered the pelvic cavity.

3. When the child is dead, except to hasten delivery or arrest hæmorrhage when the placenta is prævia.

4. If the conjugate diameter of a flattened pelvis is less than $2\frac{3}{4}$ inches.

5. A generally contracted pelvis.

6. A hydrocephalic child.

7. An attempt to perform version during a uterine contraction may easily lead to rupture of the uterus.

Preparations for Version.

Patient.—The rectum should be emptied with a soap and water enema if this has not already been done.

The bladder should be emptied by catheter.

The vulva should be thoroughly washed with soap and water, after which it should be swabbed with iodine.

The vagina should be swabbed with tincture of iodine if bipolar or internal version is to be performed.

The uterus should be douched with some suitable non-poisonous antiseptic solution after bipolar or internal version.

The exact position of the child should be ascertained. An anæsthetic should be administered.

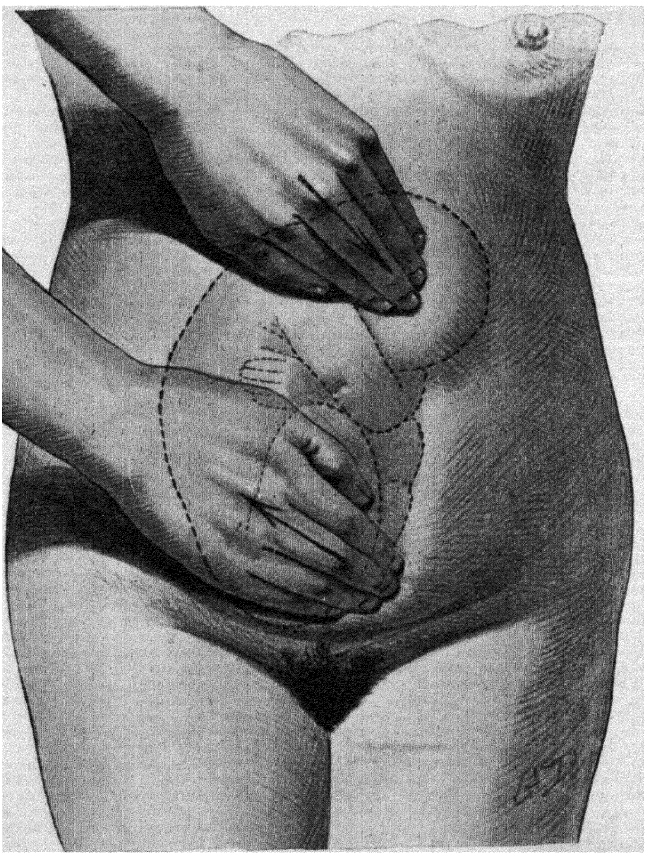


FIG. 252.—EXTERNAL CEPHALIC VERSION. STAGE 1.

Patient in the Trendelenburg position. The operator pulls the breech towards the fundus of the uterus with his right hand and pushes the head towards the brim of the pelvis with his left. Note that the direction in which the child is moved is that which tends to increase rather than to diminish flexion of the head.

Operator.—The hands of the operator should be gloved and his body covered with a sterilized overall.

Methods of Performing Version.—The operator uses both hands on the abdomen when performing *external version,* which is the safest method.

The operator uses one hand on the abdomen and two fingers of

the other hand in the uterus when performing *bipolar version*, which is the most difficult method.

The operator uses one hand on the abdomen and the other hand in the uterus when performing *internal version*, which is the easiest but the most dangerous method.

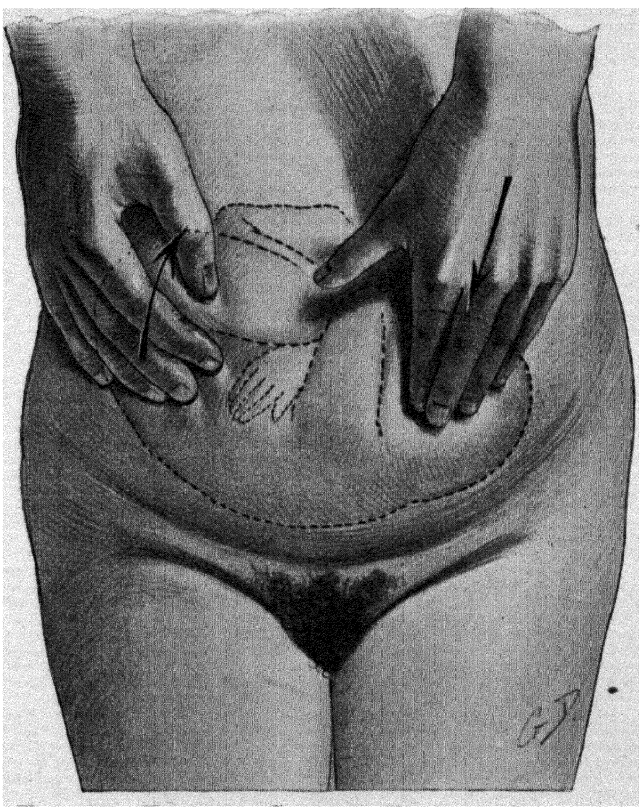


FIG. 253.—EXTERNAL CEPHALIC VERSION. STAGE 2.

Patient in the Trendelenburg position. The child has been moved from the vertical to the transverse. To complete the version the operator pulls the breech to the fundus of the uterus with his right hand and pushes the head into the brim of the pelvis with his left.

Dangers of Version.

The *patient* may be infected during bipolar and internal version.

The *uterus* may be ruptured during internal version.

The *child* may be asphyxiated during delivery by podalic version.

CEPHALIC VERSION

Cephalic version can be performed only by external version.

External Cephalic Version.—External cephalic version is most easily performed before the onset of labour. If labour has started,

the membranes must be unruptured to enable this method to be carried out.

The patient should be on her back, with her pelvis somewhat raised, her thighs flexed, and her abdomen uncovered.

Method.—The operator stands on which side of the patient he prefers, facing either her head or the pelvis, and makes sure to which

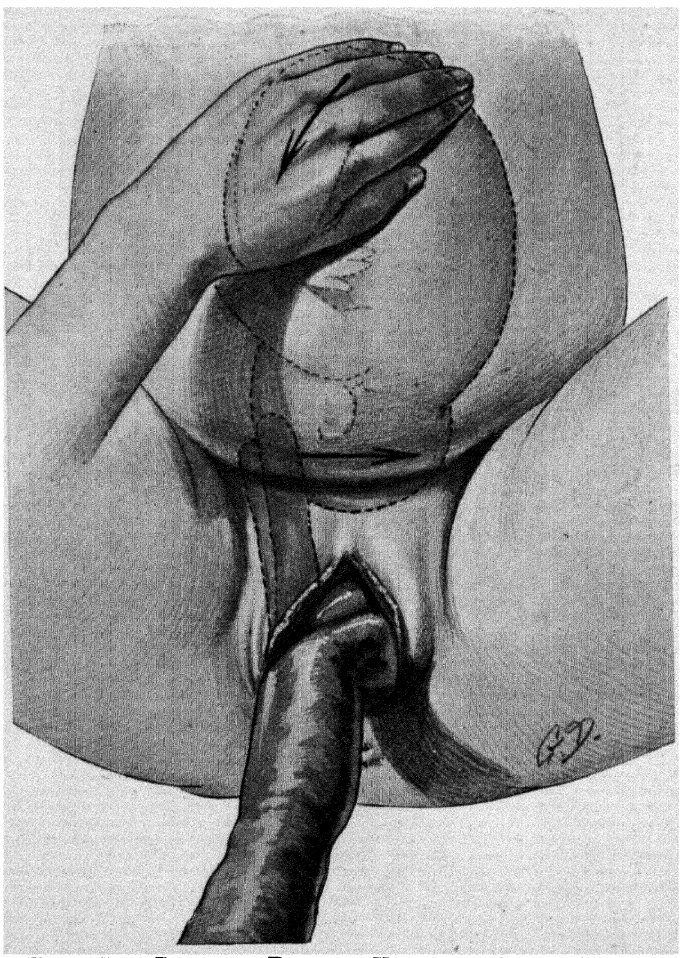


FIG. 254.—BI-POLAR PODALIC VERSION. STAGE 1.

The operator pushes the head of the child towards its back with the index and middle fingers of his right hand, passed through the cervix, and presses the breech towards the brim of the pelvis with his left on the abdomen.

side the back of the child lies. It is important to maintain flexion. This can be done by pushing the head away from the back so as to keep the chin as near the chest as possible.

The operator by a series of small pushes forces the head of the child towards the pelvis with one hand and the breech towards the fundus of the uterus with the other (Fig. 252). When the child is

in the longitudinal lie its head should be pressed into the brim and a binder applied (Fig. 253).

If labour has started, the patient should be kept on her back unless there is marked obliquity of the uterus, in which case she should lie on the side opposite to the obliquity. When the cervix



FIG. 255.—BI-POLAR PODALIC VERSION. STAGE 2.

As the child moves the head is displaced and the fingers of the operator's right hand now impinge on the shoulder, which is then pushed towards the head, the left hand on the abdomen continues to press the breech towards the brim.

is fully dilated the membranes should be ruptured in order to ensure the head engaging in the brim.

If the breech or shoulder has entered the brim, external version cannot be performed until they are freed. The breech must first be liberated if necessary by pushing it out of the pelvis with two fingers in the vagina. When this is done the breech should be pushed into the iliac fossa and retained there by one hand while the head is

pushed down with the other hand. The Trendelenburg position may facilitate the escape of the breech or shoulder from the pelvis.

Difficulties.—If the abdominal wall is rigid, the patient nervous, or the liquor amnii very little in amount, external version may be very difficult or impossible without the aid of deep anæsthesia. With every help it may be impossible with the legs extended.

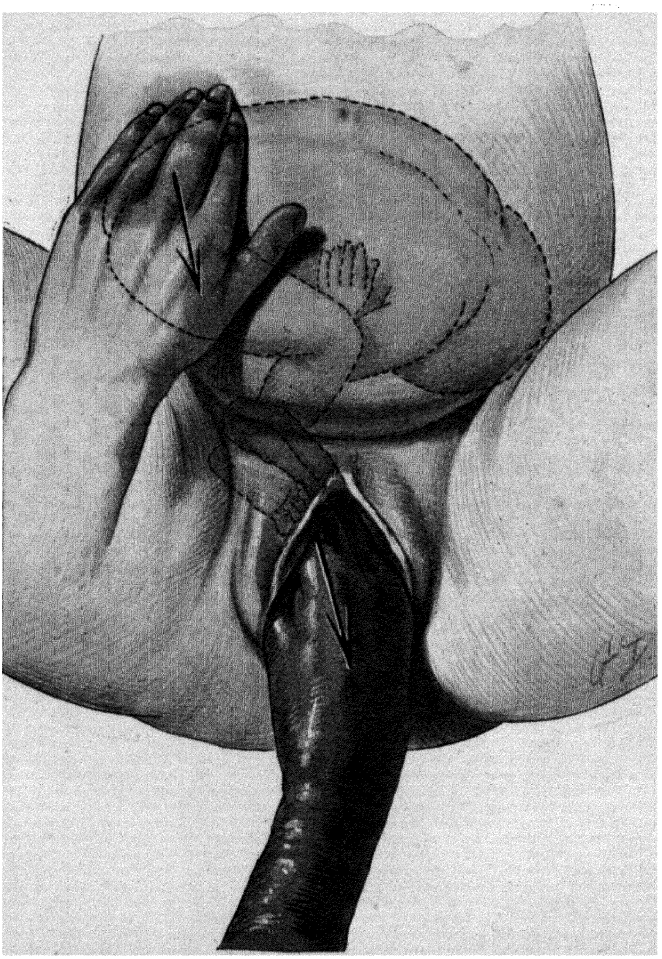


FIG. 256.—BI-POLAR PODALIC VERSION. STAGE 3.

The operator feels the knee, ruptures the membranes and grasps a foot with the internal fingers, draws it down into the vagina, and presses the breech down towards the brim with his left hand on the abdomen.

Internal Cephalic Version.—Cephalic version cannot be carried out by internal manipulations.

PODALIC VERSION

External Podalic Version.—The remarks made and the directions given under external cephalic version may be applied to external

podalic version, substituting the word "breech" for that of "head" when the latter is mentioned.

Bipolar Podalic Version.—The patient is placed on her back or left side with her legs flexed, the operator standing on her right side in the former case and facing the buttocks in the latter.



FIG. 257.—BI-POLAR PODALIC VERSION. STAGE 4.

The operator pulls the leg down with his right hand till the half breech is engaged, and with the left hand on the abdomen he brings the head to the fundus.

Method.—The operator passes the index and middle fingers of his right hand through the os, and if the head of the child is presenting pushes it towards its back, or if the shoulder is presenting this is pushed towards the head of the child (Figs. 254, 255). At the same time with his left hand the operator pushes the breech in

the opposite direction. By this manœuvre the knees of the child should present at the os. When the knee is felt the membranes must be ruptured, and the foot is then seized (Fig. 256). The operator next pulls a leg of the child into the vagina, using gentle traction till the half breech is engaged, at the same time pushing the head towards the fundus with his left hand (Fig. 257).

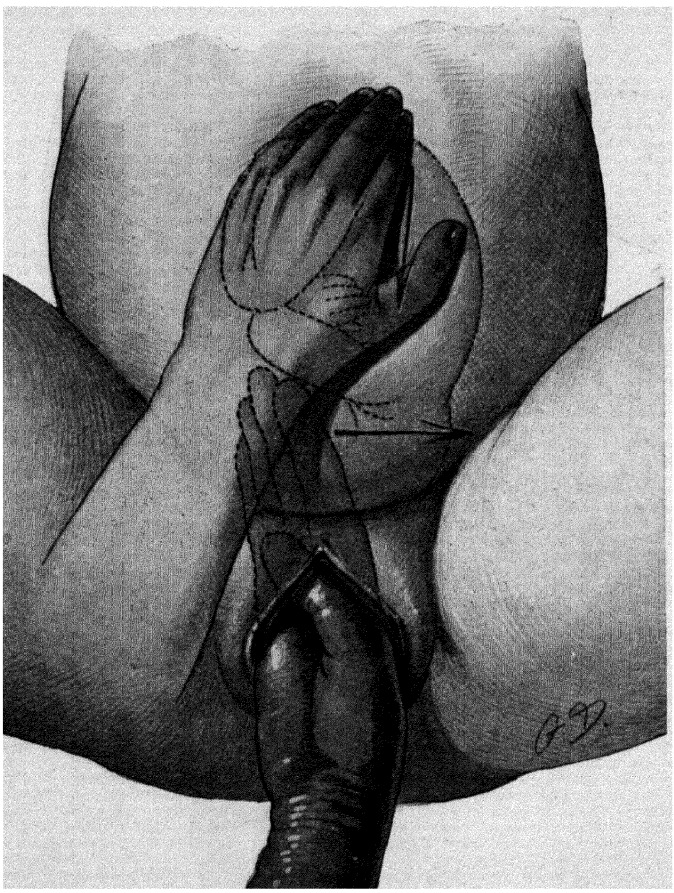


FIG. 258.—INTERNAL PODALIC VERSION. STAGE 1.

The operator passes his right hand into the uterus, and as the hand enters the uterus he pushes the head to one side. With his left hand on the abdomen he presses the uterus downwards.

Difficulties.—The difficulties are those already mentioned under bipolar cephalic version. In addition, if there is too much liquor amnii the child may move so readily that difficulty is experienced in grasping a knee or foot. In this case if the membranes are ruptured and the internal hand is left *in situ*, sufficient liquor amnii can be drained away to allow bipolar podalic version to be carried out, but not too much to endanger the life of the child.

The elbow may be mistaken for the knee, or the hand for the foot (see p. 359). The head of the child may not rise properly to the fundus if the breech is not pulled well into the os.

Internal Podalic Version.—The position of the patient and operator is the same as that already mentioned for bipolar podalic version.

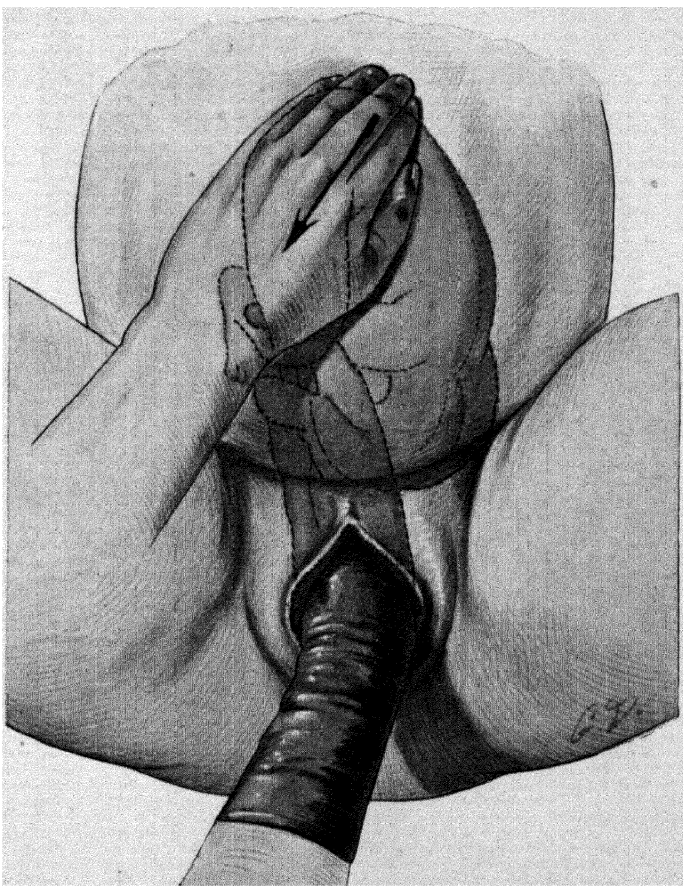


FIG. 259.—INTERNAL PODALIC VERSION. STAGE 2.

The operator passes his internal hand along the body of the child until the knee is reached, when it is grasped. The external hand on the abdomen presses the breech down to enable the operator to reach the knee or foot better.

Method.—The operator passes his right hand gently through the vulval opening into the vagina and then through the os into the uterus, this organ being supported externally meanwhile with the left hand. The internal hand should be made to occupy as small a space as possible while it is being passed, the thumb and fingers being approximated. The head or the shoulder, whichever is presenting, must be pushed on one side as the hand enters the uterus.

The internal hand is passed along the body of the child till a knee or foot is felt. The knee or foot is then pulled through the os into the vagina, and traction is kept up until the half breech enters the os. During this part of the manœuvre the external hand pushes

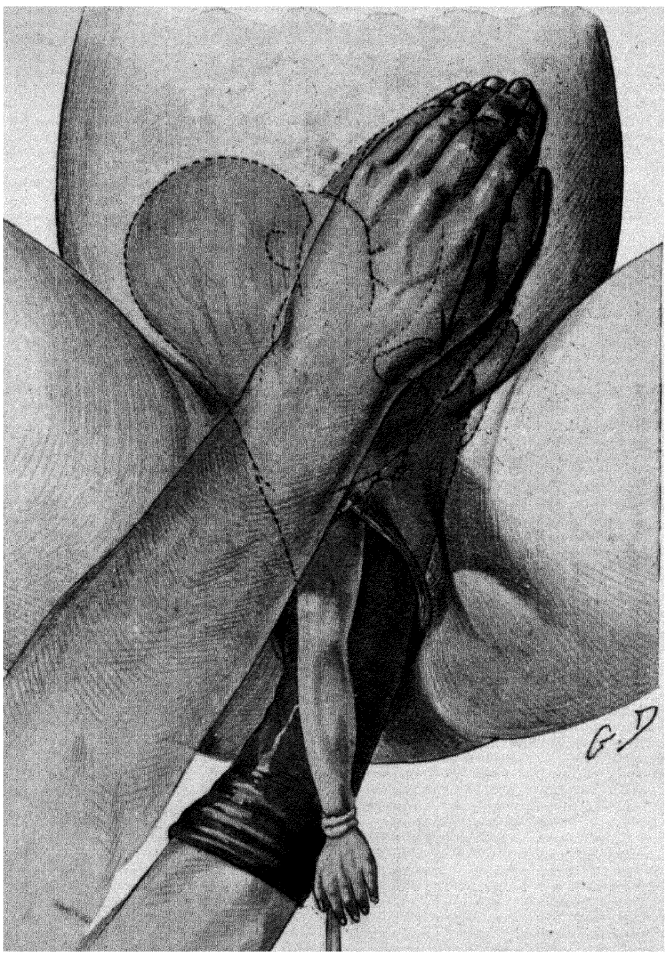


FIG. 260.—INTERNAL PODALIC VERSION IN A SHOULDER PRESENTATION. STAGE 1.

The arm is prolapsed and a tape has been tied round the wrist. The operator with his internal hand is grasping the leg that corresponds to the prolapsed arm, and with his left hand on the abdomen is pushing down the breech to make this easier.

the head of the child towards the fundus (Fig. 259). Delivery of the child can be completed if necessary by traction on the leg combined with pressure on the fundus of the uterus.

Choice of leg to pull down.—In most cases the operator can pull down whichever leg he encounters first. If there is a scolio-rachitic

pelvis or the child is lying obliquely, it is better to choose a particular leg.

In a *scolio-rachitic pelvis* there is more room on one side of the pelvis than the other. If delivery is being terminated by version, the biparietal diameter of the child's head can be made to engage in that side of the pelvis which has the most room if the corresponding leg of the child is brought down. Thus if there is more room on the left side of the pelvis the left leg should be chosen.

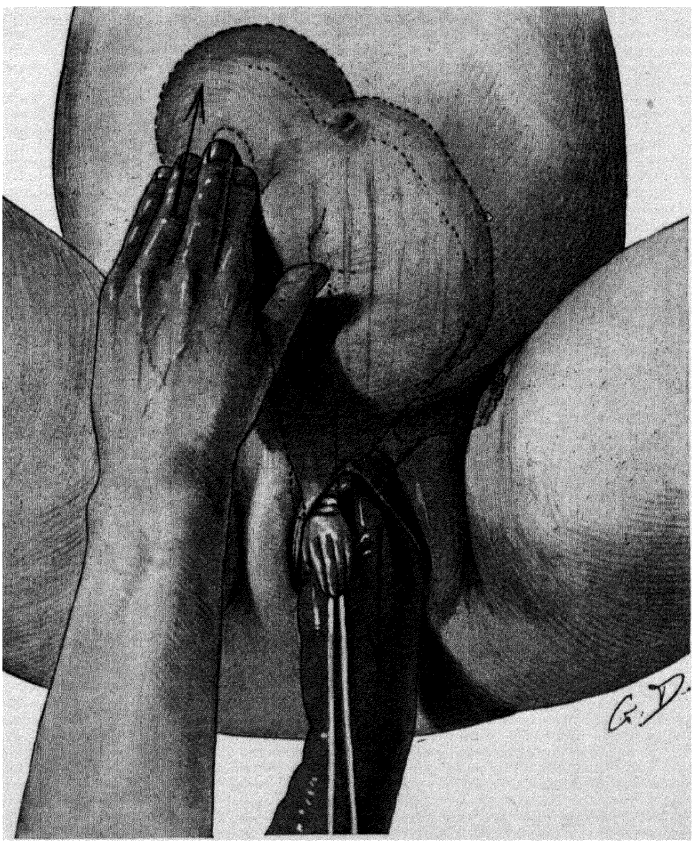


FIG. 261.—INTERNAL PODALIC VERSION IN A SHOULDER PRESENTATION. STAGE 2.

The operator is now drawing down the leg and pressing the head up.

In a *transverse lie of the child* the arms, when version is carried out, are apt to become extended. In such circumstances the posterior arm can usually be brought down without much difficulty or loss of time, but the delivery of the anterior arm is much more difficult, and the child is occasionally lost from the delay incurred thereby. It is possible to ensure that the anterior arm shall not become extended by bringing down an arm before the version is

commenced and tying a piece of tape to it (in many cases the arm is already prolapsed) (Fig. 260). When the half breech is pulled

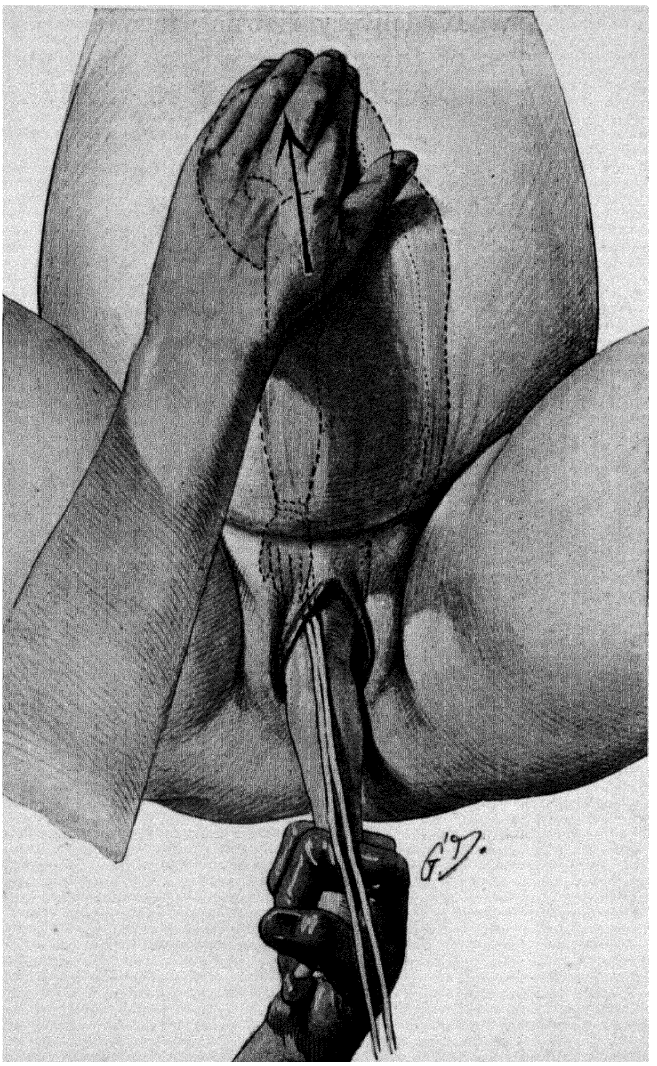


FIG. 262.—INTERNAL PODALIC VERSION IN A SHOULDER PRESENTATION. STAGE 3.

The operator has pulled upon the leg he grasped till it has engaged, and the leg is now interior. As this leg corresponded to the prolapsed arm, the arm must now be anterior. During the version, by gentle traction on the tape, the operator has prevented the prolapsed or anterior arm from becoming extended.

into the os the body will rotate, so that the leg that is being pulled upon will be anterior.

If, then, the leg corresponding to the prolapsed arm is pulled upon and gentle traction is made on the piece of tape, as the arm

is carried up into the uterus it is kept from extending, and remains anterior.

Difficulties.—Internal version cannot be attempted until the os is large enough to admit the hand. Internal version with an oblique presentation may also be very difficult or impossible if all the liquor amnii has drained away.

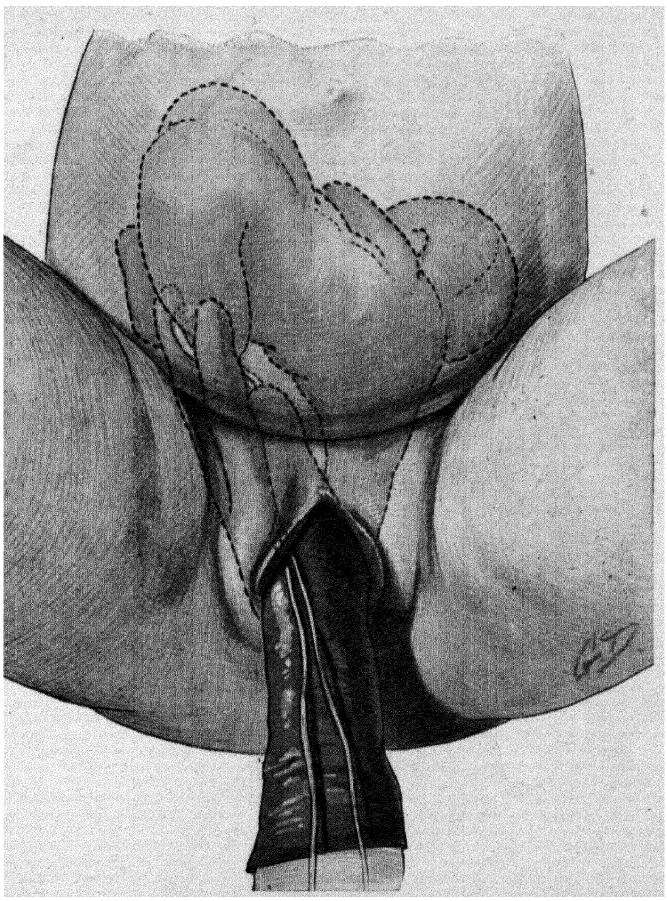


FIG. 263.—A DIFFICULT INTERNAL PODALIC VERSION WITH THE SHOULDER PRESENTING. STAGE 1.

Passing a loop of tape round the ankle.

In such a case, if there is no tonic contraction of the uterus or ring of Bandl present, additional help may be gained by tying a piece of tape to the foot or passing a blunt hook round the back of the knee. The tape or blunt hook can then be pulled with one hand externally while the other hand can be used internally to push the shoulder up (Figs. 263, 264, 265).

It requires much experience to know when these additional

methods may be employed; when in doubt it is better to decapitate the child than run the risk of rupturing the uterus (see p. 390).

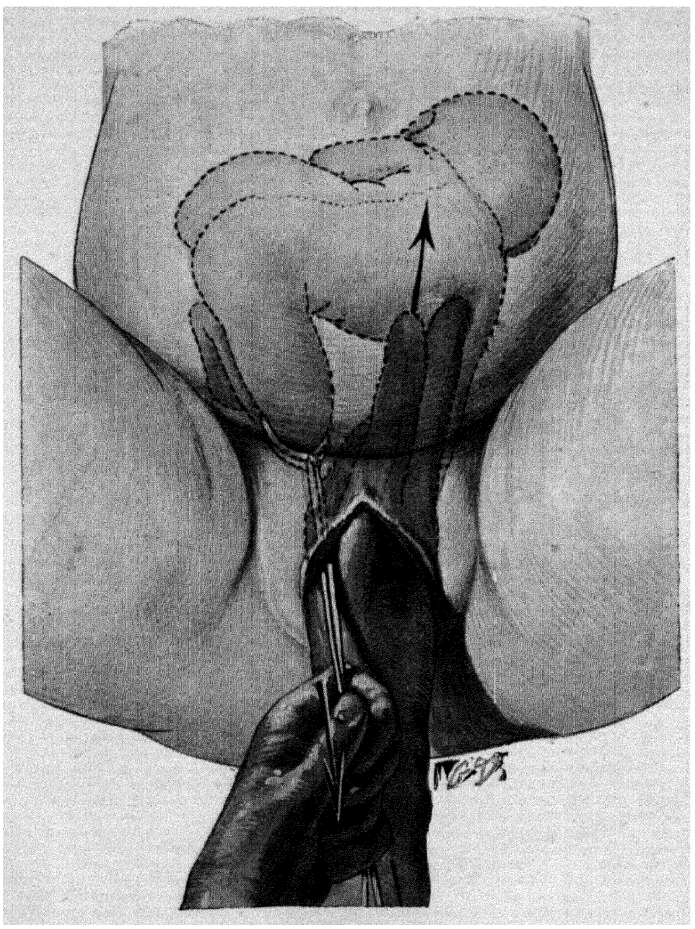


FIG. 264.—A DIFFICULT INTERNAL PODALIC VERSION WITH THE SHOULDER PRESENTING. STAGE 2.

Pulling on the tape with the left hand outside the vulva, and pushing on the shoulder with the right hand on the uterus. The tape should be round the ankle not round the knee as shown in the figure.

CÆSAREAN SECTION

Absolute Indications.

1. Extreme degrees of contracted pelvis.
2. Tumours of the uterus, ovaries, vagina, rectum, pelvis.
3. Atresia of the cervix or vagina.
4. Misplacement of the uterus.

It is impossible to deliver a full-time child by any method through

a pelvis in which the conjugate diameter at the brim is less than 2 inches and the transverse less than 3½ inches.

A fibroid of the uterus or ovarian tumour may be situated below the presenting part, and so prevent delivery of the child. Cancer of the cervix, vagina, and rectum have necessitated the performance of this operation.

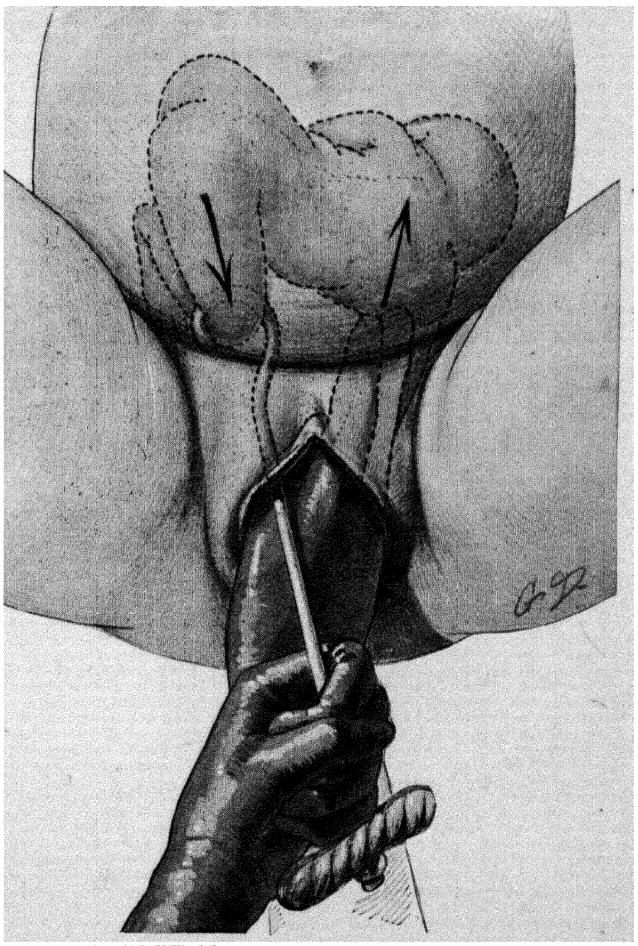


FIG. 265.—A DIFFICULT INTERNAL PODALIC VERSION WITH THE SHOULDER PRESENTING.

The blunt hook passed round the popliteal space. Traction exerted by the left hand. Right hand on the uterus pushing up the shoulder.

It has been found necessary on rare occasions to perform Cæsarean section in a patient who has had the uterus ventrofixed, owing to the fact that the anterior wall of the uterus formed a thick pad of obstruction, and the cervix was tilted so far back that it could not be dilated either naturally or artificially (see Fig. 39).

Relative Indications.

1. Minor degrees of contracted pelvis.
2. Some tumours of the uterus, ovaries, vagina, rectum, and pelvis.
3. Urgent condition of the mother.
4. Urgent condition of the child.

The relative indications for Cæsarean section in contracted pelvis are dealt with on p. 734. Here it will suffice to say that Cæsarean section may be properly performed in selected cases of contracted pelvis with a true conjugate up to 3½ inches.

The treatment of labour obstructed by tumours of the genital organs is discussed on pp. 479, 520, and 522. As a general rule it is best to deliver the child by Cæsarean section and remove the tumour at the same operation, but in some cases the alternative method of pushing the tumour aside or tapping it if cystic may be indicated.

In certain cases of eclampsia (see p. 135) and antepartum hæmorrhage (see pp. 494, 504) the safest treatment for the mother may be to perform Cæsarean section, in which case also the chances of the child surviving will be greatly increased.

Although the claims of the mother must always be considered first, when the question of saving the life of the child has to be settled there are certain urgent conditions of the child, such as prolapse or expression of the umbilical cord or locked twins, which, if the parents are prepared to take the slight risk of Cæsarean section, are very properly treated by this operation, since the fœtal mortality of the complications mentioned is a very high one.

Choice of Time for Operating.—The best results are obtained in Cæsarean section when there is ample time to prepare the patient and her surroundings, and for this reason the operator, when he has free choice, decides upon some day in the week preceding the termination of pregnancy. The uterus will contract and retract after the child is removed whether the patient is in labour or not, and the custom of waiting till labour has begun in order to ensure such contraction and retraction has now been given up. If, however, there is any uncertainty as to the date of pregnancy, it is better to wait till labour begins before operating.

Preparation for the Operation.—The preparation of the patient and her surroundings depends entirely on whether the case is an urgent one or has been previously selected for operation.

Selected Cases.—A room should be chosen which has a good light. The day before the operation the walls, woodwork, and floor should be well cleaned, and the furniture which will not be required should

be removed from it. A clean sheet or drugget should be tacked down over the floor. Four small tables will be required, one for the anæsthetist, one for the instruments, one for the swabs, and one for the dressings. In the absence of a proper operating-table a kitchen table 4′ × 2′ × 28″ will suffice. One chair for the anæsthetist. A large bowl of biniodide of mercury 1 in 1000 for the hands. Two small baths or large basins to contain hot and cold water respectively in case the child is asphyxiated. Three gallons of boiling water and 3 gallons of cold boiled water. A set of overalls, towels, swabs, and dressings, which should, of course, be properly sterilized. Such a set can now be procured already sterilized and put up in hermetically sealed tins. Indiarubber gloves for the operator and his chief assistant. In addition to the anæsthetist at least two assistants, one of whom may be the nurse, should be available, and it is better to have three, the extra one being able to give his or her undivided attention to the baby.

The pubes must be entirely shaved the day before the operation, after which the patient should have a bath. In the evening, when the skin is dry, the abdomen and pubes should be painted with a solution of 2 per cent. iodine in rectified spirit, after which the operation area should be protected by a piece of sterilized gauze. This painting is to be repeated the next morning, when the patient is on the table and under the anæsthetic. A dose of castor oil should be given to the patient on the afternoon before the operation, and a soap and water enema on the morning of the operation. Food should not be given to the patient during the five hours prior to the operation.

It is most important to ensure that the catheter is passed just before the patient is placed on the operating-table.

Urgent Cases.—In these cases it will be best not to disturb the furniture of the room. A sheet or drugget can be placed over the carpet, and as many of the articles and appliances mentioned in the foregoing list as can be obtained in the time at disposal should be available. In the absence of previously sterilized towels and swabs, boiled towels will suffice.

The bladder must always be emptied with a catheter, and if there is time a soap and water enema should be given. The mons veneris should be dry-shaved, after which the abdomen, pubes, and vulva should be well painted with iodine. It is essential for the welfare of the child that the patient should not be under the influence of the anæsthetic longer than is absolutely necessary

before the operation is started. All preparations, therefore, must be made before the anæsthetic is begun.

The Operation.—A median incision through the abdominal wall, 5 inches in length, should be made between the umbilicus and pubes (Fig. 266), special care being taken not to injure the bladder when the peritoneum is being incised at the lower angle of the wound, since this organ is often found to be dragged upwards, especially in obstructed labour (Fig. 267). The uterus is then centred. The

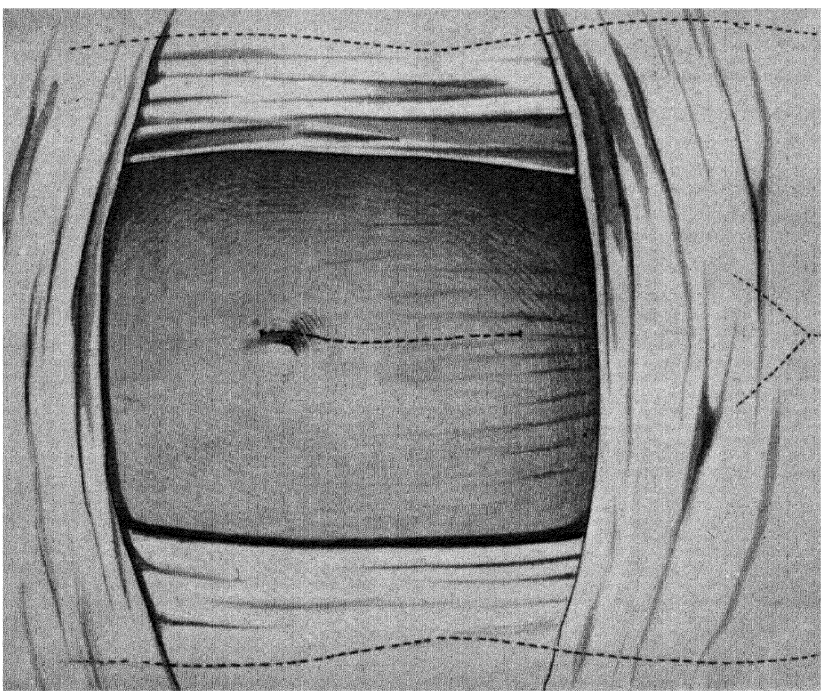


FIG. 266.—CÆSAREAN SECTION.

Showing the line of the abdominal incision.

upper angle of the parietal incision is dragged well up by the operator and his assistant so as to expose as much of the upper uterine segment as possible (Fig. 268). An incision, 4 inches in length, is then made deliberately, by successive strokes, through the upper uterine segment in its middle line.

During this part of the operation a fair amount of blood will escape from the vessels in the cut surface, and the bleeding may be very free if the placenta is attached to the anterior wall of the uterus, as it not infrequently is. No notice should be paid to this bleeding, since it cannot be stopped until the uterus is empty and

its wall retracted. If the placenta is attached to the anterior wall of the uterus it should at once be removed with the hand, when the liquor amnii will escape in a gush, or if the placenta is posteriorly situated the liquor amnii will escape when the membranes are incised. The operator next passes a hand into the uterus, and taking hold of a leg delivers the child forthwith (Fig. 269). The uterus will at once contract and retract, and the assistant should then deliver the uterus through the abdominal wound, placing a large swab behind

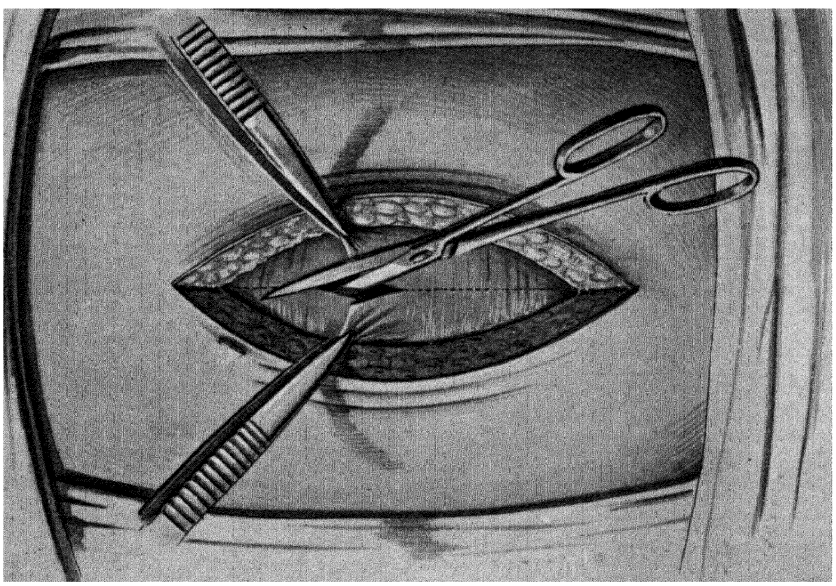


FIG. 267. – CÆSAREAN SECTION.

The skin, fat, muscle, and fascia of abdominal parietes incised. Commencing the incision of the parietal peritoneum.

the uterus in the pouch of Douglas. The child is now separated by clamping the umbilical cord at 2 inches and 3 inches from its abdominal attachment and dividing the cord between the clamps, after which the child is given to an assistant, who ligates its cord and otherwise attends to it. The placenta and membranes are now carefully removed, or if the placenta had to be removed before the child was delivered, then a careful examination should be made for any portion of membrane still *in situ*. An injection of ½ c.c. (minims 15) of pituitary extract should be given after the child has been extracted. The uterine wound is closed with two layers of sutures, a superficial and deep. The deep layer consists of a series of interrupted sutures passed through the peritoneal and muscular coats

of the uterus on each side, avoiding the decidua as much as possible (Fig. 270). Some operators use mattress sutures instead of interrupted sutures. After the deep sutures have been tied they are buried by a superficial layer of Lembert's sutures (Fig. 271). If the patient is to be sterilized (see p. 697), this is best effected by resecting the Fallopian tubes. The pouch of Douglas is now cleaned of any blood or liquor amnii that may have trickled into it, after which the uterus should be returned to the abdominal cavity and the abdominal wound sutured in three separate layers, the peritoneum, fascia, and skin respectively, or Michel's clips can be used for uniting the skin. If after the child, placenta, and membranes have been removed the

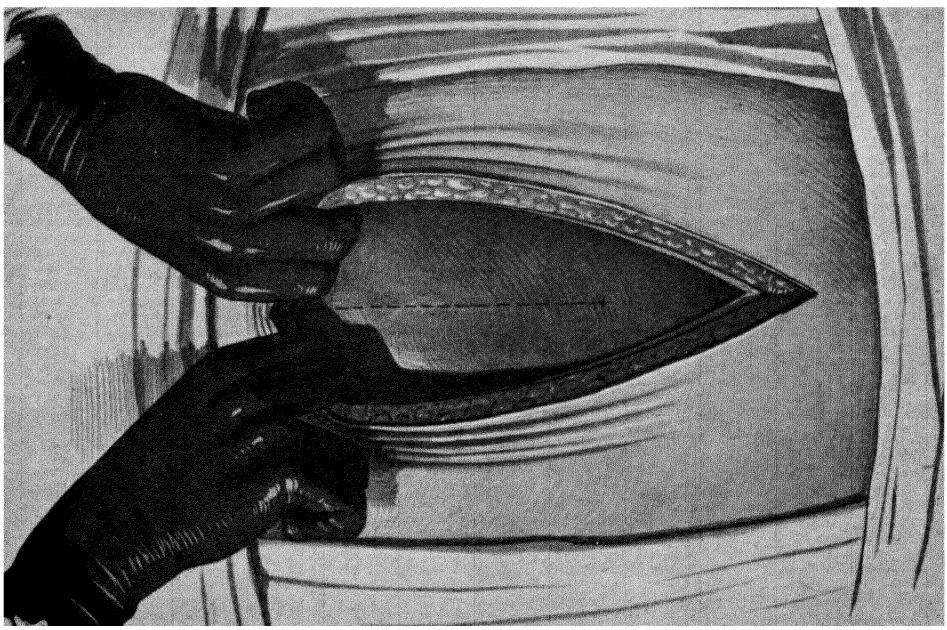


FIG. 268.—CÆSAREAN SECTION.
Abdominal cavity opened. Parietes retracted. Line of incision on the uterus.

bleeding from the uterus is at all free owing to deficient retraction, it can best be treated by massaging the uterus, surrounding it with a towel wrung out of very hot water, and by putting into it a swab wrung out of very hot water. In the latter cases the operator must be careful to remove the swab before he closes the wound in the uterus. As several swabs or towels will have been used during the operation, their number should have been carefully noted, and they should be counted before the abdominal wound is closed.

After-treatment.—Unless there is any contra-indication the patient should be encouraged to nurse her child. She cannot always

do so, however. The patient should not be given anything by the mouth unless it be a little water to wash it out with for the first twelve hours, after which milk and soda, beef-tea, and tea may be given, at first in quantities of 1 ounce every hour or so, and this is increased in frequency and quantity as circumstances demand.

The head of the bed should be raised or the patient propped up, so that the drainage of the lochia may be better effected. On the evening of the third day an aperient should be given, and the next morning a soap and water enema. After the bowels have been opened the patient may have solid food.

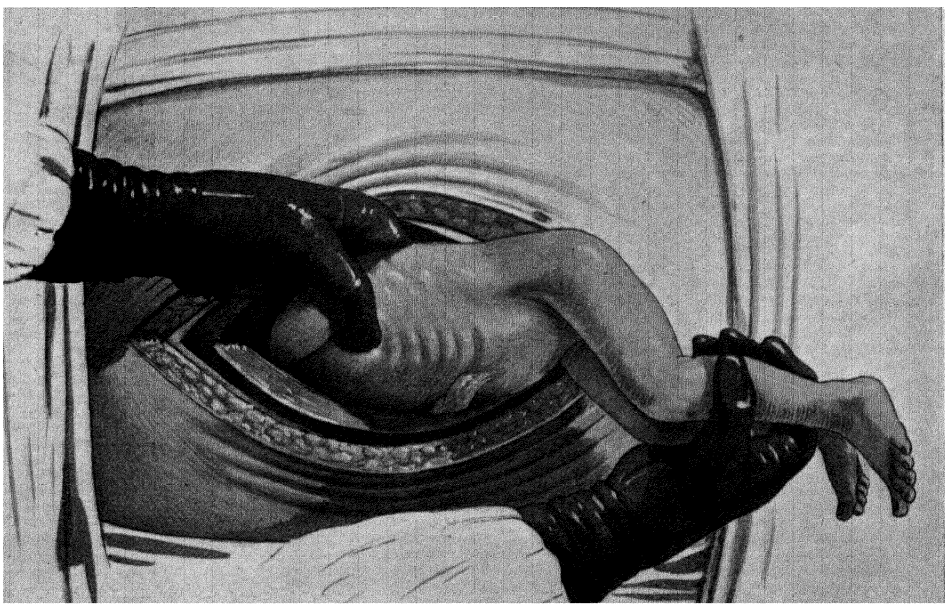


FIG. 269.—CÆSAREAN SECTION.
Delivering the child, which was presenting by the breech.

If the skin edges have been approximated with sutures these are removed on the seventh day; if Michel's clips have been used they can be taken out on the fifth day. The patient may be allowed out of bed on the seventeenth day.

The lochial discharge is less after Cæsarean section than after a normal labour.

Dangers of Cæsarean Section.—The danger of Cæsarean section is concerned almost entirely with the question of sepsis. If there is ample time to prepare the patient and her surroundings for the operation, and the latter is performed by one who is accustomed

to surgical work, the operation is a very safe one—2·9 per cent. in 1282 cases collected by Amand Routh. These cases included only those in which the membranes had not ruptured, or having recently ruptured, intra-uterine manipulations had not been employed, so that the uterine cavity was in each case presumably sterile. Directly the fingers, hand, or any instrument have been passed into the uterus this organ may be infected, the severity of the infection depending upon the state of the patient, thus, if she had any septic condition of the genital passages, or if these are bruised, torn or swollen, it is

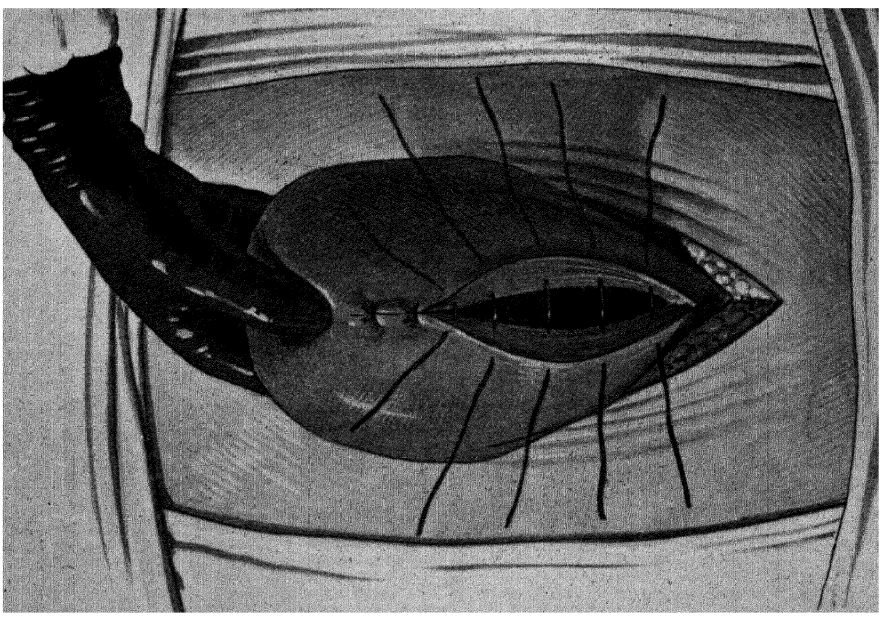


FIG. 270.—CÆSAREAN SECTION.

Uterus delivered through the parietal incision. First layer of sutures including the peritoneum and nearly the whole thickness of the muscle, but superficial to the decidua.

obvious that the risk of infection during the first few days following the operation is enormously increased. It has been calculated that the mortality of the operation upon patients in whom the membranes have been ruptured some time beforehand or upon whom repeated efforts at delivery have been made is as high as 17 per cent. The operator must use his judgment in such cases, but at times, in spite of the fact that infection of the uterus has already taken place, Cæsarean section may be the only procedure available for delivering the child. As a rule, if the Cæsarean section has to be performed on a patient with a uterus frankly septic, the operator will be wise

to remove the uterus as well—Cæsarean hysterectomy. The danger of hæmorrhage is not a very real one. That occurring from the cut surface of the uterus is always stopped when the sutures are tied. Very rarely the uterus will not contract and passes into a state of inertia, the bleeding from the placental site being so severe that hysterectomy is necessary to save the patient. Several cases have now been reported in which the scar in the uterus of a previous Cæsarean section has ruptured during labour, or even before labour, for no apparent reason. With such records, however, it is important

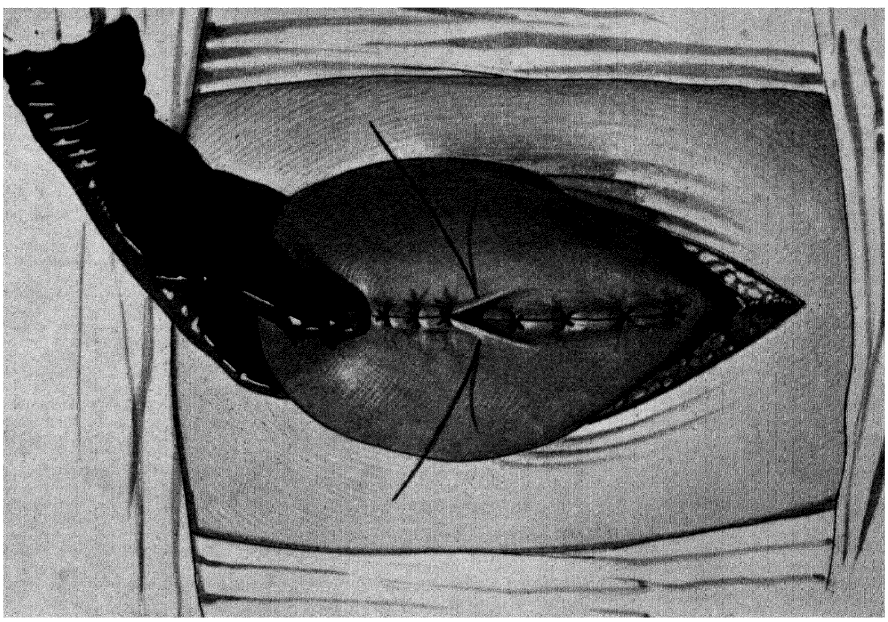


FIG. 271.—CÆSAREAN SECTION.

Second layer of sutures (Lembert's), including the peritoneum, but only a superficial layer of muscle. This layer of sutures protects the uterine incision.

that if a woman who has had Cæsarean section again becomes pregnant, she should be kept under observation just before and during her labour.

Should the Patient be Sterilized?—Apart from these cases of infection and hæmorrhage and cases of grave and permanent organic disease in the mother, the question of the justifiability of removing or mutilating healthy organs in a healthy woman, so as to make her incapable of bearing children for ever afterwards, is a very grave one for the conscientious operator. Take

only the extreme cases in which there is an absolute indication for Cæsarean section, as no question of rendering the patient sterile ought ever to arise under any other circumstances. Induction of labour, even at so early a period of pregnancy that the child has but a poor chance of survival, can always be done when there are only relative indications, and in the event of this not giving a living child, and the parents changing their minds and wishing another child, Cæsarean section can be done a second time. Cæsarean section can be repeated indefinitely—it has been done six times on the same woman—and the risk when performed under proper conditions is no greater than at the first operation. The practitioner may be urged by wife or husband, or both, to do some mutilating operation to prevent conception, and may feel that his duty is to carry out his patient's wishes. The medical profession has never recognized that patients have a right to give to its members such orders as to disconnect Fallopian tubes from the uterus, as they might order their plumber to disconnect the supply pipe to their bath. The Fallopian tube cannot be replaced like a bit of lead piping. Should the child die and the parents desire another, or should the mother become a widow and re-marry, and her second husband wish for a child of his own loins, she may return to her surgeon with the pathetic and hopeless demand to be put right again. Such things have happened, but the chance of their occurring weighs but slightly in deciding the balance against mutilation. The question is to be decided on higher ethical grounds, and the practitioner has a duty to the State as well as to his patient. If the woman fears to undergo another operation, it is the parents' business to avoid future pregnancies, not the practitioner's to make them impossible. If their measures fail and pregnancy results, abortion is at any rate a less immoral procedure than mutilation, for it involves the destruction of one pregnancy only, and not incapacity of child-bearing for the woman's lifetime.

The best procedure is for the operator not to open the question; if it is opened by the patient, let him put the future possibilities before her as strongly as he can, and, if she persists, then he should insist on his right to exercise his own judgment and refuse to take his orders as if he were a jobbing plumber. Each case must be decided on its merits, and the individual operator ought to be guided by his conscience and not by the demands of his patients. Many factors will influence him in individual cases—suitability of the home conditions for the operation or easy access of the patient to hospital, the number of times the patient has already been operated on. or the number of children alive, and so on. The point

is that the matter is not one on which much more can be said than that the operator should hesitate long and think well before doing what is an irrevocable injury to his patient, which can be justified only by very good reasons.

Method of Sterilization.

Mere ligature of the tube and even excision of a portion between ligatures have been proved occasionally to be ineffectual in the prevention of future pregnancies. To make certain of sterilizing a patient a permanent occlusion of the uterine end of the tube must be brought about either by excision of the cornu and suture of the cut surfaces or by division of the tube and burying the uterine end under the peritoneum of the broad ligament. In the hands of those accustomed to major pelvic operations, removal of the body of the uterus is almost as quick as suture of the uterine incision and has the further advantage of avoiding the risk of infection from the uterine cavity. Removal of the healthy ovaries as a method of sterilizing the patient is a brutal and unjustifiable procedure.

CÆSAREAN HYSTERECTOMY

Indications.—1. If the obstruction is due to a fibroid tumour of the uterus and myomectomy cannot be done.

2. If there is an operable carcinoma of the cervix present.

3. If the uterus is septic.

4. In the concealed variety of accidental hæmorrhage when the uterus will not retract.

5. If in any case the uterus will not contract and retract after the child is delivered, and a dangerous hæmorrhage is taking place from the placental site.

6. In all cases of true concealed accidental hæmorrhage.

7. In some cases if the uterus has been ruptured.

With regard to these indications it may be noted that the fibroid may sometimes be enucleated and the uterus saved; that the degrees of septicity must be considered, though a frankly septic case absolutely demands hysterectomy. It must also be remembered that hysterectomy in a patient whose life is already endangered by loss of blood is an extremely serious operation, for even though the hæmorrhage is stopped the added shock of the operation may be fatal to the chances of recovery.

Only the essential details of the operation will be given.

Preparation for the Operation.—This will be the same as is noted under "Cæsarean section".

Operation.—The whole of the uterus may be removed (total hysterectomy), or only the body (supra-vaginal hysterectomy).

The steps of the first part of the operation up to the delivery of the child are the same as already noted for Cæsarean section in both varieties of hysterectomy. The placenta and membranes should be left *in situ*. The further steps are as follow :—

Supra-vaginal Hysterectomy.—Pressure forceps are applied to the Fallopian tubes near their uterine origin, to the round ligament, and to the broad ligament internal to the ovary. The broad ligaments are then divided between the two forceps, and the round ligament is severed. The bladder is next reflected by dividing the peritoneum on the anterior surface of the uterus above the level of the internal os and pushing it down with a swab. The uterine vessels are now clamped close to the uterus as they pass on to it, after which the body of the uterus is amputated.

The ovarian and uterine vessels are then ligatured on each side, as well as the round ligament, and the forceps removed, after which any oozing points on the divided stump are secured with mattress sutures. The anterior flap of peritoneum is united with a continuous suture to the posterior flap of peritoneum formed by the peritoneum of the back of the broad ligaments and uterine stump. Lastly, the pelvic cavity having been cleaned of blood, the abdominal wall is closed in three layers as described under Cæsarean section.

Total Hysterectomy.—The steps of this operation are the same as for supra-vaginal hysterectomy up to the time the uterine vessels are clamped, except that in this case the bladder is reflected until the vaginal wall is exposed. The vagina is now opened by piercing it with a scalpel, after which the opening is enlarged, the incision being continued right round the cervix till the uterus is free. The clamped vessels are then ligatured as before, and the oozing which always takes place from the cut surfaces of the vaginal wall controlled by mattress sutures. The method of suture of the peritoneal flap and parietal wound is the same as described for supra-vaginal hysterectomy. If the uterus has been removed because it is septic, a large drainage tube should be inserted into the pouch of Douglas. The drainage tube should not be touched for forty-eight hours, after which it may probably be shortened, and if the patient is progressing normally it should be removed in a week. It may have to be left in longer.

VAGINAL CÆSAREAN SECTION

Indications.—This operation may be indicated when there is any urgent necessity to deliver the child before the seventh month of pregnancy it is a most satisfactory operation, and might with advantage be employed in cases in which the removal of the fœtus before the seventh month through an artificially dilated cervix necessitates a long and tedious operation. It is a much more difficult operation than abdominal Cæsarean section, and should not be attempted by anyone unless he is constantly operating, and, moreover, at least two efficient assistants will be necessary.

Preparations for the Operation.—The preparation necessary will be the same as that mentioned for Cæsarean section on p. 690, the vagina being well swabbed with tincture of iodine.

Operation.—With the patient in the lithotomy position, a weighted speculum is inserted into the vagina; the cervix is pulled down as far as possible with two pairs of forceps. An incision is made across the anterior vaginal wall and the bladder separated with the fingers and pushed up above the level of the internal os. With a pair of strong scissors the operator next divides the anterior wall of the cervix as far as the internal os. The two halves of the divided anterior cervical wall are now separated, the membranes punctured, and the child delivered by version of the forceps. It may at times be necessary to divide the posterior cervical wall in addition. The placenta and membranes having been removed, the divided cervix is united with interrupted sutures and the vaginal wall with a continuous suture.

CRANIOTOMY

Craniotomy is an operation devised to reduce the size of the head of the child when there is such disproportion between it and the genital canal that labour could not otherwise be terminated *per vias naturales*, or when for some reason it is necessary in the interests of the mother to deliver the child as quickly as possible by a method other than that of Cæsarean section. This operation is most frequently performed when the child is dead and there is any difficulty in delivery.

With the modern aseptic technique and the resulting safety of Cæsarean section, the operation of craniotomy is deservedly becoming rarer every day, since no practitioner has any right to kill a child when it can be delivered alive by Cæsarean section with as

much or more safety to the mother than by craniotomy. Nevertheless, there must always be a certain number of cases in which craniotomy will be the best treatment.

The Absolute Contra-indication for Craniotomy.—It is impossible to deliver the head of a child, no matter what method has been employed in crushing it, through a true conjugate diameter of less than 2 inches, and the transverse diameter must measure at least 3½ inches. As a matter of fact, however, craniotomy should never be attempted if the conjugate diameter is less than 2¼ inches, since it has been shown that the maternal mortality of such cases is over 38 per cent., and therefore much greater than Cæsarean section in practically any circumstances.

The Absolute Indications for Craniotomy.—1. When the child is dead, labour is delayed, and delivery by the forceps or version difficult.

2. When the child is dying, labour is delayed, and delivery by the forceps or version impracticable.

3. When Cæsarean section is contra-indicated because the genital tract is certainly or presumably infected or the conditions or surroundings render it specially dangerous.

4. In certain malpositions of the child, *e.g.* brow, other methods of delivery *per vias naturales* having failed.

5. Hydrocephalus.

6. Refusal to submit to Cæsarean section.

The first three indications require no further comment. If, before further assistance is sought, repeated attempts have been made to deliver the child with the forceps or version, it is almost certain that the genital tract will have been infected. Normally the uterus is sterile while the vagina and vulva are not; the passage of instruments or hands up the vagina into the uterus will, therefore, result in organisms being conveyed to the latter organ.

In a third or fourth vertex or first and second face presentation, if the occiput or chin respectively does not rotate forwards naturally, and the usual treatment (see pp. 329, 347) fails to effect this rotation, then, supposing the head is not born spontaneously as it may be, and delivery by the forceps has failed, craniotomy will be necessary.

In breech presentations, the after-coming head may require craniotomy if other methods for effecting its delivery have failed, In some cases of brow presentation the head has advanced too far into the pelvis to make version or conversion feasible, and. forceps-delivery failing, the head has to be delivered by craniotomy.

Finally, in certain cases of locked twins craniotomy may be

necessary (see p. 407). The delivery of a living hydrocephalic child is not worth any risk to the mother. It is not likely to live long, and if it does it will be mentally deficient.

The Relative Indications for Craniotomy.—When the birth of a child is prevented by a contracted pelvis or some abdominal or pelvic tumour, and there is sufficient room, delivery may be effected by craniotomy, but, as has already been pointed out, such treatment is absolutely incorrect and should only be persisted in if Cæsarean section is refused or the patient infected. Moreover, quite apart from the standpoint of the child, in certain of these cases, such as when an ovarian tumour or a fibroid of the uterus is causing the obstruction, the mother can be relieved of these tumours after the child has been delivered by Cæsarean section.

Preparation for the Operation.

The preparation for the operation is the same as that described on p. 662 for forceps-delivery.

Operation.—Delivery by craniotomy is always carried out in three stages, and rarely a fourth will be necessary.

1. Perforating the head of the child.
2. Crushing the head of the child.
3. Extracting the child.
4. Removing the vault of the head of the child.

Perforating the Head of the Child

Of the various instruments that have been devised to perforate the head of the child that of Oldham is the best (Fig. 272). The head can, if necessity demands, be perforated with a pair of sharp-pointed scissors.

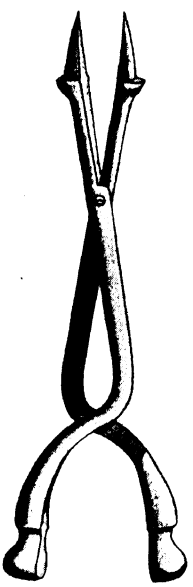


FIG. 272.

Oldham's perforator consists of two halves joined together by a screw. Each half has a cutting blade 1½ inches long, a shank 7 inches long, and a handle. Where the top of the shank passes into the blade it is broadened out, so as to form a shoulder.

It is better for the patient to be placed in the lithotomy position, and if the head is not fixed in the pelvis, the assistant should press down the child from the abdomen so that the head may remain steady.

The operator inserts his left hand into the vagina until the finger-tips impinge on the head. Grasping the perforator in the

manner shown in Fig. 273, he passes the instrument along the palmar surface of his left hand, and its point is guided to a portion of the scalp which covers a bone, great care being taken that the promontory of the sacrum is not mistaken for a portion of the cranium. To ensure that the point of the perforator is at right angles to the

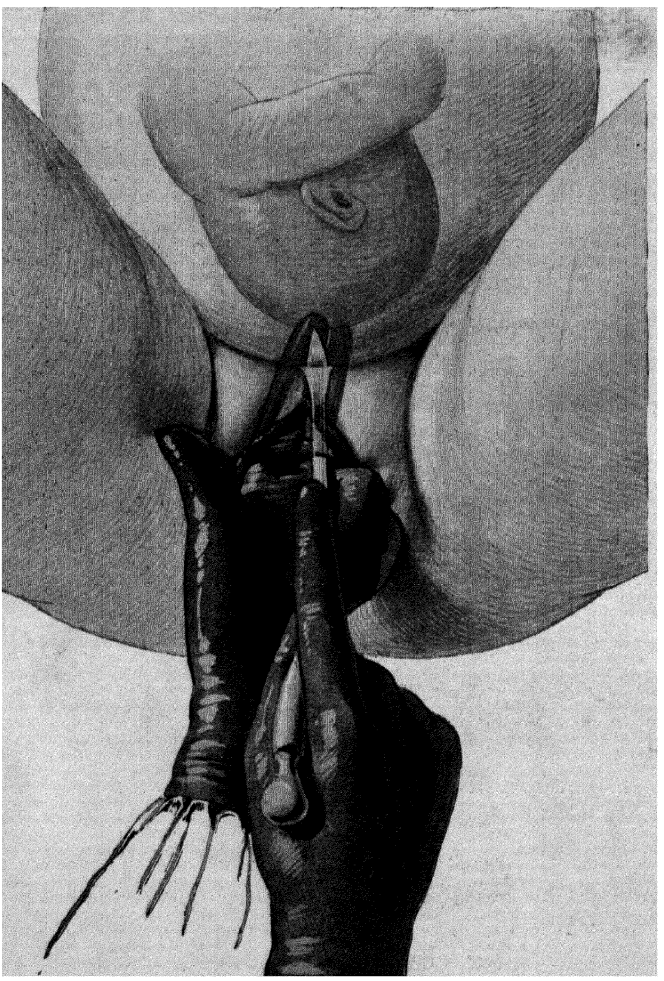


FIG. 273.—PERFORATION OF THE FŒTAL SKULL. STAGE 1.

Showing the perforator guided to the child's head by the index and middle fingers of the left hand of the operator. The head in the figure is not fixed and would be held at the brim by an assistant.

bone to be perforated, the instrument is next placed against the perineum, after which its point is made to perforate the bone by a rotating movement. If it is sought to perforate the bone by a sharp thrust, the instrument may slip off and seriously injure the soft parts of the mother. When the perforator has been forced into the

cranial cavity as far as its shoulder, the operator, by approximating its handles and so separating the points, lacerates the bone (Fig. 274). The handles are then separated, the instrument is withdrawn slightly, reinserted, and rotated a quarter of a circle, and by again approximating the handles a laceration is made in the bone at right angles to the first one. It is necessary for the bone to be perforated and

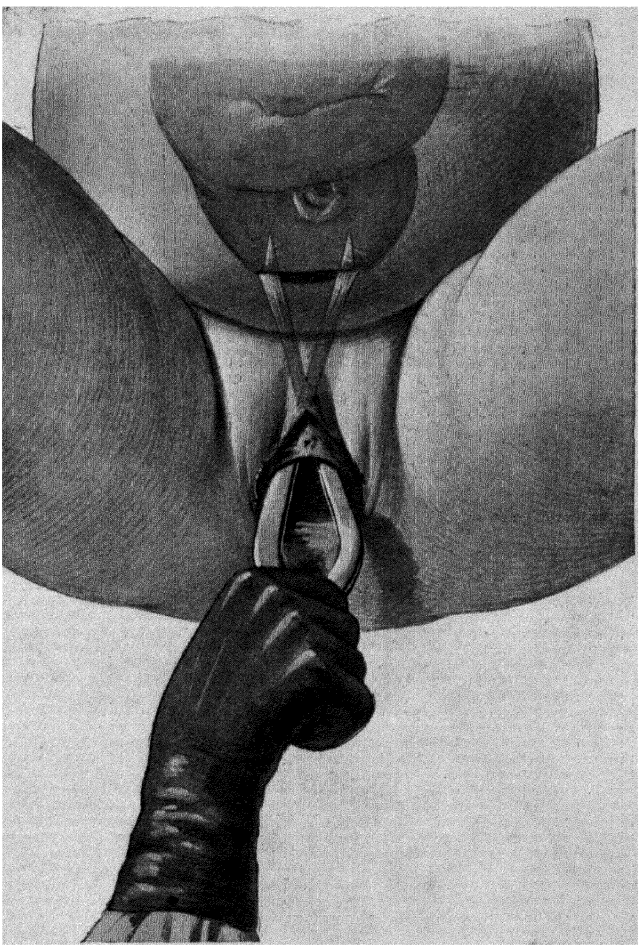


FIG. 274.—PERFORATION OF THE FŒTAL SKULL. STAGE 2.

Showing the perforation pushed in as far as the shoulders of the blades, the handles approximated and the parts of the blades separated.

not a fontanelle or suture, since in them the hole thus made would be too small to allow of the cranial contents being evacuated. The child is then destroyed by pushing the perforator into the brain and stirring up the medulla oblongata.

The object of perforation is to allow the head to collapse under pressure from the natural forces or by some instrument.

Crushing the Head of the Child

The head of the child is next crushed by instruments or by the genital canal of the mother during extraction.

Instrumental Crushing.—The head of the child may be crushed by the cephalotribe, cranioclast, the three-bladed cephalotribe, or the forceps.

Cephalotribe.—The cephalotribe, which is made entirely of steel, is a heavy instrument consisting of two halves and a crushing screw. Each half is divided into a solid blade smooth on the outer surface and serrated on the inner, 1 inch broad and 5½ inches long, a shank 4 inches longand a handle, at the lower part of which is a slot into which the crushing-screw fits. In some instruments the crushing-screw is attached to the handle of the lower or left blade by a swivel joint. When the handles are locked and approximated by the screw, the ends of the blades are in contact, and at their broadest part they measure 1½ inches. The blades have practically no cranial curves, but they are slightly curved on their edge to form a pelvic curve.

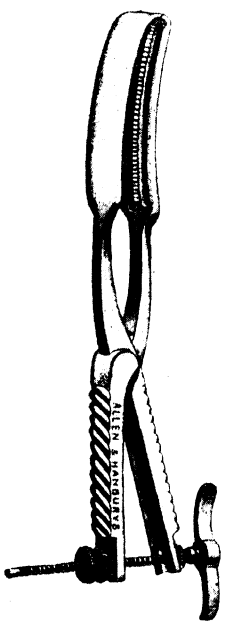


FIG. 275.

The cephalotribe is applied in a manner similar to that described for the forceps (see p. 665), the blades lying one on each side of the pelvis. In the case of a flat pelvis an assistant pushes down the head and fixes it. The blades must be fixed over the broadest part of the head of the child, otherwise as the screw is tightened they will slip either forwards or backwards. The handles being locked, the screw is turned and the blades thus gradually approximated, the operator from time to time examining them to ensure that they are not slipping, until at last the tips of the blades are in apposition (Fig. 276). As it is very important not to apply traction till such apposition has been effected, the operator must, before using the instrument, ascertain the distance between the ends of the handles when the ends of the blades are touching. During the crushing, brain will be expelled through the hole in the skull. The child is now ready for extraction; the method of accomplishing this with the cephalotribe will be described later (see p. 708). The best cephalotribe is that invented by Braxton Hicks (Fig. 275).

Cranioclast.—The cranioclast is a steel instrument consisting of a crushing-screw and two halves, the position of which will depend

upon whether the instrument is being used as an extractor, to remove the vault of the child, or to crush the base of the skull. Each half of the instrument consists of a blade, shank, and handle. The blades are 4 inches long, the shanks 6 inches long, and the handles at one end have the English lock and at the other

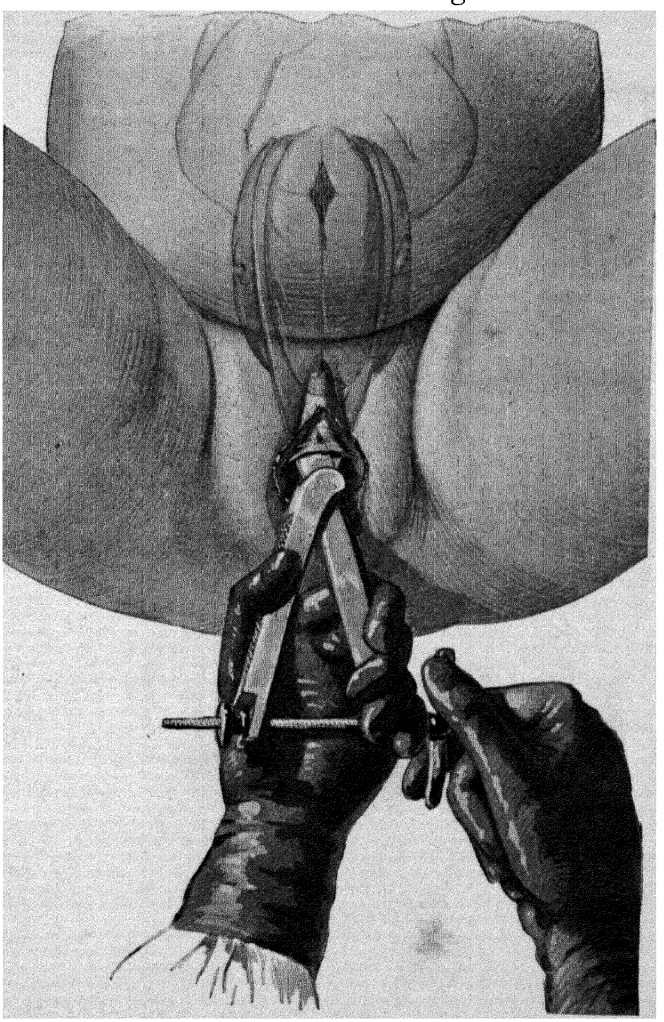


FIG. 276.—DELIVERING THE CHILD WITH THE CEPHALOTRIBE. STAGE 1.

Showing the blades applied to the head above the brim and the handles being approximated with the screw.

a slot cut to receive the screw handle. Both blades are curved in the manner shown in Fig. 277, and while one is fenestrated the other is solid, and when in apposition fits into its fellow. The outer surface is smooth and the inner serrated. The use of the cranioclast as a crusher is extremely rare, since it will only be necessary to use it in this way in cases of extreme contraction of the pelvis.

The method of crushing is as follows: The vault of the head of the child having been removed as described on p. 712, a face presentation is induced by manipulation. By this means the crushed diameter of the face (about 1½ inches) is brought into the smallest diameter of the brim, generally the conjugate, the bimastoid diameter of 3 inches then lying in the largest transverse diameter. A sharp hook having been fixed on to the chin to steady it, the hollow blade of the cranioclast is then passed under the chin of the child, and the solid blade is passed over the sella turcica, the handles are locked, and approximated with the screw, and the base

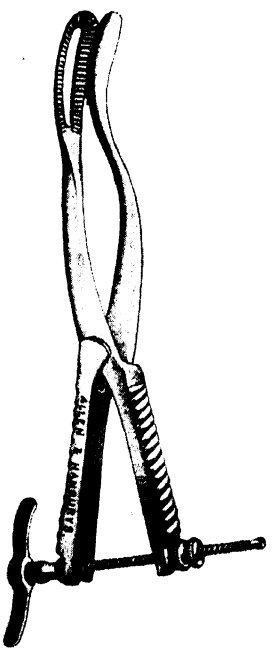


FIG. 277.

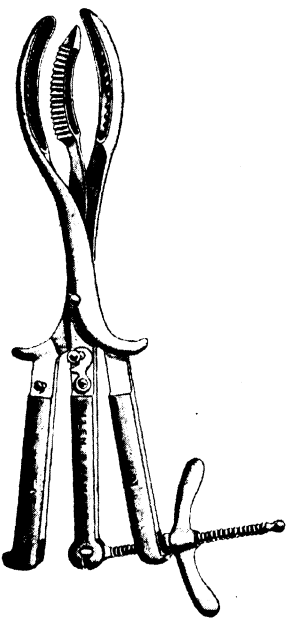


FIG. 278.

of the skull still further crushed preparatory to extraction. The best cranioclast is that devised by Roper.

The Three-bladed Cephalotribe

This instrument, which has been modified in small particulars, is a much lighter and more convenient instrument for crushing the fœtal skull than the heavy cumbersome instrument of Braxton Hicks. It is composed of three parts, one of which is furnished with a sharpened point serving as a perforator, and carries the pin of the French lock to which the other two blades are fitted. The other two blades have a small head curve and serve as the crushing blades. A screw and pinion are hinged to the central blade and can be made to operate upon each crushing blade in turn. Two slotted

metal strips are hinged to the handle of the central blade and serve to lock the crushing blades tightly when screwed up to the utmost. Then the blades are held firmly together when the crushing is complete. Finally the instrument is used as a tractor to deliver the head (Fig. 278).

The Forceps.—The head may be crushed, after perforation, by the obstetric forceps. This instrument is very unsuitable for the purpose, because of its great liability to slip off the head directly traction is applied, and its use is only called for when the practitioner, finding it necessary to deliver at once by craniotomy, has not any suitable instruments with him. The head of the child can then be perforated with scissors and afterwards extracted with the obstetric forceps.

Extracting the Child

The child may be extracted by instruments, by the hand and fingers, or it may be delivered spontaneously.

Instrumental Extraction.—The child may be extracted by the cephalotribe, the cranioclast, Auvard's three-bladed cephalotribe, the forceps, the crochet or the vertebral hook.

Cephalotribe.—The method of extracting with the cephalotribe varies according to whether the head of the child is above the brim or in the cavity of the pelvis. If the head of the child is above the brim the longest diameter when it is crushed will be at right angles to the transverse diameter of the pelvis, that is it will be lying parallel with the true conjugate, and as the operation has been performed because this is diminished it will be obviously impossible to deliver the head without rotating the longest diameter of the crushed head into the transverse diameter of the pelvis. This is accordingly done by rotating the cephalotribe through a quarter of a circle, after which the head can be guided through the brim and delivered. If the head of the child is already in the pelvic cavity there will be no need to rotate the cephalotribe, the head being delivered by gentle traction, care being taken to remove any sharp pieces of bone that are projecting, otherwise the soft parts of the mother may be seriously lacerated. The operator must keep one hand in the vagina while the head is being delivered (Fig. 279).

Cranioclast.—When the cranioclast is used as an extractor the fenestrated blade is passed outside the scalp and over that portion of the head of the child which is most convenient, the face if possible. If a parietal bone is gripped and pulled on by the cranioclast, it may be torn from the rest of the skull and lacerate the mother. Hence

the frontal or occipital bone should be chosen when possible. The solid blade is then passed through the perforation into the cranial cavity, so that the bone and scalp are between the blades The head being firmly gripped is then gently extracted, care being taken to ensure that there are no pieces of bone projecting, the sharp edges of which might tear the soft parts of the mother.

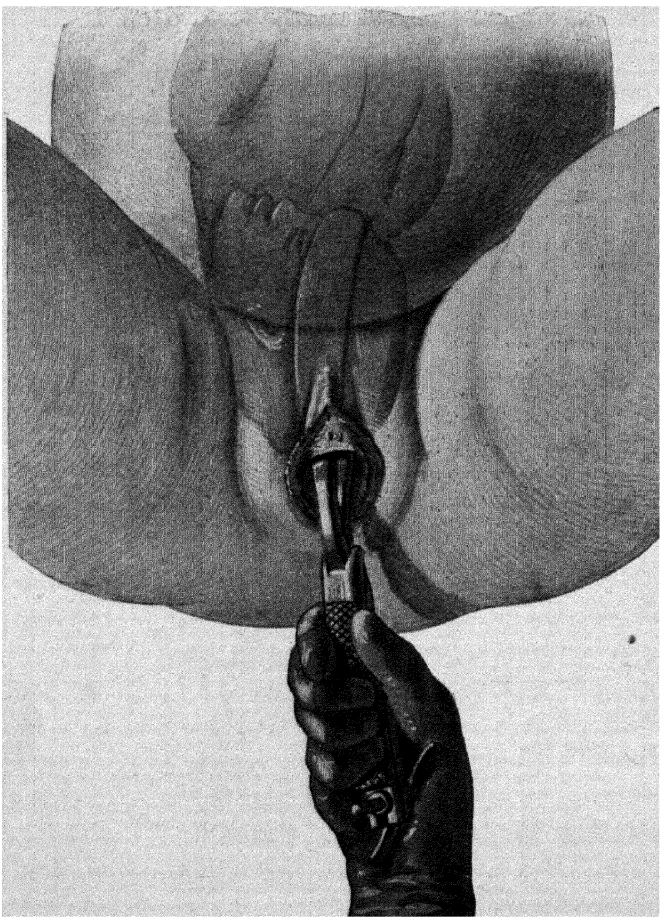


FIG. 279.—DELIVERING THE CHILD WITH THE CEPHALOTRIBE. STAGE 2.

Showing the blades approximated, and the longest diameter of the crushed head rotated into the transverse diameter of the brim, which is the longest diameter in a flattened pelvis.

Before the cranioclast was invented this method of extraction was carried out by an instrument known as the craniotomy forceps, which was similar in construction to the cranioclast, except that it had no screw handle, and therefore the handles had to be approximated as firmly as possible with the hand. As the cranioclast fulfils

the requirements of a craniotomy forceps better than this instrument, it has entirely taken the place of it (Fig. 280).

The Three-bladed Cephalotribe.—The three blades having been

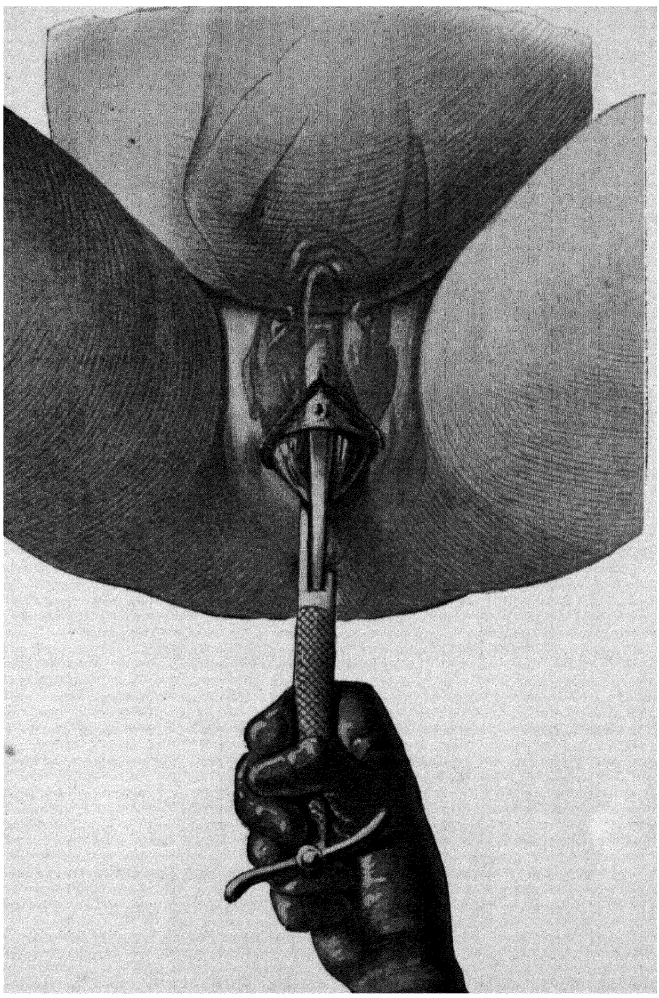


FIG. 280.—DELIVERY OF THE CHILD WITH THE CRANIOCLAST USED AS A CRANIOTOMY FORCEPS.

Showing one blade inside the fœtal skull and the other outside. The left hand of the operator would be inside the vagina to prevent laceration of its walls by sharp edges of bone.

securely fixed, the head is extracted with the same precaution as previously mentioned.

The Forceps.—The perforated head can be extracted with the forceps. The drawback connected with such a method of extraction has already been mentioned.

Crochet.—The crochet is an antiquated instrument and seldom used to extract the head. It is passed into the cranial cavity and its end fixed if possible against some portion of bone. The crochet can also be passed into the mouth of the child to extract it after the vault has been removed (Fig. 283).

Extraction by the Hand or Fingers.—Version. If the head is above the brim it may be delivered after perforation by version if there are no contra-indications, such as a marked contraction of the pelvis, to such a procedure. This method of extraction has been carried out with success in cases in which the practitioner, not having any suitable instruments, has perforated the head with a pair of scissors.

Fingers. The perforated head has on occasions been extracted with the fingers passed either through the perforation or into the mouth of the child; but only an easy case could thus be delivered, and the procedure is fraught with a certain amount of discomfort to the operator, since his fingers may be lacerated. As a method of extraction, therefore, it should obviously only be attempted when the practitioner has no instruments with him and no time to procure them.

Removing the Vault of the Head of the Child

This method of delivery is effected by the cranioclast, and is conducted as follows:—

The fenestrated blade is passed between the scalp and the bone, and the solid blade is passed into the cranial cavity. The blades are locked and then screwed up as tightly as possible. A portion of the vault is thus grasped between the two blades (Fig. 281). The operator now tears away this portion of the vault by twisting the instrument, and when the piece of bone is quite loose he gently extracts it, folding the fingers of his left hand, which he has passed up to the head for this purpose, over the separated piece of bone as it is gently extracted through the vagina by the cranioclast. The sharp edges of the separated bone will thus be prevented from lacerating the vagina (Fig. 282).

The instrument, after being taken to pieces to release the piece of bone, is again introduced and used as before, and this procedure is continued until the whole vault has been removed.

To extract the child it is now necessary to induce a face presentation by combined external and internal manipulation with the fingers and hand, after which the cranioclast can be applied to the face or the crochet or vertebral hook can be inserted into the mouth and the child extracted.

This method of delivery is rarely employed, and only when the diminution in the size of the pelvis is very marked and Cæsarean section is contra-indicated.

To sum up, the head having been perforated, the child can be delivered in one of the following ways:—

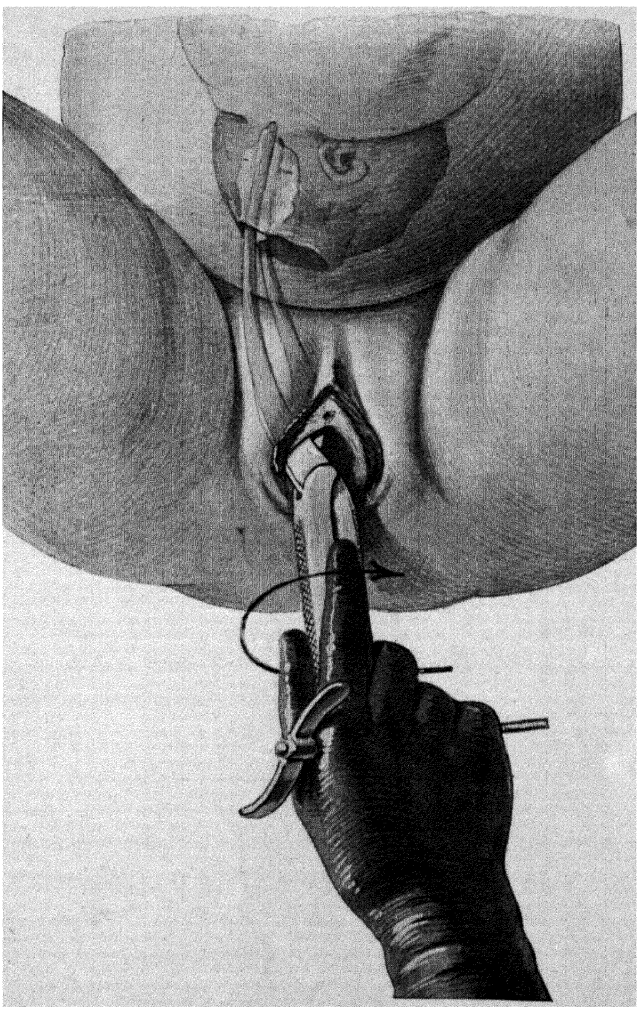


FIG. 281.—DELIVERING THE CHILD BY THE OPERATION OF CRANIOCLASM. STAGE 1.

Showing a piece of the parietal bone being grasped with one blade inside the fœtal skull and the other blade between the scalp and the skull. By twisting the cranioclast in the direction of the arrow the piece of bone is loosened. The left hand would protect the vaginal walls from laceration by fragments of bone.

With the cephalotribe by the operation known as cephalotripsy.
With the cranioclast used as a craniotomy forceps.
With the cranioclast by the operation known as cranioclasm.
With the three-bladed cephalotribe.

With the crochet.
By version.
With the fingers.
By the natural forces.
Whichever method of delivering the head of the child is employed

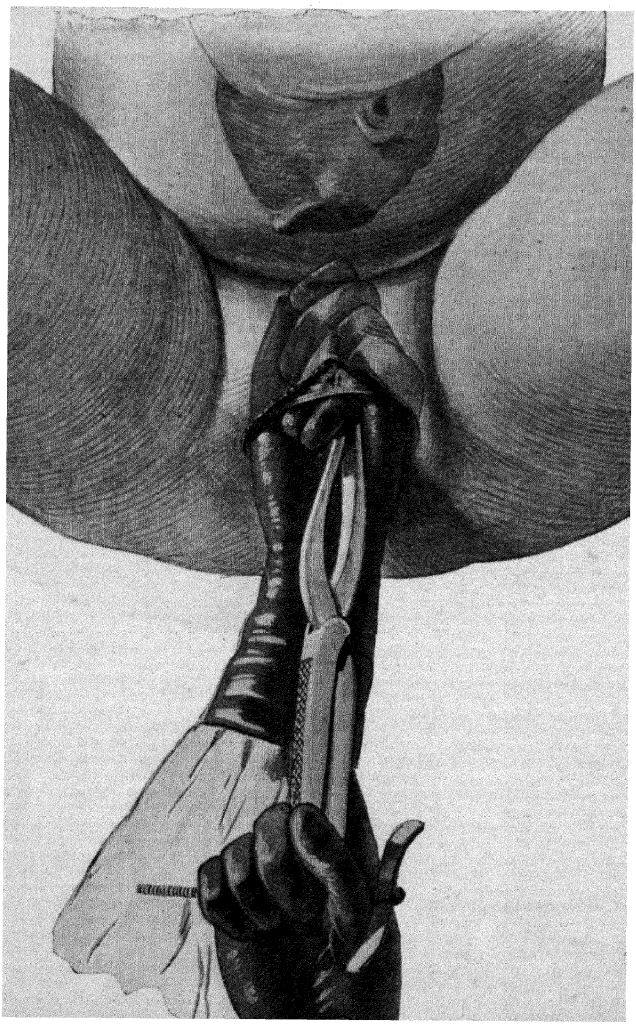


FIG. 282.—DELIVERING THE CHILD BY THE OPERATION OF CRANIOCLASM. STAGE 2.

Showing the piece of bone torn from the skull and being removed with the hand grasping it, so that the sharp edges of the bone shall not lacerate the vagina.

it occasionally happens, especially when the pelvis is markedly contracted or the child is beyond the normal size, that further difficulty is encountered with the body of the child. In this case the arms may be brought down and used as an additional means of traction, or the blunt hook may be passed under one or other

axilla of the child for the same purpose. The breadth of the shoulders may also be lessened by dividing the clavicles (cleidotomy) (see p. 719).

Choice of Methods.—In most cases it is best to use a cephalotribe or cranioclast. Since Cæsarean section is resorted to much more frequently nowadays, the opportunity of performing craniotomy is becoming less and less frequent. In only very exceptional cases will either of these instruments be particularly indicated, and it is best therefore to accustom oneself to the use of one of them and always use it.



Fig. 283.—Crochet and Blunt Hook.

Perforation in Face Presentation or of the After-coming Head.—If it is necessary to perform craniotomy and the face is presenting, the perforator should be pushed into the cranial cavity through the orbit, care being taken to push towards the mid-line.

If it is necessary to perforate the after-coming head the perforator should be pushed into the cranial cavity through the occipital bone or through the floor and roof of the mouth, the legs of the child being pulled forwards or backwards as the case may be; the head will thereby be fixed, and the body being held out of the way the perforator can more easily be introduced. After the head has been perforated it can be delivered very easily by traction on the legs. In rare cases it may be necessary to use the cranioclast or cephalotribe to effect extraction.

DECAPITATION

The operation of decapitation consists in severing the neck of the child whilst still *in utero*.

Indications.

1. In neglected shoulder presentations.

2. In certain cases of locked twins when one child is lying transversely and the other longitudinally, or when both are vertical, but the body of one has been born and its after-coming head is obstructed by that of the child still *in utero*.

3. Very rarely in certain cases of double monsters when the heads are locked.

It is not necessary to discuss further the above indications except to remark that in the case of locked twins where one is transverse and the other longitudinal Cæsarean section might be a preferable procedure.

It is very important for the student to remember that the forecoming head must never be decapitated.

Preparation.—The preparation for the operation is the same as that described on p. 662 for delivery by the forceps. The patient should be in the lithotomy position.

Operation.—The neck of the child should be fixed by pulling on an arm, which should be brought down for that purpose if not already prolapsed. The operator passes his left hand into the vagina so that the palmar surface is in contact with the neck and shoulder of the child, and the dorsal surface is in contact with the anterior wall of the pelvis if it is lying in the first or second transverse positions. The decapitating hook is next passed with its point backwards, along the palmar surface of the hand and fingers till the neck of the child is reached, and by rotating the instrument it is guided *over* the neck of the child. The fingers are then passed to the front of the neck in order to ensure that the point of the instrument is free and not digging into the chest. The neck

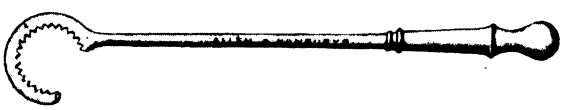


FIG. 284.

of the child is next divided by a rocking movement of the instrument, the handle being kept well back and the operator pulling strongly all the time, keeping his fingers on the point. After the neck of the child is divided the body is easily delivered by pulling on the prolapsed arm. The decapitated head is finally delivered spontaneously, or failing this by the forceps or by the fingers, or the crochet inserted in the mouth. As a rule it is quite easy to convert the head into a face presentation by putting the finger in the mouth and then to deliver it. If the pelvis is contracted great difficulty may be experienced in delivering the head, in which case it may be necessary to use the cephalotribe or cranioclast. The best decapitating hook is Ramsbotham's (Figs. 284, 285).

Difficulties and Dangers.—If care is not taken to ensure that the point of the instrument is free, the operator, instead of cutting in a direction transverse to the neck, may cut into the shoulders in a slanting direction, and thus fail in his object. The point of the instrument, unless guided by the fingers of the left hand of the operator, may injure the soft parts of the mother. The lower segment of the uterus may be wounded if the greatest care is not taken.

If the pelvis is much contracted or the uterus over-retracted, it may be necessary to eviscerate the child or even cut through its back (spondylotomy) before the neck can be reached.

Decapitation is a very dangerous operation.

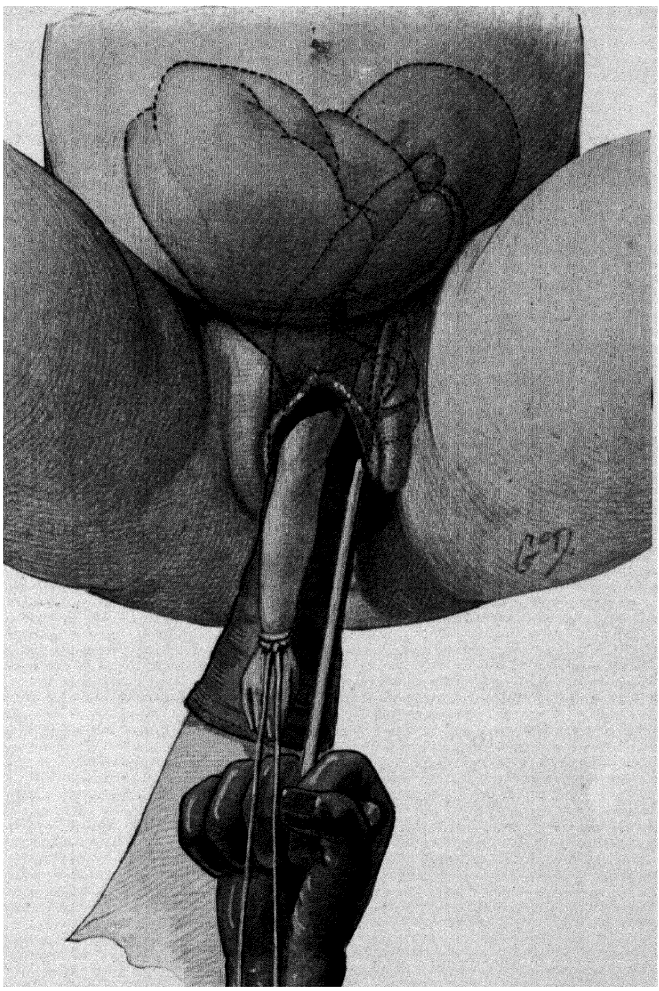


FIG. 285.—DECAPITATION.

Note that the point of the hook is directed away from the bladder.

Other Methods of Decapitation.—If the practitioner decides that immediate decapitation is imperative and has not got a decapitating hook with him, the neck can be divided with a strong pair of scissors; in fact, this is a preferable method in cases of double monsters or locked twins with the body of one child already born. The neck of the child can also be sawn through with a piece of

whipcord, or better, strong wire passed over the neck, each end being fixed to a piece of wood. As the wire or cord is likely to damage the genital canal when this is being done, it is best, after it is in position, to pass the ends through a Fergusson's speculum before they are fixed to the pieces of wood. The speculum can then be inserted into the vagina and the danger of injury thus obviated.

EVISCERATION

Indications.—1. Impacted shoulder presentation when decapitation cannot be performed.

2. Increased size of the thorax or abdomen (fluid, tumours) preventing the birth of the child.

The operation is conducted as follows:—

Preparation.—The preparation is the same as that described for forceps-delivery on p. 662.

Operation.—The body of the child being fixed by traction on a prolapsed arm or by pressure from above, the operator passes his left hand into the vagina till his fingers reach the abdomen or thorax as the case may be. A sharp-pointed pair of scissors is then passed with the right hand along the palmar surface of the left hand and the abdomen or thorax opened (Fig. 286). The viscera are removed with the left hand, and the rest of the child delivered by traction. The uterus is lastly douched with an antiseptic solution.

SPONDYLOTOMY

Indications.—This operation, which consists in cutting the body of the child in half, is indicated when the neck cannot be reached for decapitation, or when the body cannot be delivered after evisceration.

Preparation.—The preparation is the same as that described for delivery by forceps on p. 662.

Operation.—The operator passes his left hand into the vagina and feels for the most prominent part of the vertebral column. He then guides a strong pair of scissors along the palmar surface of his left hand until their points impinge on the body of the child, when it is divided, the vertebral column and the tissues covering it being cut through first (Fig. 287).

After the body has been cut through, the upper half is delivered by traction on the arm and the lower half by traction on the leg.

CLEIDOTOMY

Indication.—The birth of the shoulders is sometimes delayed owing to their abnormal size. Other methods of delivery having failed (see p. 317), it may be necessary to divide the clavicles.

Preparation.—It may have been necessary to deliver the head



FIG. 286.—EVISCERATION OF THE CHILD IN A TRANSVERSE PRESENTATION.

by some operation, and it is only then found that the clavicles will have to be divided. In this case the preparation will have been the same as that already noted on p. 662. If labour has progressed normally till the birth of the head, no special preparation will have been employed beyond that necessary to all labours (see p. 310), in which case the vulva should be swabbed with tincture of iodine.

Operation.—The operator places the finger of his left hand on the clavicle of the child, and using this as a guide he divides the clavicle with a strong pair of scissors. The body is afterwards delivered by traction on the head or feet (Fig. 288).

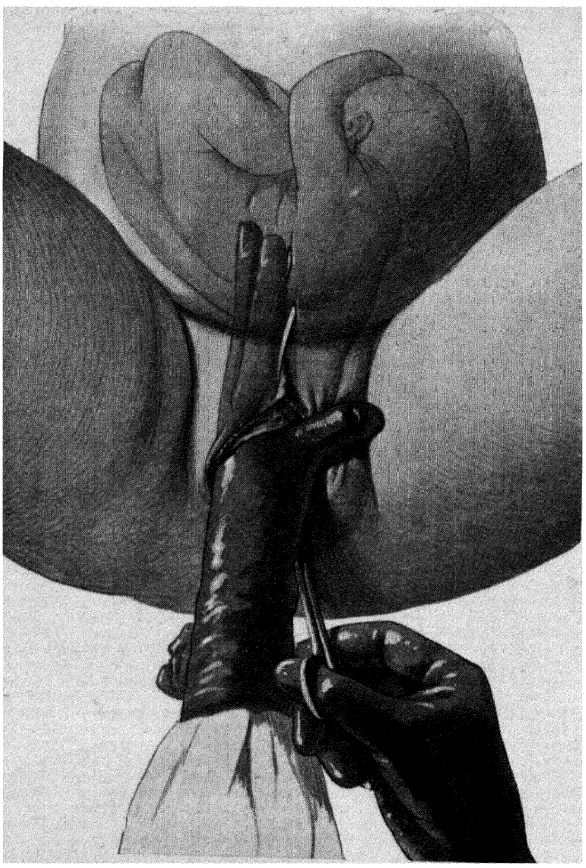


FIG. 287.—SPONDYLOTOMY.

CUTTING OFF THE LEGS OF THE CHILD

In certain cases of impacted breech when great difficulty is experienced or it is impossible to bring down the legs of the child, they may be amputated through the thighs by Ramsbotham's hook.

SYMPHYSIOTOMY

This operation consists in enlarging the true conjugate of the pelvis half an inch by dividing the symphysis pubis.

Indications.—When the head is presenting, is delayed, and the delivery of a living child can be practically ensured by enlarging the

conjugate diameter half an inch. Its performance, therefore, is limited to pelves with a true conjugate of 3 inches or over. In most of the cases reported the true conjugate has been over $3\frac{1}{4}$ inches.

Contra-indications.—A primigravida.
If the child is dead.

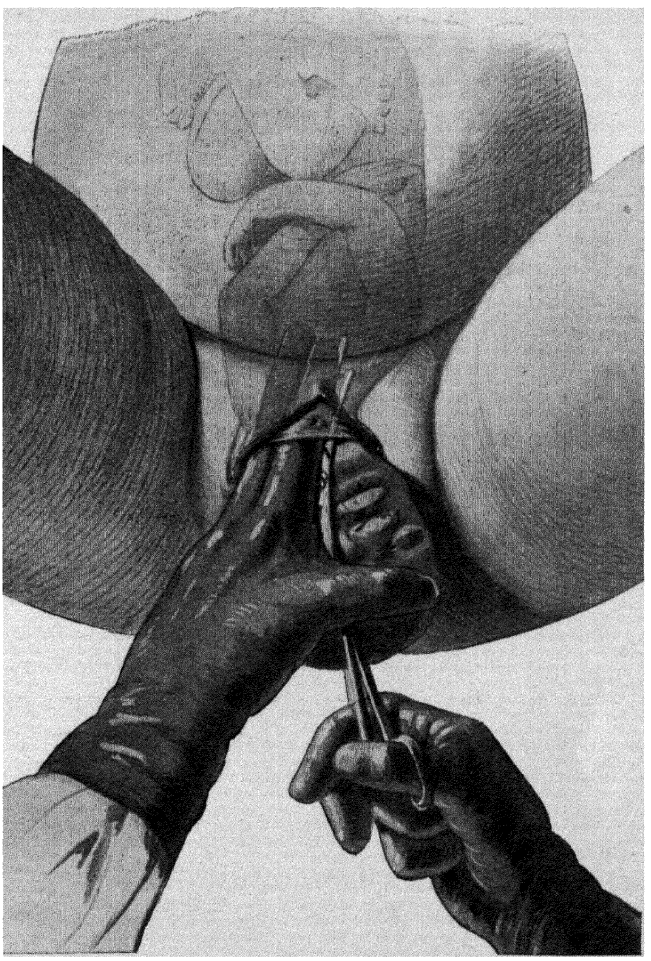


FIG. 288.—CLEIDOTOMY.

Showing the clavicle being divided.

If the cervix is less than three-quarters dilated.
If there is any reason to suppose that the patient is infected.
If repeated attempts at forceps-delivery have been made.

Method.—After the patient has been suitably prepared and anæsthetized, the joint is divided from above downwards with a blunt-pointed bistoury, which is inserted through an incision pre-

viously made with a scalpel between the clitoris and the meatus urinarius.

The index finger of the left hand is kept in the vagina to control the point of the bistoury. After the joint and the sub-pubic ligament are divided the head is delivered with the forceps, an assistant on each side pressing the hips together to prevent too wide a separation of the sacro-iliac joints. This is known as the subcutaneous method and is the best. The joint may be divided by the open method, in which case the tissues in front of the symphysis pubis are divided down to the bone. The clitoris is pushed downwards, the suspensory ligament divided, and the index finger of the left hand is pushed behind the symphysis between the bladder and bone. The joint is then divided from above downwards with a knife. After delivery the incision is closed with a few stitches; the pelvis is tightly bandaged with a roller bandage.

Dangers.—Hæmorrhage, which stops as soon as the child is born. Injury to the bladder and urethra. Too forcible separation of the sacro-iliac joints, in which case the patient may have difficulty in walking, or even be unable to walk. Infection of the operation area.

PUBIOTOMY

This operation consists in dividing the pubic bone about half an inch external to the joint on one side or the other. It is considered by some to be a better operation than symphysiotomy, as by it the pelvis is permanently enlarged and there is not so much danger of wounding the urethra. It is a more difficult operation and requires special instruments.

Indications and Contra-indications.—Similar to those already mentioned for symphysiotomy.

Method.—By the subcutaneous method a pubiotomy needle is pushed behind the body of the pubic bone about half an inch from the middle line and made to emerge through the skin just internal to the pubic spine.

A Gigli saw is then attached to the needle, which is withdrawn, leaving the saw in position. The bone is next divided with the saw, and the child delivered as in symphysiotomy.

By the open method an incision is made down to the bone internal to the pubic spine. The index finger of the left hand is pushed between the bladder and the bone. With this finger as

a guide Bumm's needle is passed, the Gigli saw attached, and the bone divided as before.

Dangers.—The same as those described for symphysiotomy, and more particularly the veins lying in front of the bladder may be injured.

Prognosis

According to the published results, the maternal as well as the fœtal mortality is considerably higher than that of Cæsarean section.

CHAPTER LIV

THE ARTIFICIAL TERMINATION OF PREGNANCY

PREGNANCY may be terminated artificially—

1. Before the child is viable, induction of abortion.
2. When the child is viable, induction of labour.

INDUCTION OF ABORTION

Indications.—Abortion is generally induced for some disease peculiar to pregnancy, such as hæmorrhage due to separation of the ovum, in part or whole, moles, or some toxæmia of pregnancy.

More rarely the uterus is emptied on account of some disease which has no relation to the pregnancy, but which is rapidly becoming worse and jeopardizing the woman's life because of the extra call on the mother owing to the presence of a living ovum within her uterus. Among such diseases may be mentioned cardiac, pulmonary or renal disease, diabetes, chorea, recurrent insanity, Graves's disease, pyelo-nephritis, and the severe anæmias.

Lastly, abortion has been induced for a deformity of the pelvis of such a character that the delivery of a living and viable child, except by Cæsarean section, is impossible. Any woman is, of course, quite within her right to refuse Cæsarean section. Delivery by craniotomy is a very difficult and dangerous operation if the true conjugate is under 3 inches. In such circumstances, therefore, a doctor is justified in inducing abortion, although, if he objects to sacrifice the life of the child in this way, it is open to him to ask the patient to seek advice elsewhere.

This opens up the question of certain ethical problems regarding this operation which concern the medical profession, and are therefore worth brief consideration. Unless performed by a registered medical practitioner and on absolutely justifiable grounds, induction of abortion is an "illegal" operation. Destruction of fœtal life is so detrimental to the welfare of the State that it merits punishment

only short of that meted out to murder, and it is on the strict understanding that operations of this kind are confined to cases in which the life of the mother will be endangered or her health permanently damaged by the continuance of the pregnancy, that their performance is sanctioned. As the immediate or prospective danger to the mother cannot be accurately estimated and must always be a matter of individual opinion, many cases will occur in which a correct judgment is difficult. Careful observation and a full and conscientious consideration of each case before coming to a decision is incumbent on every medical practitioner, and if there is any possible doubt as to the justifiability a second opinion should be obtained, if possible from some one of special experience. Some such warning is the more necessary, since with the increasing safety of all operative procedures under modern conditions there is a distinct tendency to have recourse to this, as to other operations, on grounds of expediency rather than of absolute necessity. Moreover, the pressure on the practitioner often becomes so strong that he may be persuaded against his better judgment and before he is fully convinced that all other measures have failed. No better instance can be quoted than a troublesome case of severe vomiting of pregnancy. The patient is nervous, irritable, and out of control. She maintains that she vomits everything she takes; that she is sinking from the constant retching and sickness, and that she cannot continue with her pregnancy. Her urine shows no abnormality, her pulse-rate is scarcely raised, her tongue is moist and clean, and there is no evidence of great loss of flesh. Her friends are convinced that the pregnancy must be ended or she will die, and, by frequent calls, the medical attendant is worried by day and by night. He knows that if the patient is isolated from her friends, properly nursed and kept under control, a few days will see her cured, but the difficulty is to persuade the patient and her friends to agree to this, when they know that an operation will rid her of her troubles and her pregnancy. But every member of the medical profession must recognize and act up to the responsibility and trust placed in him by the State. No social questions, no pressure from husbands relatives, or friends, no objections of the patient to continuing with the discomforts and troubles of her pregnancy, must be allowed to weigh in the decision. The question is to be settled purely on medical grounds, and every effort must be made to check the patient's story by observation, for she will exaggerate every symptom, and produce new ones if the old ones fail to give the looked-for result.

Many other ethical problems regarding the relative value of the fœtal and maternal interests frequently arise. It is well known that women with permanent valvular disease and a very poor expectation

of life may bear strong and perfectly healthy children. As term is approached there is no doubt that the child's is the more valuable life, and the question arises as to whether this fact should be allowed to weigh in deciding to sanction a continuation of the pregnancy which may prove the last straw in breaking down a failing heart. While every case must be decided on its merits, the doctrine is generally accepted that the mother's life should never be sacrificed for her unborn child, and even in the cases in which that life is hopelessly crippled by chronic valvular disease its sacrifice is not to be asked for.

Some practitioners are very ready to forbid a woman to have any more children because something went wrong during pregnancy or labour, and to recommend induction by abortion, even repeatedly, if pregnancy occurs. In many instances the grounds for this advice are manifestly absurd and inadequate, for instance patients have been forbidden to have any more children because in their first labour the perineum was badly torn, because there was a placenta prævia, because there was postpartum hæmorrhage, and so on. In other cases there is more, though not much, to be said for the grounds on which the advice is given, namely, slight contraction of the pelvis, poor physique of the patient, the occurrence of tubal pregnancy, chorea in pregnancy, etc. Such advice must never be lightly given, as it may endanger the happiness of both husband and wife, and is likely to render the wife neurasthenic. The colloquial phrase that the "maternal instinct is driven inwards" contains a good deal of truth. It is the practitioner's duty to do all in his power to counteract the modern tendency to curtail families, for the sake of the State as well as for the sake of the woman's bodily and mental health.

There are a few conditions on account of which child-bearing should be forbidden, among which insanity, epilepsy, chronic nephritis, and tuberculosis take foremost place, from the point of view of the State and of the patient's subsequent health. The presence of advanced morbus cordis is another reason for advising against further child-bearing. Toxæmia of pregnancy cannot be considered as an entity in this connection. If it has been manifested as eclampsia and the patient has made a complete recovery, there is no reason why she should not bear further children, as the risk of recurring eclampsia is extremely small. Pernicious vomiting, a rare occurrence in Great Britain, may be, however, considered to be sufficient grounds for advising against further pregnancy, if it has recurred in several successive pregnancies.

Cases of insanity cannot be considered as a whole in this respect.

There are many of them in which advice must be given unhesitatingly against further pregnancy, but there are some cases in which, though a short period of insanity followed the first labour, after a lapse of several years with no trace of mental disorder, the advice of an alienist should be obtained.

Many patients who have had a tubal pregnancy are advised never to become pregnant again. There is a distinct risk of recurrence of tubal pregnancy, said to be 5 per cent., but patients should be advised to take this risk, the chances being 19 to 1 in their favour, on the

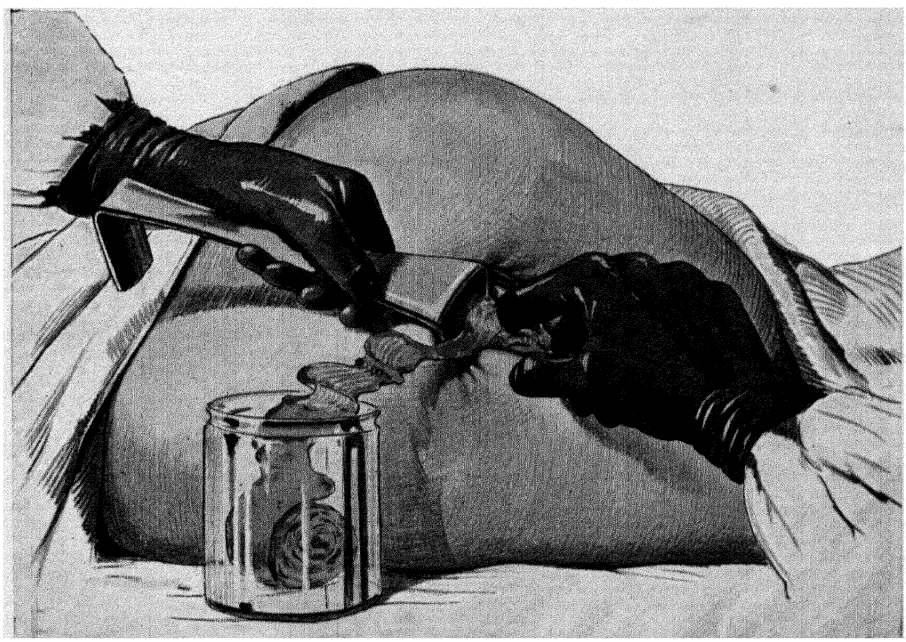


FIG. 289.—PLUGGING THE VAGINA.

understanding that they will seek advice as soon as they have reason to suspect that they have become pregnant again. The risk to life of tubal gestation under modern operative conditions, should the odd twentieth chance be against them, is so small with the patient under observation, that there need be no hesitation in taking it.

Women belonging to hæmophilic families are not likely to suffer from dangerous postpartum hæmorrhage, and therefore such tendency is no just ground for advising against pregnancy.

Methods.—Abortion may be induced by

1. Insertion of tents.
2. Rupturing the membranes.

3. Plugging the vagina.
4. Dilating the cervix.

And if the pregnancy has advanced to twenty weeks, by

5. Insertion of bougies.
6. Insertion of a small de Ribes's bag.

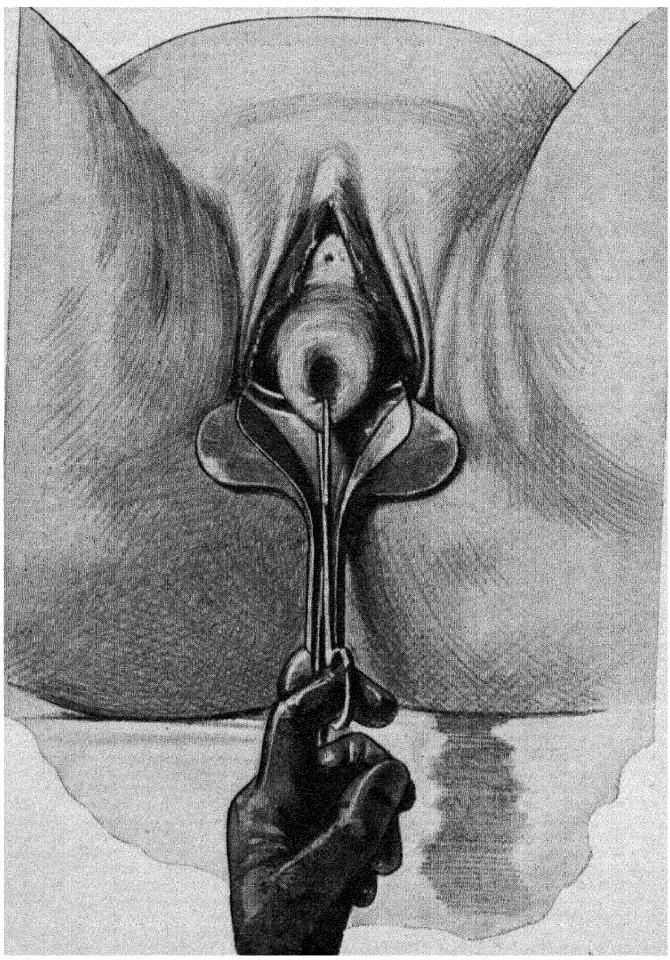


FIG. 290.—PATIENT IN LITHOTOMY POSITION, SHAVED, WEIGHTED SPECULUM IN VAGINA, AND CERVIX PULLED DOWN WITH A VULSELLUM.

Tents.—Sterile laminaria tents 4 inches in length should be used, and before being inserted they should be kept in absolute alcohol for a week or more, and the cervix and vagina should be well swabbed with iodine.

Rupturing the Membranes.—Before the membranes are ruptured, the vulva and vagina must be made as aseptic as possible by

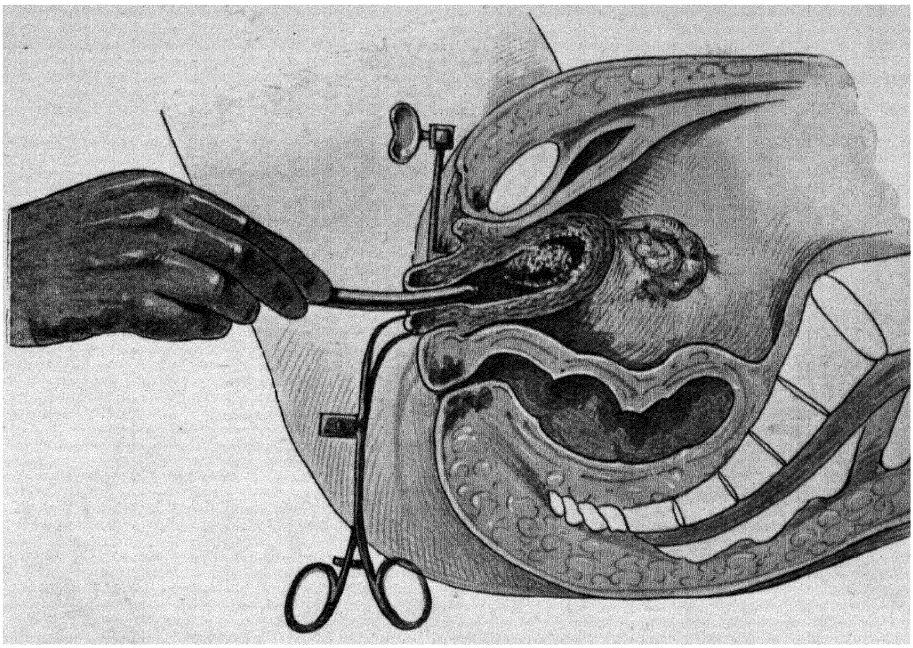


FIG. 291.—DILATATION OF THE CERVIX WITH METAL DILATOR.

This drawing shows an alternative form of vulsellum and speculum.

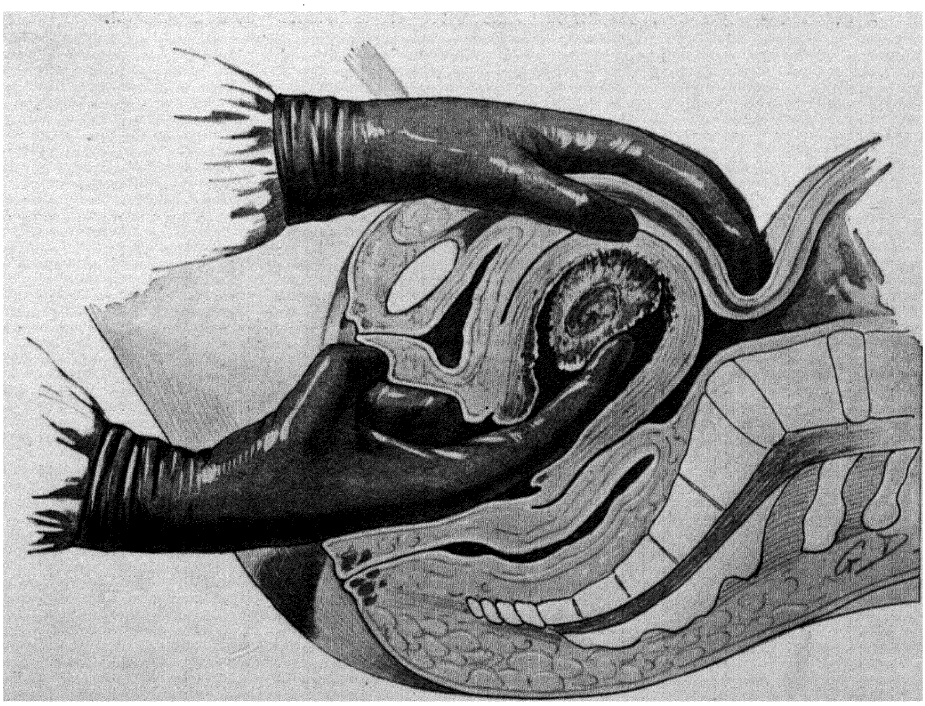


FIG. 292.—INSERTION OF THE INDEX FINGER OF THE RIGHT HAND INTO THE UTERUS AND DETACHMENT OF THE OVUM FROM THE FUNDUS.

The left hand presses the uterus down and steadies it.

swabbing with iodine. After the membranes are ruptured drachm doses of the liquid extract of ergot may be given every few hours if necessary.

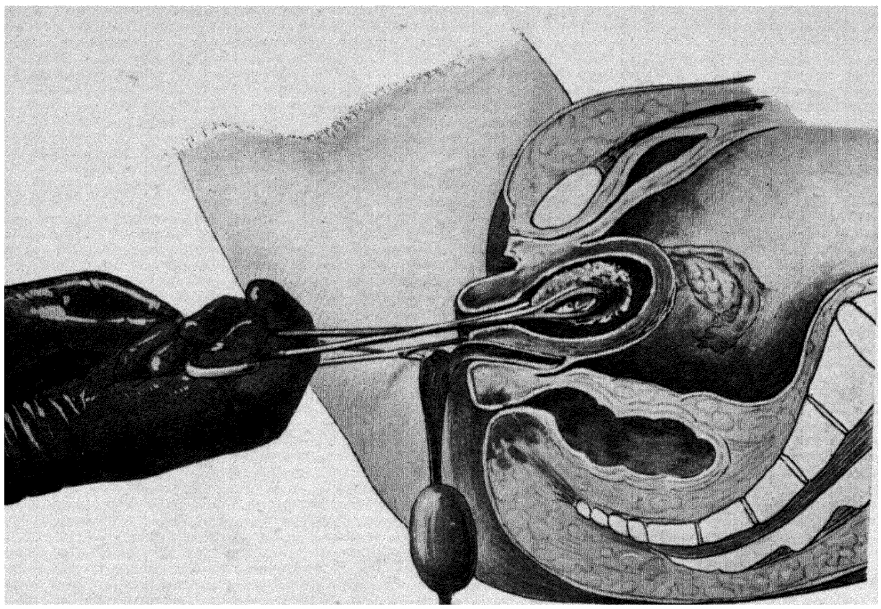


FIG. 293.—REMOVAL OF THE DETACHED OVUM WITH OVUM FORCEPS.

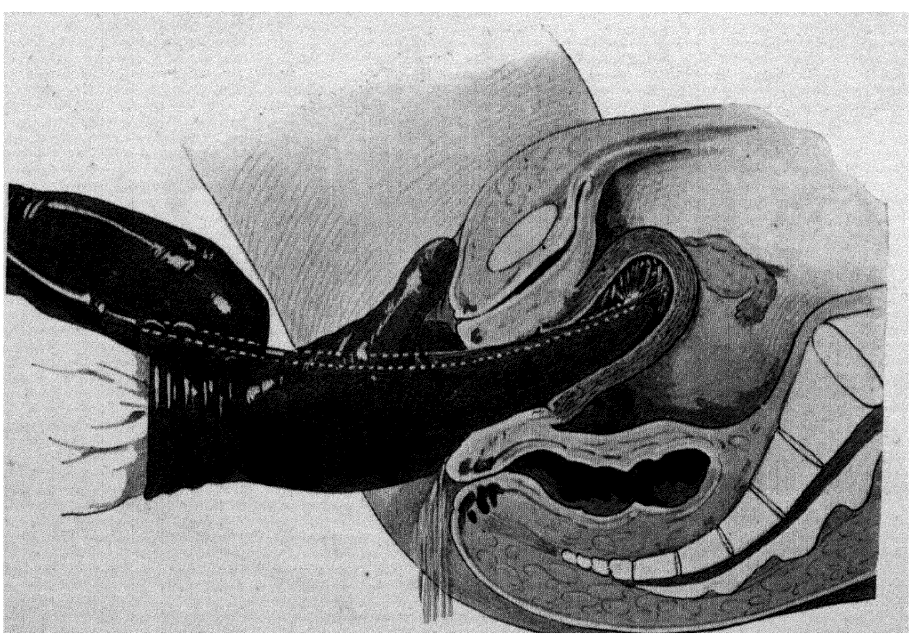


FIG. 294.—DOUCHING THE CAVITY OF THE UTERUS AFTER IT HAS BEEN EMPTIED.

A better method is to pass the nozzle of the douche after the ovum has been extracted and before the speculum and vulsellum have been removed.

The membranes should be ruptured with a sterilized uterine sound, a Sims's speculum being used to expose the cervix.

Plugging the Vagina.—This method is generally used for severe hæmorrhage, the membranes being ruptured before the plugging is inserted. The vulva and vagina should be swabbed with tincture of iodine, and the bladder must be emptied, since the pressure of the plug on the anterior vaginal wall will hinder micturition, and the plug must be kept in some time. The plugging, which is best composed of sterilized gauze, should be inserted through a Sims's speculum, after which a T-bandage and binder

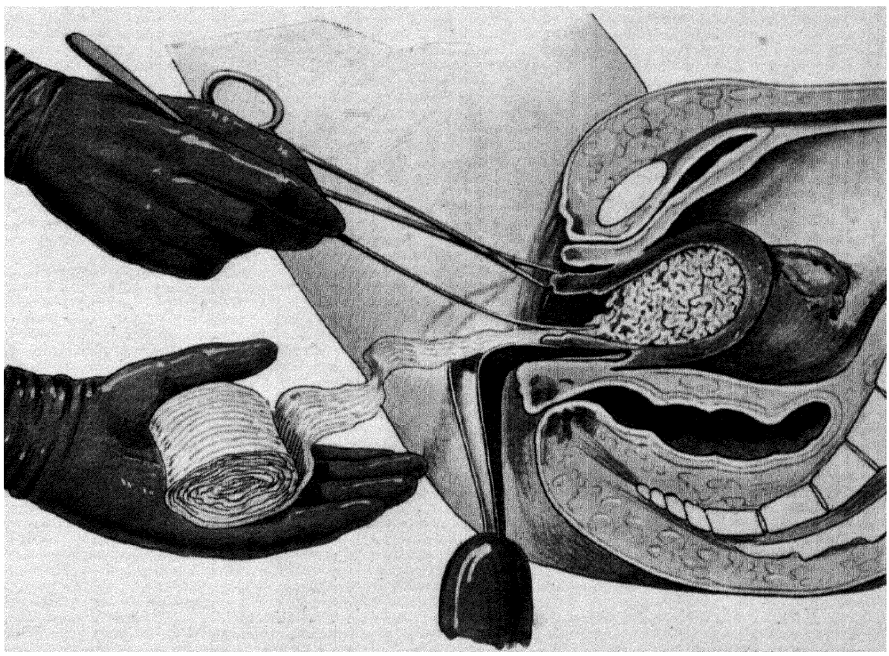


FIG. 295.—PACKING THE CAVITY OF THE UTERUS WITH STERILE GAUZE.

are applied. The plug must not be left in longer than 12 hours; after its removal the vagina must be well douched (Fig. 289).

Dilating the Cervix.—It is rarely necessary to empty the uterus rapidly, but if so this is the best method.

Operation.—The bladder and rectum having been emptied and the vulva shaved, the patient is anæsthetized and placed in the lithotomy position. The vagina is then soaked with tincture of iodine, after which a weighted speculum is inserted and the cervix is then pulled down with a vulsellum (Fig. 290).

The cervical canal is now carefully dilated till it is large enough to insert the index finger (Fig. 291).

The uterus being pressed down from the abdomen by the left hand of the operator he passes the index finger of his right hand into the uterus, separates the ovum and removes it (Fig. 292). Occasionally it may be more convenient to remove the ovum with the forceps (Fig. 293).

The ovum having been removed the interior of the uterus is douched (Fig. 294), after which if the bleeding is at all excessive the uterus can be packed with gauze (Fig. 295).

In some cases when this operation is performed some time after the abortion, for hæmorrhage due to the retention of some portion

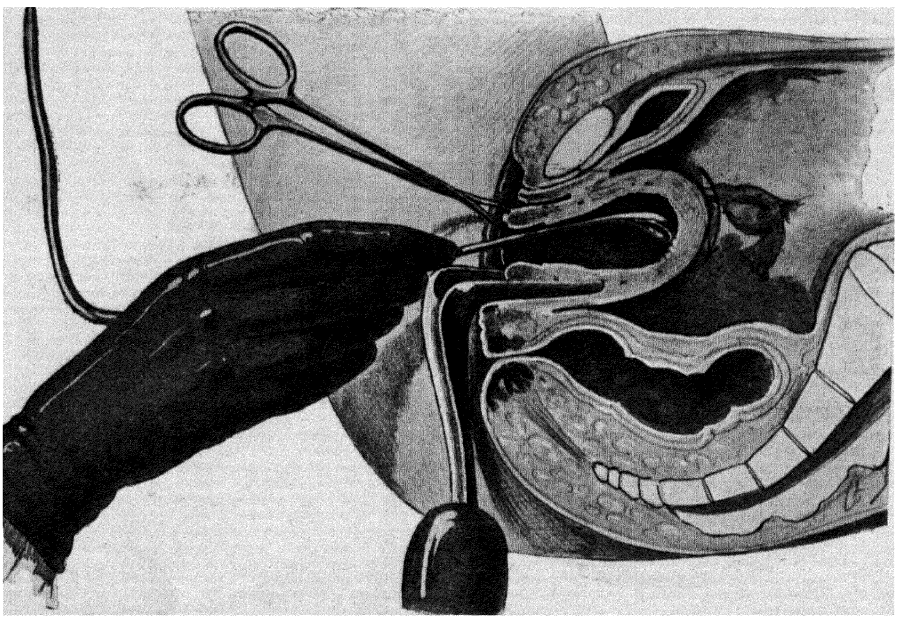


FIG. 296.—CURETTING THE UTERUS WITH A FLUSHING CURETTE.

This step of the operation should never be performed in a recent or septic case because of the danger in the first place of perforating the uterus since it is so soft, and in the second case of causing pelvic or general peritonitis by opening up fresh lymph channels.

of the ovum, it may be necessary to curette the uterus. In such a case the greatest care must be exercised lest the uterus is perforated with the curette (Fig. 296).

It is important that the student should grasp the fact that although this operation is an easy one to perform, it is full of dangers, and that unless the operator is expert and uses the greatest care, he can quite easily perforate the uterus or infect the patient. Hæmorrhage is often very considerable, and means for dealing with it should be at hand.

After the end of the twelfth week of pregnancy, if the cervix is

closed, it is a matter of very considerable difficulty to empty the uterus immediately by the vaginal route. At this period of pregnancy the head of the child is of such a size that it is only rarely that the cervix can be rapidly dilated to a degree which will allow of the easy passage of the head. Hence it is not an operative procedure to be lightly undertaken, as it is probable that the cervix will be dangerously lacerated in attempts to dilate it, or else the head of the child will become detached from its body and is then difficult to seize and crush. In attempting to deliver the separated head only blunt instruments should be used such as large ovum forceps or the forceps usually used for the introduction of a De Ribes's bag.

If the case is one of considerable urgency in which it is necessary to empty the uterus as quickly as possible, the pregnancy having already reached 16 weeks and no dilatation of the cervix having occurred, the best treatment is to empty the uterus through an abdominal incision as in abdominal Cæsarean section.

Vaginal Cæsarean section may. be performed, see p. 701.

Bougies and De Ribes's Bag.—These methods will be described in the next section.

INDUCTION OF LABOUR

Indications.—It may be necessary to empty the uterus after the child is viable; for some of the diseases peculiar to pregnancy or associated with pregnancy already mentioned under the Induction of Abortion, see p. 724.

After the child is viable, however, its life has to be more particularly considered, and labour may therefore be properly induced in cases in which the pelvis is not large enough to allow the passage of a child at full time. More rarely labour is induced if the child is very large, if the previous children have died after they became viable, or if pregnancy has extended over forty weeks.

Contracted Pelvis.—The fact that the pelvis is contracted has been ascertained by measuring it in the manner described on p. 417.

It cannot be too strongly insisted upon that every primigravida should have her pelvis measured at the earliest opportunity. The neglect to do so when the patient first engages the doctor's services for her confinement may lead to the death of the child and perhaps of the mother.

Having ascertained that the pelvis is contracted, but not too much contracted to allow a viable child to be born by induction of labour, the question will arise as to when the labour ought to be induced.

There is only one scientific method of determining this date, and that is by a repeated examination of the relation of the size of the child's head to the mother's pelvis. As long as the head can be easily pressed into the pelvis, pregnancy may be allowed to continue. When a little difficulty arises in getting the head to engage in the brim, then labour should be induced.

The old-fashioned method of being guided by the duration of pregnancy only in association with the size of the true conjugate is unscientific, inasmuch as the size of the child's head, which may vary, is not taken into account, and in most cases it is impossible to fix the day on which the ovum was fertilized.

The bimanual method of estimating the relative sizes of the child's head and the mother's pelvis.—The patient lies on her back, with her legs flexed and her abdomen bared. An anæsthetic is often preferable, and sometimes necessary. The index and middle fingers of the left hand are passed into the vagina, and the thumb of the same hand above the pubes so that it touches the head. With the right hand the head of the child is forced down into the brim. The fingers and thumb of the left hand can then determine how far the head can be forced into the pelvis and if it overlaps.

Limitations.—In cases of contracted pelvis, labour should be induced to obtain a child that will not only be living when it is born, but will have every prospect of living afterwards. The perusal of a large number of statistics on this subject dealing with thousands of cases shows that children born before the 34th week have but very little chance of surviving their birth, or if they do, a large majority are dead before twelve months have passed.

The induction of labour, therefore, when carried out purely in the interests of the child, should not be done before the period covered by the 34th to the 36th week, roughly with true conjugates between 3¼ and 3½ inches in a flat pelvis. Below 3¼ inches Cæsarean section is preferable with an average-sized child, and over 3½ inches more children will be born alive at full time than if labour is induced. In a certain number of cases which have been allowed to go to term Cæsarean section will have to be performed when the natural forces have been proved to be insufficient.

Large child.—The size of the child's head can be determined by the bimanual method. As a rule, if labour is to be induced for the size of the child, it is on account of the history of a former labour being difficult and perhaps resulting in the death of the child because of its abnormal size.

Habitual death of the child.—When previous children, though

viable, have died before term, a living child is occasionally obtained by the induction of labour just before the time the previous child died.

Pregnancy over forty weeks.—If it is known for certain that pregnancy has advanced beyond forty weeks, or even if there is strong reason to suspect that it has, labour should be induced, because in such cases it is found that if labour is allowed to come on naturally, the child is frequently dead, or dies during the first stage of labour.

Methods

The method to be chosen will depend somewhat upon whether labour is being induced in the interests of the child or of the mother.

In the interests of the child.—The best methods are

1. Bougies or œsophageal tube.
2. De Ribes's bag.

In the interests of the mother.—Besides the above, which in certain cases may be indicated,

3. Rupture of the membranes.
4. Rapid dilatation of the cervix.

Bougies.—Bougies induce labour more naturally than any other method. Their use is contra-indicated if there is a purulent vaginal discharge. They have certain disadvantages inasmuch as they may be very slow in inducing labour, and during their insertion the membranes may be ruptured or the placenta separated.

Bougies made of celluloid or gum-elastic should be used. These can be sterilized by covering them for several hours with 1 in 1000 mercurial solution or boiling for a few minutes.

The patient should be properly prepared as for any other operation. Thus the rectum and bladder should be evacuated, the vulva should be shaved, and in addition antiseptic and hot vaginal douches should be given twice daily for two days before the insertion of the bougies. The bougies are best introduced in the morning, and labour may be expected to commence from twenty-four to seventy-two hours later. The patient is anæsthetized and then placed in the lithotomy position, after which the vagina and cervix should be swabbed with iodine. The cervix is exposed with a speculum, and then gently pulled down with a pair of ring forceps and the canal is swabbed out with tincture of iodine. A finger is introduced within the internal os and swept round so as to separate the membranes as far as possible. A bougie is then introduced up the cervical canal. No force should be used, the bougie being allowed to travel in whichever direction is easiest. The lower end of the bougie having been pushed right into the

uterus, another, and if possible a third bougie, is introduced. An anæsthetic is necessary, as without it asepsis cannot be thoroughly carried out. Some people prefer to use an œsophageal tube instead of the bougies. After the introduction of the bougies or tube, the vagina may be lightly plugged with gauze, which should be removed in twelve hours, and a hot douche given (Fig. 297).

If the membranes are ruptured during insertion of the bougies

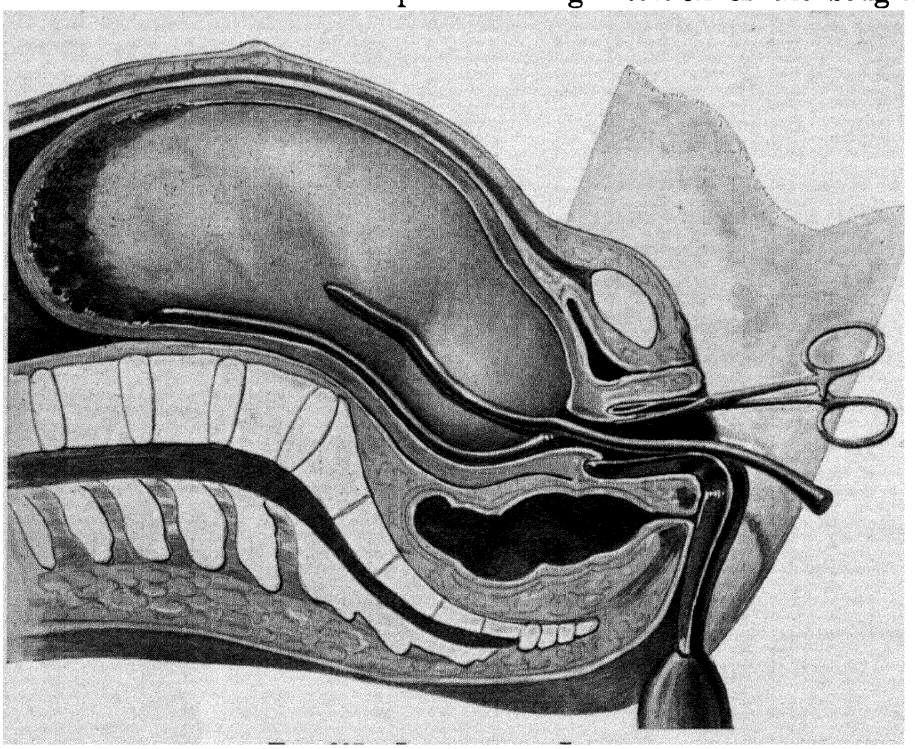


FIG. 297.—INDUCTION OF LABOUR.

One bougie already in position, another being introduced.

in a case in which labour is being induced in the interests of the child, a De Ribes's bag should be forthwith inserted.

If the bougies are too stiff or there is a low insertion of the placenta there is a risk of causing bleeding from separation of the edge of the placenta. If such an accident should occur the bougie should be withdrawn. The bleeding will stop and the bougie should then be inserted in the other side of the uterus.

De Ribes's Bag.—Labour is induced more quickly with De Ribes's bag than with bougies. It is particularly indicated in the interests of the child when bougies have not started labour within forty-eight hours, or when the membranes were accidentally ruptured during the introduction of the bougies. In the interests of the mother it can

be used to terminate labour quickly, as for instance in pregnancy-albuminuria, or to arrest hæmorrhage in cases of placenta prævia.

Disadvantages.—As the bag may burst, it should be filled with non-poisonous fluid that has been sterilized.

It may leak; it should therefore be carefully examined before use.

It may be the means of conveying infection; it should therefore be sterilized by boiling before use. Some bags will not stand boiling, they should be avoided. It may rupture the lower uterine segment. This is a very rare complication, and cannot be guarded against, except by avoiding the use of a bag that holds more than 17 ounces.

It may displace the presenting part. If this happens the head must be pushed into the pelvis again as the bag descends.

Method of Using De Ribes's Bag.—The amount of fluid it will hold should be ascertained beforehand by filling it and then pouring the fluid into a sterilized jug. When the bag is in the uterus this fluid can be again pumped into the bag. The os must be dilated sufficiently to admit two fingers, or if not it must be dilated first with metal dilators. The bag is introduced into the uterus with special forceps; these are then unlocked, and some of the fluid is pumped into the bag with a Higginson's syringe. When sufficient fluid has been pumped in to prevent the bag slipping out of the uterus, the forceps is removed and the bag filled. When all the fluid has been pumped in, the tap is turned and the tube is bent on itself and tied: this will prevent the fluid escaping if the tap is accidentally turned. An average of five hours elapses before the bag is expelled. If time is an essential, a 2-lb. weight can be hung on to the tube of the bag by a string which can be carried over the end of the bed. When used for placenta prævia, the bag is introduced into the amniotic cavity, but when used for a contracted pelvis, it can be introduced between the membranes and the uterus.

When the bag has been expelled from the uterus, the fluid should be allowed to run out and the bag then removed.

The bag is made in two sizes, according to whether it is to be used before or at full time. Many varieties of small rubber bags are used for starting labour.

Rapid Dilatation of the Cervix.—The cervix can be rapidly dilated by the hand, by instruments, or by incision.

Manual Dilatation

The os must be large enough to admit the index finger and thumb. The patient is anæsthetized, and the index finger and thumb of the gloved right hand are then inserted into the os, and the cervix stretched

by their separation. The middle finger is next introduced, and then the fourth and fifth fingers, and the cervix gradually stretched until the whole hand can be passed into the uterus. A leg of the child is then seized, and the child is delivered by traction.

This method is likely to be successful if the cervix is soft. Manual dilatation is extremely difficult unless the cervix is taken up and the os is as large as a two-shilling piece.

Disadvantages.—Manual dilatation of the cervix is a fatiguing procedure, and unless great care is used the cervix or lower uterine segment may be lacerated. There is also an increased danger of infection.

Instrumental Dilatation

The cervix may be rapidly opened by means of a metal screw-dilator (Fig. 298).

Method.—The patient is anæsthetized, placed in the dorsal position, and with all aseptic precautions the dilator is passed up the cervical canal till its upper ends project beyond the internal os.

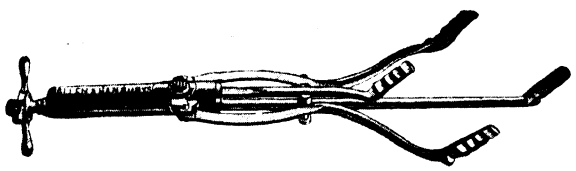


Fig. 298.

The handle of the instrument is then gradually turned, in the intervals between the pains only, for a distance of 1 centimetre every four minutes. A rotation of 10 centimetres will separate the ends for their full distance.

Disadvantages.—The danger of laceration is very great, and consequently this instrument is but rarely used. Laceration may be obviated to a certain extent by slow dilatation during the intervals between pains, by sliding broad covers on to the ends of the blades directly there is room for them, by ensuring that the ends of the blades project beyond the internal os, and by using the dilator only when labour has started.

Incision of the Cervix.—Incision of the cervix, or vaginal Cæsarean section, is described on p. 701. With the exception of abdominal Cæsarean section, it is the most rapid means of emptying the uterus available. Vaginal Cæsarean section is a difficult operation, should only be attempted by one accustomed to operate, and is most usefully employed, if at all, before the seventh month of pregnancy.

INTRA-VENOUS INFUSION

The best vein to choose is the median basilic or the median cephalic.

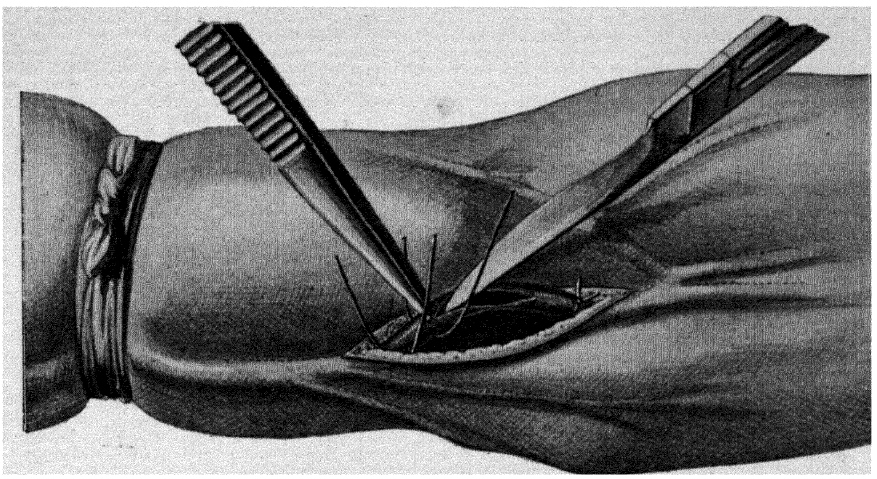


FIG. 299.—INTRA-VENOUS INFUSION. STAGE 1.

Showing the bandage round the arm. The distal end of the median basilic vein has been ligatured. Two loose ligatures have been placed on the proximal end of the vein and the vein opened.

Preparation for the Operation.—The skin over the operative area is painted with 2 per cent. iodine in rectified spirit. The normal

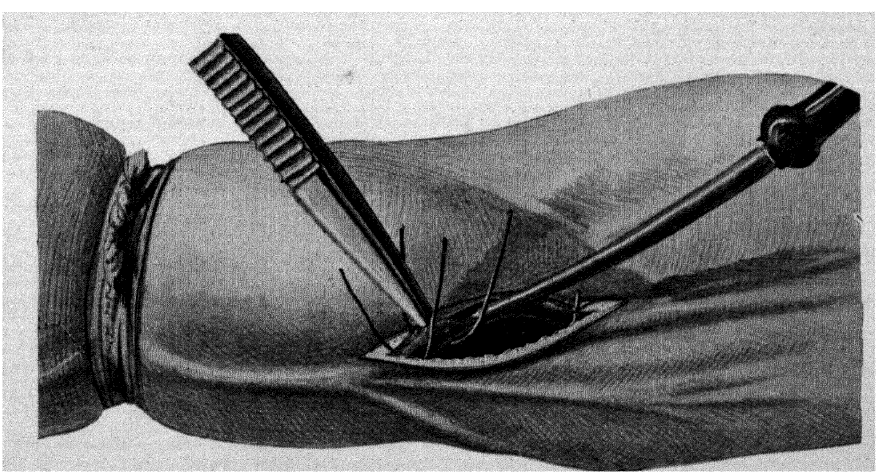


FIG. 300.—INTRA-VENOUS INFUSION. STAGE 2.

Showing the nozzle of the container being passed into the vein.

saline solution should be prepared by adding a teaspoonful of sodium chloride to a pint of water and boiling it. An infusion apparatus will be needed, and a sterilized jug for the saline solution.

Operation.—The arm is tightly bandaged above the upper border of the biceps. The vein, having been exposed by dividing the skin, is freed for a short distance (Fig. 299). The vein is then ligatured at the lower angle of the wound, and two other ligatures are passed under the vein but not tied; the middle one is used to tie in the cannula, and the upper one to ligature the proximal end of the vein after the infusion is finished. The vein is now opened in its long axis and the cannula inserted (Fig. 300), the saline solution at a temperature of 100° which has been poured into the container of the infusion apparatus being allowed to escape from the cannula all the

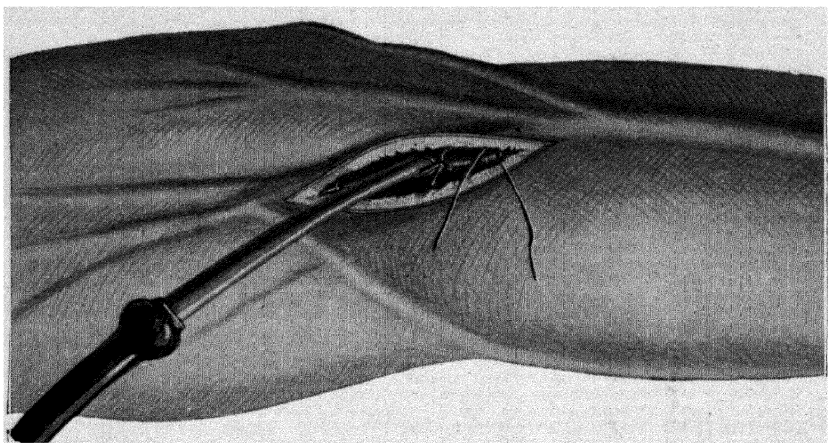


FIG. 301.—INTRA-VENOUS INFUSION. STAGE 3.

Showing the arm with the bandage removed, the nozzle tied into the vein and the loose ligature for tying the proximal end of the vein when the infusion is completed.

while, thus washing any blood away, and so disclosing the opening into the vein more clearly and preventing the entrance of air. After the cannula is introduced, the middle ligature is tied and the bandage removed from the arm (Fig. 301). When sufficient saline solution has been run into the vein the cannula is withdrawn, the proximal end of the vein ligatured, and the skin-wound united with a couple of sutures.

If there has been a large amount of blood lost it is important not to infuse too much solution, otherwise there is great danger of œdema of the lungs supervening. Up to three pints is the proper quantity to infuse.

CHAPTER LV

THE MANAGEMENT OF LABOUR WITH PELVIC CONTRACTION

THE discussion of the management of labour in contracted pelvis was deferred to this stage because it requires an acquaintance with so many of the processes and procedures of complicated midwifery. The object of this chapter is largely to collect what is scattered through preceding chapters so far as it applies to the treatment of contracted pelvis.

The subject is best considered under two headings: I. If the patient is seen during pregnancy; II. If she is already in labour at term.

I. *During Pregnancy.*

If, in following the routine examination of every primigravida or multipara with a history of difficulty in labour by the methods described in Chapters XXXVI and XXXVII, some degree of pelvic contraction is detected, there are three courses possible:—

(1) To allow the pregnancy to go to term in the hope that the natural powers, with assistance if need be, will effect the delivery of a living child.

(2) To induce labour some time before term, when the smaller size of the child will enable it to be born naturally and with a reasonable chance of surviving.

(3) To advise the patient to submit to Cæsarean section at term, if the contraction is such as to render the prospect of obtaining a living child unlikely by the other methods.

The degree of contraction, or rather the disparity between the size of the head and that of the pelvis is the chief factor in deciding which of these three methods is to be adopted, though other points, such as the variety of contracted pelvis, the age and general health of the patient and the history of her previous labours, if any, must also be taken into consideration.

The best course to pursue in the extreme degrees of contraction, say with a true conjugate at the brim of 3 inches or under, is easily

determined, *viz.* to perform Cæsarean section. With as low a measurement as 2-2¼ inches delivery at term *per vias naturales* is impossible (see p. 689), and the only alternative would be the induction of abortion before the sixth month, a proceeding only justified by the refusal of the parents to submit to the operation and the ethics of which has been discussed in Chapter LIV. Again, for a child to be born naturally through a conjugate of 3 inches would require induction of labour at about the seventh month, *i.e.* at too early a period to afford a reasonable prospect of its survival, hence the statement on p. 734 that Cæsarean section is the better method of treatment even with a true conjugate of 3¼ inches, and is often justifiable in selected cases with a conjugate up to 3½ inches (see p. 690). The most difficult problems are presented by the cases of contraction of minor degree, a true conjugate of 3¼ inches and upwards, and as such cases are much more frequent than the extreme degrees, they call for more detailed discussion.

As the pelvis cannot be measured during life without allowing at least ¼ inch as the possible margin of error, and as the size of the child's head is also a factor, the most important point in coming to a decision as to management is to determine the relative size of the head to the pelvic brim by the method described on p. 425. If by this examination the head is found above the brim and cannot be made to enter it as early as the 32nd week, then it may be taken for granted that the chances of survival as the result of induction of labour at such an early period are so remote that Cæsarean section at term is to be preferred. This would hold good even later than the 32nd week if other considerations were present, *e.g.* that the patient was an elderly primigravida, for the most favourable time for induction is the 34th to 36th week (see p. 734). It must be remembered that the comparatively soft head of a premature infant is more liable than the harder head of a full-time child to be injured in its passage through the genital canal of a woman who has not borne a child before. In other words, induction of premature labour is likely to be less successful in a primigravida than in a multipara. It stands to reason that if the compression of the head of a premature child during a difficult spontaneous labour is likely to be injurious, the compression resulting from extraction by the forceps will almost certainly be fatal. If the head can be made to enter the pelvis easily and unmistakably after the 37th week, it is clear that the best plan will be to allow the pregnancy to go to term, as the child will probably be born spontaneously, or with instrumental assistance if the mother is becoming exhausted. On p. 659 a true conjugate of 3½ inches was given as the smallest through which it is

desirable to use the forceps, but a head which can be pushed into the brim up to within two or three weeks of term, would, if plenty of time was given for moulding to occur, be correctly treated by extraction by axis-traction forceps if the natural forces were insufficient.

Up to now the measurements considered have been those of contraction in the antero-posterior diameter at the brim only, *i.e.* those of a flat pelvis. If it is suspected that the pelvis is contracted in all its diameters, what has been said hitherto would hold good for a conjugate of $\frac{1}{4}$ an inch more; *i.e.* a conjugate of $3\frac{3}{4}$ inches in a generally contracted would be considered as equivalent to $3\frac{1}{2}$ inches in a flattened pelvis.

It must also be remembered that general contraction is more difficult of detection than flattening, as the promontory does not thrust itself on the notice in the same way, and a degree of general contraction so small as to be within the margin of error of observation may yet suffice to cause serious difficulty in labour. In well-marked contraction pelvimetry and the points mentioned on pp. 432-438 will serve to distinguish these two types, but in the less marked degrees reliance must chiefly be placed on an estimate of disparity in size between the head and the pelvic brim. Even by this method it is not an easy problem to decide when the auspicious moment for induction has arrived, the child having reached the maximum development which will allow of its being born by the natural powers without instrumental aid. The common and safer error is to induce too early. If induction is done too late so that extreme moulding is followed by forceps extraction, severe cerebral injury generally results, and the child does not survive (see pp. 624, 625).

If the child is not presenting by the vertex, further difficulty arises in deciding on the treatment to be adopted. Malpresentations are more common with the flat pelvis and should be remedied by external version during pregnancy if possible, and the head brought over the brim. The only doubtful case is a breech presentation, as the after-coming head passes more easily through a flat pelvis than the fore-coming. For a breech presentation in a flat pelvis there ought to be a true conjugate of at least $3\frac{1}{2}$ inches. Any malpresentation which cannot be rectified and maintained as a vertex presentation would weight the scales heavily in favour of Cæsarean section.

Other questions may influence the decision in individual cases. For instance, if the patient is an elderly primigravida with but slender chances of another pregnancy and some rigidity of the soft parts which will increase the difficulty of delivery, even a slight degree of contraction will justify Cæsarean section with its certainty of a living

child. On the other hand, with a young primigravida the tendency would rather be, if possible, to allow the pregnancy to go to term or near it, as the experience of her first labour would be a most valuable guide for the future. In the case of a multipara with a history of difficult labours, the problem is an easier one. If the labours at term have resulted in dead-born or injured children, induction before full time is obviously the best policy; if the difficulty at labour has been extreme and has necessitated craniotomy, and especially if the woman is over thirty, anxious to be sure of a living child and willing to submit to Cæsarean section, that operation at term under suitable conditions is clearly justified.

Again, some general condition of the mother may influence the decision in favour of induction of labour or Cæsarean section. Chronic valvular disease of the heart, or chronic renal disease, for instance, not severe enough in itself to suggest interference, may, if the pelvis is slightly contracted, make it inadvisable to allow the pregnancy to go to term with the additional risks that a long and difficult labour would involve.

Briefly summarized, the management of pregnancy with pelvic contraction would be to urge Cæsarean section at term for all cases in which there is less than $3\frac{1}{4}$ inches true conjugate in a flat pelvis and $3\frac{1}{2}$ in a generally contracted, or in which the head cannot be pressed into the pelvis at the 32nd week. If the head will not enter the brim at the 36th week, induction of labour may be tried unless the patient is an elderly primigravida. If the head can be pressed into the brim beyond the 36th week, the pregnancy can be allowed to proceed to term, and the case managed as described in the treatment of labour with contracted pelvis. In maternity hospitals the tendency of recent years has been to limit the induction of labour in these doubtful cases. The patient is allowed to go to term and fall into labour; the labour is conducted with the minimum of internal examination and under the strictest technique as regards surgical cleanliness; if there is good uterine action and the head becomes fixed in the brim, time is given to see if it will mould and enter the cavity; if it becomes evident, however, that the head will not engage, Cæsarean section is done at once. This method is not suited to family practice, and hence there will always be a more prominent place for induction of labour in private practice owing to the impossibility of providing hospital conditions for observation and for operation at any moment.

II. *During Labour.*

As the flat pelvis is the common variety it will be considered first.

In the management of the patient when actually in labour with

contraction of the pelvis, the first and all-important duty of the attendant is to make a thorough investigation and collect every possible item of evidence which will help to decide whether the disparity in size between the head and the pelvis is such as to make delivery by the natural passages impossible. If Cæsarean section is to be done, the minimum amount of interference beforehand is essential if the results of the operation are to be satisfactory. On page 695 the danger of sepsis after internal manipulation was fully discussed. Hence a decision ought to be made as early as possible in labour, preferably before rupture of the membranes. If the pelvic measurements have not been taken, because the patient is first seen at term or at the beginning of labour, they should be taken now and a thorough external examination carried out. An internal examination should then be made under full anæsthesia, the diagonal conjugate measured (see p. 421, Fig. 170), and the true conjugate deduced from it; the presentation and position should be made out, the whole hand, if necessary, being passed into the vagina (see p. 296), and an attempt made to ascertain the relative size of the child's head to the pelvis, and, if it overlaps the symphysis pubis (see Fig. 172, p. 425), to estimate whether an excessive amount of moulding would be required to enable it to enter the cavity. If kyphosis is present the measurement of the outlet must not be omitted (see p. 443).

Cases of Slight Contraction.—As the size of the head is an important factor in prognosis, the most important observation is that of the amount of overlapping. Roughly with an average-sized child, a conjugate of 3½ inches in a flat pelvis and 3¾ in a generally contracted would justify leaving the labour to proceed if the other factors were favourable. The other conditions are that the pains should be normal, the cervix dilated or the membranes unruptured and the cervix dilating normally, the vertex presenting, the head flexed and in an occipito-anterior position, and the patient's general condition good. A border-line case of this kind offers one of the most difficult problems in midwifery and requires great care and judgment to reach a correct decision. The abdominal examination may suggest that the head is high up and movable, so that doubt is felt as to its entering the brim and yet on vaginal examination it appears to come well into the brim. Most of these cases will be delivered without great difficulty; the tendency is not to give Nature sufficient credit for what she can accomplish, but the labour requires careful watching. If the case is not seen till the second stage, and the head is fixed in the brim, it may be left with some confidence, careful observation being made of the mother's general condition, of the character and frequency of the pains and of the fœtal heart. If the patient

is a young primigravida little hesitation need be felt in waiting and watching.

Once it has been decided to leave the labour to proceed naturally the following points ought to be attended to. As the membranes tend to rupture early, nothing should be done which might provoke their rupture. The patient should be kept lying down and on her side; all straining and bearing-down efforts on her part should be avoided, and it is well not to give enemata. Also great care must be taken in making vaginal examinations. If there is any marked uterine obliquity (see p. 330), it should be remedied by changing the patient's posture. As the patient has a long labour before her nothing that will save her from physical or nervous exhaustion must be omitted (Chapter XXXVIII), food and hot drinks should be given, and sleep encouraged, if necessary by the giving of sedatives, if there are any signs of fatigue, for fear of abnormal uterine action supervening. Should the membranes rupture early, the head may come down and complete the dilatation. If so there is clearly no obstruction of moment. But if it cannot come down, the cervix is liable to be nipped (see p. 433), and the anterior lip especially may hang down in front of the head as a soft œdematous swelling; if this occurs it must be treated as described below. So long as the patient's general condition remains good, and the fœtal heart sounds are unaffected, no interference is indicated. The tendency with the inexperienced, when called in to a case of contracted pelvis, is to think that rapid delivery is called for. It is quite the reverse; Nature ought to be given every chance, but the progress of the labour should be most carefully watched and no interference made except for very definite reasons.

Whether the patient is seen for the first time in labour, or has been allowed to go to term in the hope of a natural delivery, interference may be called for.

If, as the result of early rupture of the membranes and non-descent of the presenting part, the os is less than half dilated, a Champetier de Ribes's bag may be put in (see p. 736). If it is more than half dilated and especially if there is a tendency to nipping and œdema of the lips, manual dilatation and pushing up of the œdematous lip above the presenting part is more likely to succeed. Prolapse of the cord would also be an indication for the use of a de Ribes's bag. If the head is in the unfavourable posterior parietal obliquity (p. 435) or the face or brow is presenting, internal podalic version would be the best treatment in a flat pelvis, as also if the head remained floating above the brim so that the forceps is contra-indicated (see pp. 664 and 674). If the head is not in a faulty position and is engaged,

time should be allowed for moulding and for the natural powers if possible, to drive it through the brim; but should there be signs of fatigue and exhaustion in the mother or of fœtal distress or warning of failure of the expulsive powers (Chapter XXXVIII), delivery by the axis-traction forceps should be attempted. The high forceps operation is always a serious one and prolonged efforts at delivery are to be deprecated. The precautions mentioned on p. 672 must be carefully observed, and not more strength than can be exerted by the arms should be exercised, and if the head cannot be got through in half an hour further efforts should be discontinued.

Any evidence of "irritated" uterus would also indicate cessation of efforts at delivery, and that the treatment advised on p. 457 should be adopted. In other words, delivery must be assisted if commencing failure of the uterine powers suggests the possibility of uterine exhaustion supervening (see p. 452), or if violent and continuous uterine action without advance presages the occurrence of tonic contraction (see p. 454). If the axis-traction forceps fails to effect delivery, no advantage will be obtained by performing version, unless the mistake has been made of applying the forceps to a faultily placed head. If the patient is a primipara, perforation is the only resource; if a multipara symphysiotomy (see p. 720) may be done. Cæsarean section entails great risks when once intra-uterine instrumentation has been tried, and is only justifiable in special circumstances, certainly not with a young primipara with the prospect of many more pregnancies before her and the advantage of the experience gained at her first and unfortunate confinement. As soon as definite evidence of death of the fœtus is obtained, craniotomy (see p. 701) is the only thing to be done. It must be recognized that the delivery of a dead child after a difficult forceps operation is not only a failure but an obstetrical disaster. It means that the difficulties have neither been appreciated nor successfully met, and further that the mother has fruitlessly run unnecessary risk of uterine rupture and laceration of the soft parts.

Generally Contracted Pelvis.—If the pelvis is generally contracted and not flattened, besides deducting an extra inch in the conjugate in all calculations, there are a few other points of difference. Though there is less danger of rupture of the membranes and prolapse of the cord, there is greater danger of nipping of the cervix. Version is contra-indicated as it gives no advantages. It is an old dictum that the prognosis in cases of contraction of slight degree is worse than that in contraction of severe degree. This apparent paradox is due to the absence of symptoms or signs that obtrude themselves on the notice. If there is a marked degree of contraction the head will be

delayed at the brim, but in the minor degrees of contraction—and most cases of general contraction come under this category—there may be no suspicion that anything is wrong until the head is impacted in the cavity of the pelvis. When this has occurred the gravity of the case soon becomes apparent. The vulva becomes œdematous, the mother's general condition rapidly deteriorates, and the need for immediate delivery is obvious. Delay or a long-continued and probably fruitless attempt at delivery with the forceps will result in sloughing, the formation of fistulæ, and death of the child.

Delay in spite of good pains calls for careful investigation before the occurrence of impaction, when Cæsarean section may be impossible. Failing this, an attempt at delivery with the axis-traction forceps may be successful, but must not be persisted in if there is no advance. Perforation is then the only resource. Induction of premature labour or Cæsarean section at term is to be advised in subsequent labours.

Cases of Medium Contraction.—In cases of small flat or flat and generally contracted pelves with a true conjugate between $2\frac{1}{4}$ and $3\frac{1}{4}$ inches, delivery of a living child at term is impossible. Cæsarean section (see p. 689) ought to be performed if the patient is not infected and the child is alive; with the larger measurement symphysiotomy or pubiotomy would be an alternative in a multipara. If the child is dead delivery is effected by craniotomy and extraction by cephalotripsy or cranioclasm (see pp. 709-715). If the child is alive and there is reason to suspect infection, craniotomy should be done in a young woman, but if she has reached an age that makes further pregnancies unlikely, Cæsarean hysterectomy will give her the chance of having one living child and avoid the risk of septic peritonitis (p. 699).

Cases of Extreme Contraction.—In the extreme degrees of contraction with a conjugate of 2 to $2\frac{1}{4}$ inches or less, Cæsarean section is the only method of delivery, but in cases of possible infection should be followed by hysterectomy (see p. 699).

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