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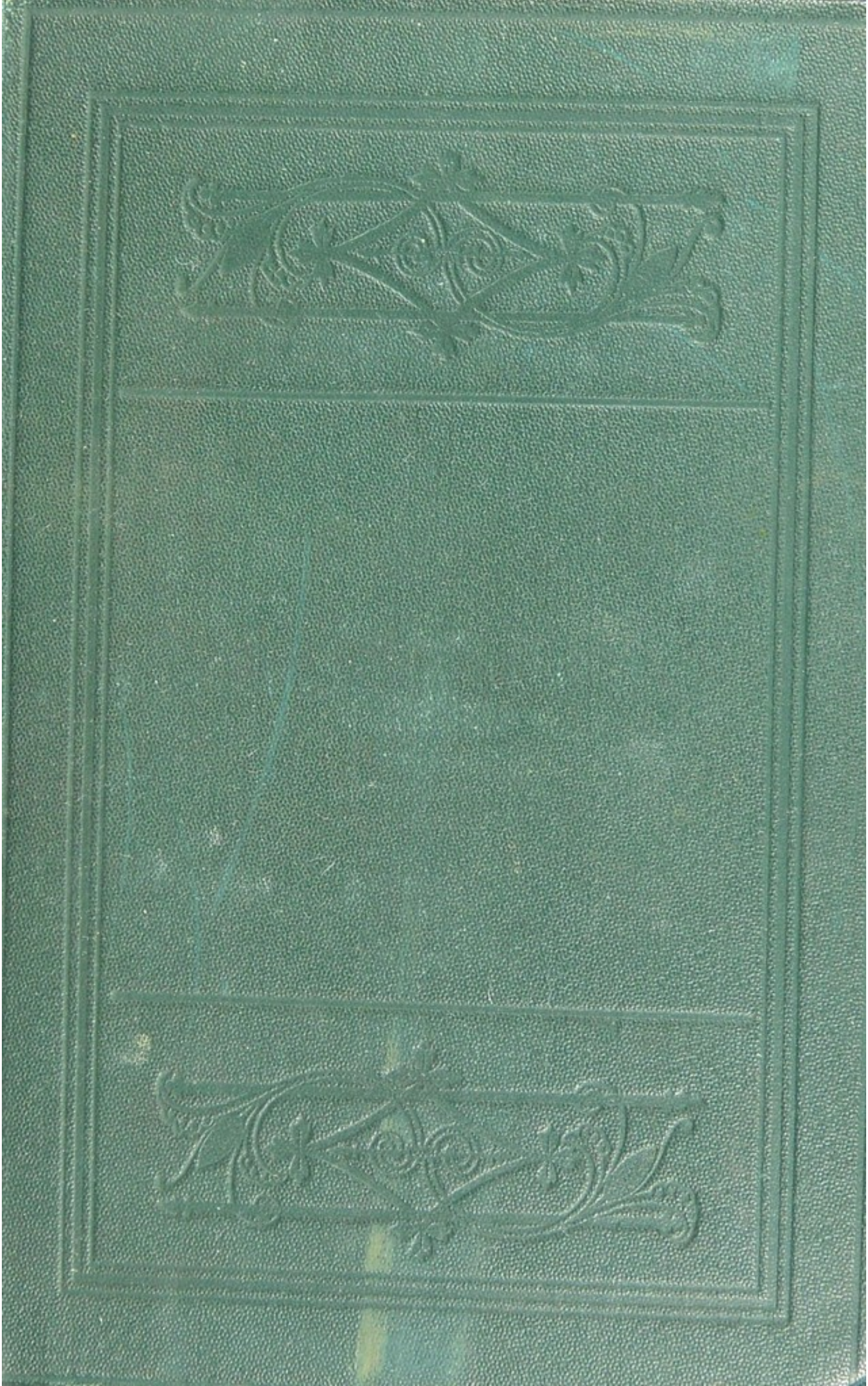

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THE PRACTICE OF MIDWIFERY

Preparing for publication by the same Author,

A HANDBOOK OF OPERATIVE GYNÆCOLOGY.

W. Lloyd Roberts . 22.11.99.

RUTHWELL,
COMBE PARK,
WESTON, BATH

THE PRACTICE OF MIDWIFERY

A GUIDE FOR PRACTITIONERS & STUDENTS

BY

D. LLOYD ROBERTS, M.D., F.R.S. EDIN.,
F.R.C.P. LOND.

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AND HONORARY FELLOW OF THE OBSTETRICAL SOCIETY OF BERLIN

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THE OWENS COLLEGE,

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PREFACE TO THE FOURTH EDITION

In preparing the Fourth Edition of this book, I have endeavoured to make it a concise and a practical exposition of the science of Midwifery of to-day. The volume has been thoroughly revised, and several of the chapters have been re-written. A chapter has been added on antiseptics in Midwifery, and an Appendix on the obstetrical use of anæsthetics. I owe the expression of my hearty thanks to my friend Dr. W. K. Walls, resident obstetric assistant surgeon to St. Mary's Hospital, for much help kindly rendered in passing this edition through the press.

11 St. John Street,
Manchester, *October* 1896.

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PREFACE TO THE FIRST EDITION

THIS Manual is written mainly for the instruction of Students, though I hope it may sometimes be found of service to Practitioners whose scant leisure may make it difficult for them to consult larger works.

My endeavour has been to present as complete a view of obstetrics as the compass of a Manual would permit.

I have been compelled to touch somewhat briefly, yet not I trust inadequately, on points of minor interest, in order to dwell more fully on subjects of serious practical importance. The anatomical portion I have also treated briefly, as I presume that the Student is already practically acquainted with the details of the very foundation of the subject.

The Physiology of Generation, the Mechanism of Labour, and the description of the operations

of Midwifery, I have dealt with according to the relative importance of the several subjects.

I have also endeavoured to treat of the diseases consequent on Parturition—for example, Puerperal Fever—in such a manner as to instruct the Student without confusing his mind with conflicting opinions and speculative theories.

In conclusion, I wish to tender my thanks to my friends Dr. George Bird and Dr. Dixon Mann for much kind and efficient aid they have rendered in the preparation of this work.

23 St. John Street,
Manchester, *December* 1875.

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CHAPTER I

PELVIS

THE adult pelvis is composed of four bones—namely, the sacrum, coccyx, and two innominate bones.

The SACRUM, triangular in shape, with its base upwards, is attached above to the last lumbar vertebra, below to the coccyx, and on each side to the innominate bones. Its anterior surface is concave, and, obstetrically speaking, is designated the hollow of the sacrum. In a well-formed pelvis, the depth of this concavity measures three-quarters of an inch. The sacrum is united above with the last lumbar vertebra at a considerable angle—the sacro-vertebral angle. The projection thus formed is called by some authorities the promontory of the

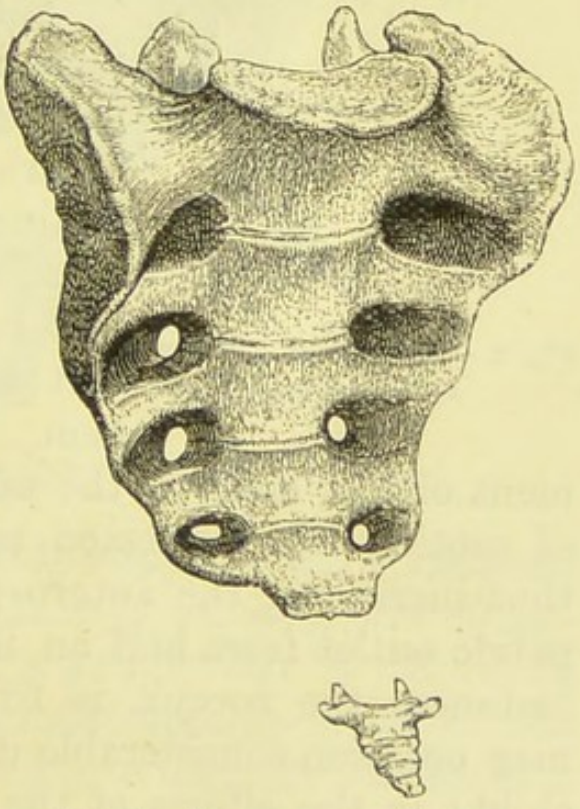


Fig. 1.—SACRUM AND COCCYX.

sacrum, though others restrict the term to the uppermost part of the anterior surface of the sacrum itself.

On each side of the median line are the anterior sacral foramina, through which pass the anterior sacral nerves: the pressure exerted on these nerves by the child's head is the cause of the severe cramp from which women so frequently suffer during labour.

The posterior surface is rough and convex, and presents numerous tubercles for the attachment of tendons, muscles, and ligaments.

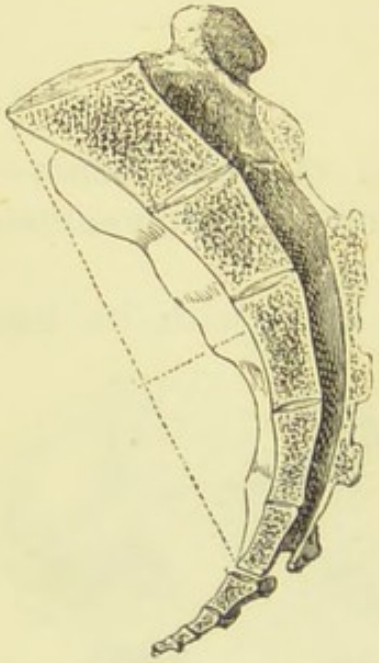


Fig. 2.—Section of Sacrum and Coccyx.

On each side of the sacrum, at its upper part, is a rough ear-shaped surface, which serves for attachment to a corresponding surface on the innominate bone.

Below the sacrum, and attached to its inferior extremity, is the Coccyx, a small triangular bone, formed of four distinct pieces; its base is uppermost, and its apex, being loose and buried in the surrounding soft parts, has a downward direction. The hinge-like attachment of this bone to the sacrum allows some degree of motion when pressed upon by the child's head, thus increasing the antero-posterior diameter of the pelvic outlet from half an inch to an inch. In some instances the coccyx is fixed by anchylosis, which may occasion considerable delay to the passage of the child; in the efforts of the uterus to overcome this obstruction the bone is sometimes fractured, an accident ordinarily followed with but little inconvenience.

The Ossa Innominata are two irregularly-shaped

bones, each of which consists of the ilium above, the pubes below and in front, and the ischium below and behind. In the fœtus, the ilium, pubes, and ischium are distinct bones, which join each other at the acetabulum.

The Ilium is the upper and expanded portion of the bone, and with its fellow contributes largely to the formation of the upper and lateral portions of

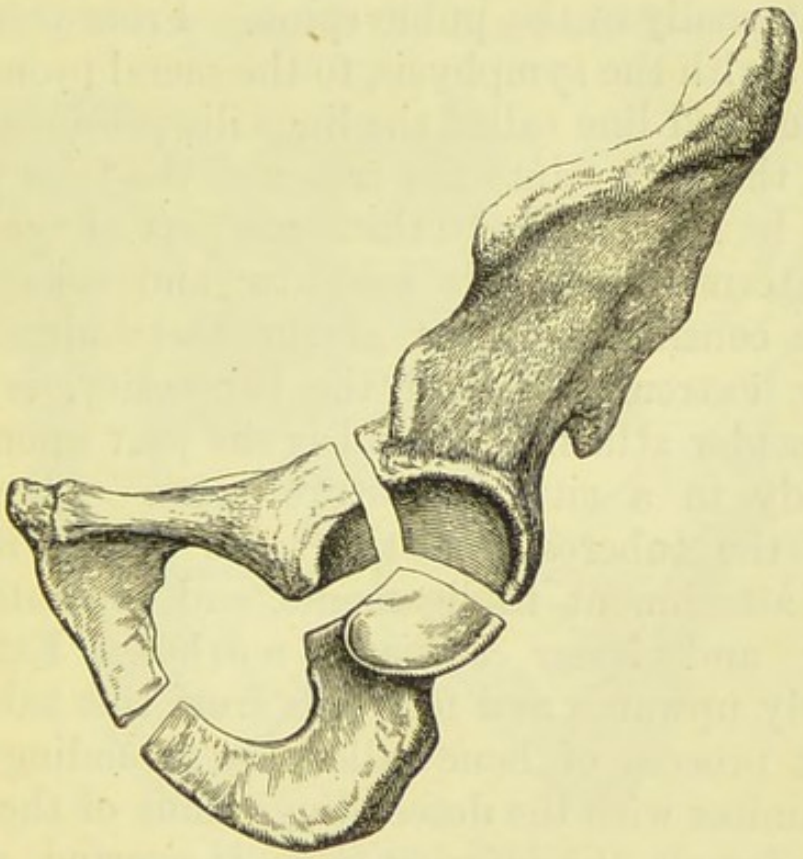


Fig. 3.—Division between Ischium, Ilium, and Pubes.

the false pelvis, and mainly supports the abdominal viscera. Its internal surface is smooth, and its external rough. The superior rough edge of the ilium, giving attachment to various muscles, is called the crest; it terminates anteriorly in the anterior superior spine, and posteriorly in the posterior superior spine. Immediately under these spines are slight notches, bounded below by the anterior and posterior inferior spines.

The PUBES is composed of a body, joined to its fellow of the opposite side, forming the symphysis pubis; a horizontal ramus which proceeds outward to join the ilium, and a descending ramus which, passing downwards, joins the ascending ramus of the ischium. The descending rami of the pubes, conjoined with the ascending rami of the ischium, form the arch of the pubes. The body of the pubes presents superiorly a short ridge, the pubic crest, which ends externally in the pubic spine. From this spine, together with the symphysis, to the sacral promontory is an elevated line called the linea ilio-pectinea, which divides the cavity into the true and the false pelvis.

The ISCHIUM occupies the lower part of the pelvis. The external surface is irregular and convex, and forms a considerable part of the acetabulum. The inferior extremity, called the tuberosity, is rough for muscular attachment, and is the part upon which the body in a sitting posture rests. Above and behind the tuberosity is the spine of the ischium, giving attachment to ligaments, and separating the greater and lesser ischiatic notches. Extending obliquely upwards and forwards from this tuberosity is a flat process of bone called the ascending ramus, which unites with the descending ramus of the pubes. In the female the inferior edge is everted, so as to afford a more spacious outlet for the passage of the child's head under the pubic arch.

The foramen ovale, nearly closed by the obturator ligament, gives exit to vessels and nerves which pass to the upper part of the lower extremities. When the pelvis is small and the cranium is large these nerves are often pressed upon during the head's descent towards the outlet, producing severe pain on the anterior inner surface of the thigh, which can be much relieved by friction.

The joints of the pelvis comprise the articulations between the sacrum and the iliac bones, between the sacrum and the last lumbar vertebra, between the two pubic bones, and the sacro-coccygeal joint.

The large bony surfaces entering into the *sacro-iliac synchondroses* are irregular and rugged, each being covered with a thin compact layer of cartilage, and in each joint a small synovial sac is described by Luschka.

In the pubic symphysis the bony surfaces are joined

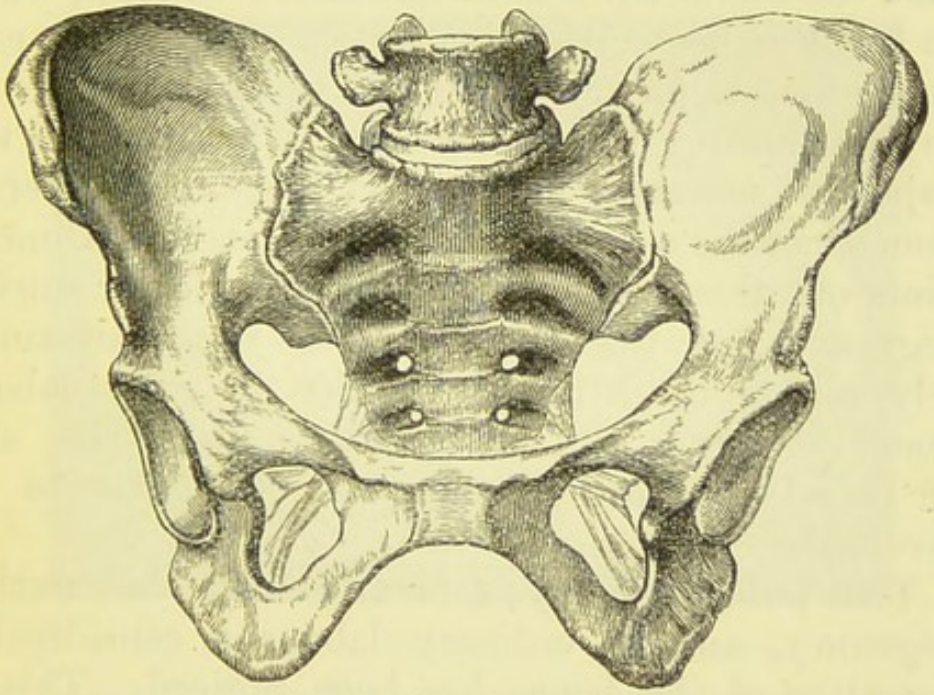


Fig. 4.—Female Pelvis.

by means of strong ligaments, especially the subpubic ; included between the bones are a plate of fibro-cartilage anteriorly and a small synovial sac posteriorly.

The sacro-vertebral and the sacro-coccygeal joints correspond with the articulations of the other vertebræ.

In this connection the *greater and lesser sacro-sciatic ligaments* should be mentioned. They form the postero-lateral boundaries of the pelvic outlet.

The range of mobility permitted by the proper

pelvic articulations is normally of limited extent, but during pregnancy the joint cavities become larger and movements more extensive.

In the sacro-iliac synchondroses the movement may be said to consist (Zaglas' observations—Report by Gairdner and Barlow, Phys. Soc. Edin. Sept. 1861) of a rotation of the sacrum on a transverse horizontal axis about the second sacral vertebra. When the body is vertical or inclined backwards the sacral promontory is in its most backward position, while the sacral tip is most forwards; whereas, when the trunk is bent forwards over the pelvis the sacral promontory is forwards and the tip backwards. In the first instance the pelvic brim is increased in the conjugate diameter; in the latter the antero-posterior diameter of the outlet is enlarged. Matthews Duncan points out that these movements are greater during pregnancy, and that the parturient woman instinctively selects the straight position in early labour when the head is about to enter the brim, and the coiled-up position when the outlet has to be traversed.

The pubic symphysis is also more lax during pregnancy, and in ordinary labour a considerable separation of the bones has been noticed. This is interesting in view of the reintroduction of symphysiotomy as an operative procedure in difficult labours.

Movement of the sacro-coccygeal joint has been referred to previously.

For obstetric purposes the pelvis as a whole is divided into true and false pelvis; the true being that portion below the ilio-pectineal line, and the false that portion above it. The true pelvis presents inlet or brim, cavity, and outlet, and it is the study of the diameters and angles of inclination

of these parts which enables us to understand, and, when necessary, to assist in effecting the expulsion of the fœtus. With the false pelvis we have little to do. If deformed it may, it is true, produce certain abnormalities in fœtal presentation, still it has no concern with the mechanism of ordinary labour. The true pelvis, then, will claim all our attention. As before intimated, we have to consider *brim*, *outlet*, and *cavity;* the brim being formed by the pubes, pubic crests and spines, ilio-pectineal line,

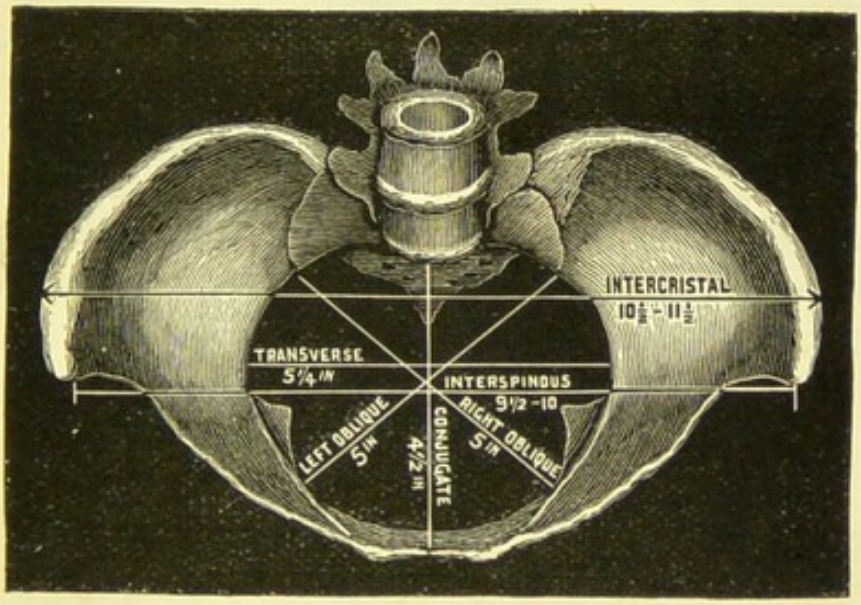


Fig. 5.—Brim of Pelvis, with its Diameters.
The figure also shows the transverse diameters of the false pelvis.

and promontory of the sacrum; the outlet by the rami of the ischia and pubes, tuberosities of the ischia, great sacro-sciatic ligaments, and coccyx; and the cavity comprising that portion lying between the brim and the outlet.

The Brim (Fig. 5) presents an irregular ovoid outline, with its long diameter across the pelvis. Its dimensions (like those of the cavity and outlet) are taken in three directions—(1) the transverse, (2) the oblique, and (3) the conjugate or antero-

posterior. The transverse diameter of the brim measured across its widest part averages $5\frac{1}{4}$ inches; the oblique, from the sacro-iliac synchondrosis of one side to the ilio-pectineal eminence of the opposite side, averages 5 inches; and the conjugate, from the promontory of the sacrum to the upper and inner margin of the symphysis pubis, averages $4\frac{1}{2}$ inches.

There are two oblique diameters, right and left,

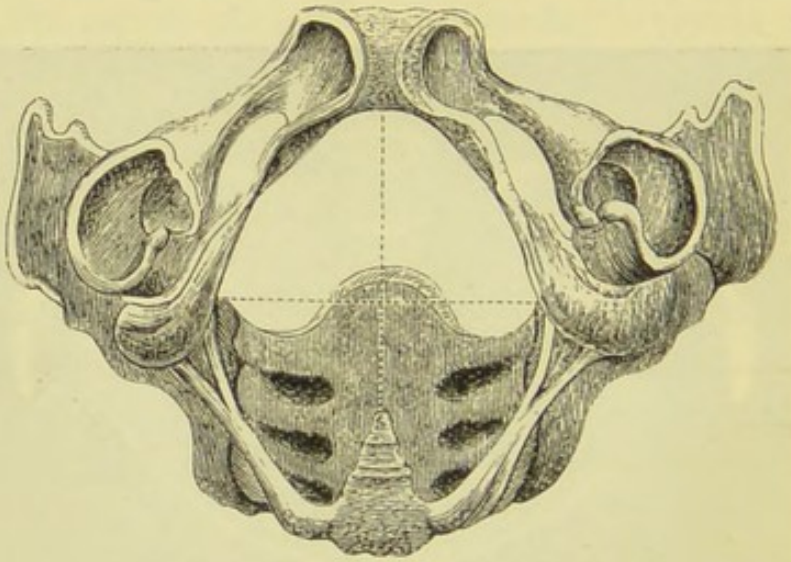


Fig. 6.—Outlet of Pelvis.
The dotted lines indicate the antero-posterior and transverse diameters.

so named from the respective sacro-iliac synchondroses whence the measurement is taken.

The average diameters in the *cavity* are, the transverse, measured between the ischia, $4\frac{3}{4}$ inches; oblique, from the middle of the great sacro-sciatic foramen to the obturator ligament, 5 inches; and antero-posterior, from middle of sacrum to the pubic symphysis, 5 inches. The cavity is deep behind and shallow in front; a line taken directly from the promontory of the sacrum to the tip of the coccyx measures $4\frac{1}{2}$ inches, or if it follows the curve of the sacrum $5\frac{1}{2}$ inches; whilst from the crest of the pubes to the

pubic arch is only about $1\frac{3}{4}$ inch. The shallower the cavity of the pelvis (other conditions being equal) the shorter the labour.

The Outlet (Fig. 6) measures transversely, between the ischial tuberosities, 4 inches; obliquely, from sacro-sciatic ligament to ascending ramus of ischium, $4\frac{1}{2}$ inches; and antero-posteriorly, from tip of coccyx, when pushed back, to inferior and inner margin of symphysis pubis, $4\frac{3}{4}$ inches. These measurements, taken from the dry bone, are modified by the soft parts, which encroach more on the transverse diameter of the brim than on that of either of the other diameters, leaving the oblique diameter the longest; so that at the brim and in the cavity the oblique, and at the outlet the antero-posterior diameters are greatest. This variation in their relative measurements necessitates that rotation of the fœtal head to be described in the chapter on the mechanism of labour. For handier reference we give the foregoing measurements in tabular form :—

	Transverse.	Oblique.	Antero-posterior.
Brim .	$5\frac{1}{4}$ in.	5 in.	$4\frac{1}{2}$ in.
Cavity .	$4\frac{3}{4}$,,	5 ,,	5 ,,
Outlet .	4 ,,	$4\frac{1}{2}$,,	$4\frac{3}{4}$,,

Besides the measurements already given, certain others remain to be noted :—

1. The diagonal conjugate, from the inferior edge of the pubic symphysis to the promontory of the sacrum. This averages $5\frac{1}{6}$ inches, being $\frac{2}{3}$ inch longer than the true conjugate of the brim.
2. The external conjugate, between the last lumbar spine and the upper part of the pubic symphysis, averaging $7\frac{1}{4}$ inches.

3. The interspinous diameter, between the anterior superior iliac spines, measuring from $9\frac{1}{2}$ to 10 inches.
4. The intercristal, from the middle of one iliac crest to a similar point on the opposite side, measuring from $10\frac{1}{2}$ to $11\frac{1}{2}$ inches.

The importance of these measurements will become more evident when we discuss pelvimetry as a means of diagnosis in pelvic deformities.

When a woman stands erect the pelvis presents a certain obliquity to the horizon, the promontory of

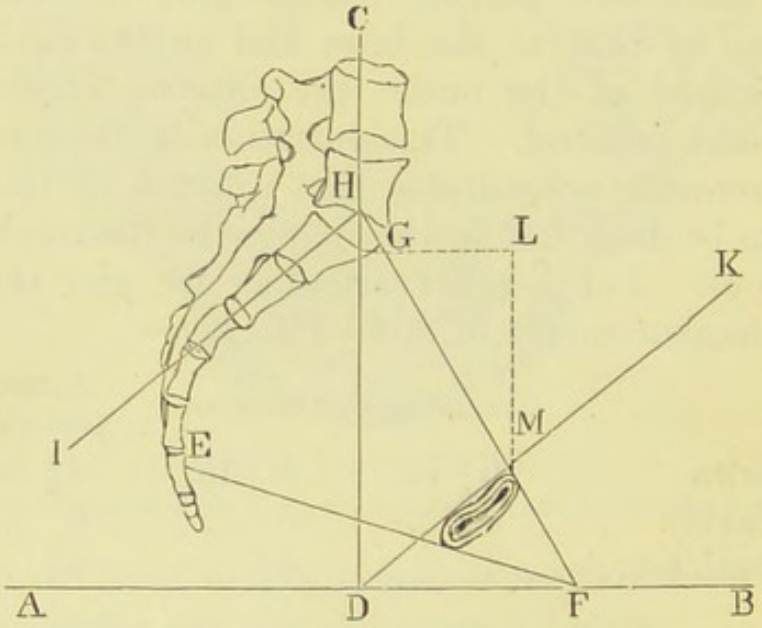


Fig. 7.

A B.—Horizon.
A F H.—Angle of inclination of brim to horizon.
F H C.—Angle of inclination of brim to spinal column.
C H I.—Angle of sacrum to spinal column.
B D K.—Angle of pubes to horizon.
L M.—Distance between relative heights of sacral promontory and upper margin of symphysis pubis, about 3 inches.

the sacrum being about $3\frac{1}{2}$ inches higher than the upper margin of the symphysis pubis; the internal surface of the symphysis pubis is deflected about 40°

from the horizontal, thus affording to the pelvic viscera a support which counteracts the effect of the large size of the pelvic outlet.

The plane of the brim, represented in Fig. 7 by a straight line taken from the promontory of the sacrum to the upper margin of the symphysis pubis, inclines towards the horizon at an angle of about 60°. The plane of the outlet, taken from the lower extremity of the sacrum to the pubic arch, forms an angle of about 15°. These two planes, if continued anteriorly, will intersect about $1\frac{1}{2}$ inch in front of and below the symphysis pubis. Tyler Smith gives a third plane, which he calls the mid-plane, represented by a line between the lower portion of the third piece of the sacrum and the symphysis pubis at the level of the upper margin of the obturator foramen, giving an angle of about 30° to the horizon. It is in this plane that rotation of the fœtal head begins.

These planes of the pelvis are used to determine the axis of the curved pelvic canal. This is accomplished by directing imaginary lines at *right* angles to the centres of the several planes (Fig. 8), when each of such lines will give the direction of the axis of that portion of the canal to which the plane whence it is derived belongs. Thus the axis of the brim will pass through the umbilicus to the tip of the coccyx

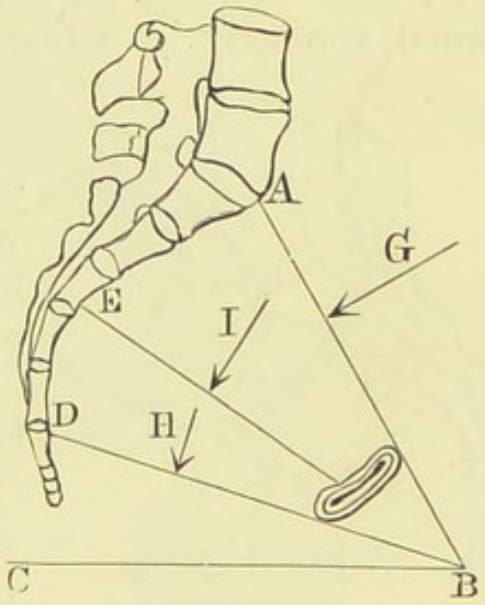


Fig. 8.—Pelvic Planes and Axes.

A B.—Plane of brim.
E B.—Mid-plane.
D B.—Plane of outlet.
G.—Axis of brim.
I.—Axis of mid-plane.
H.—Axis of outlet.

at an angle of about 30° to the horizon; that of the mid-plane or cavity will be about 60°, and that of the lower or plane of outlet about 75°.

It was formerly assumed that the axis of the pelvis as a whole could be demonstrated by striking a curve, called the *curve of Carus*, from the plane of the brim to that of the outlet, the centre from which the curve is struck being in the centre of the posterior surface of the pubic symphysis, its radius being $2\frac{1}{2}$ inches. It will, however, be easily understood that the true axis of an irregularly-curved canal cannot be represented by the segment of a circle.

In order, therefore, to ascertain the axis of the entire pelvic canal, an irregular parabolic curve is taken, passing through the centres of an infinity of lines representing the planes of the bony pelvis (Fig. 9); and beyond the plane of the bony outlet continued similarly by a line joining the centres of the planes of the canal through the soft parts below, the last portion of the curve being variable owing to the mobility of the coccyx and perineum during labour.

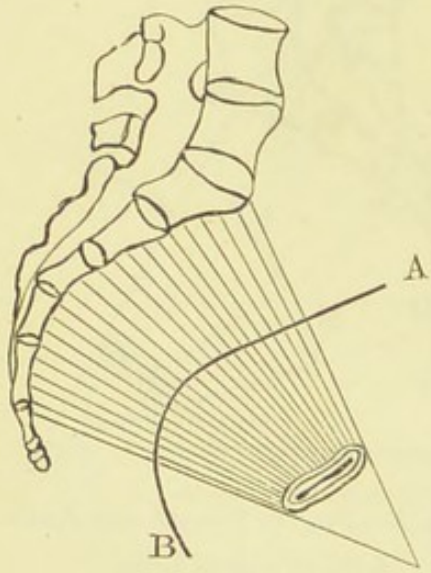


Fig. 9.

A B.—Axis of entire pelvic canal.

During the last stage of labour the perineum is carried so far forward that when the head passes the vulva, a line drawn between the margin of the pubic arch and the anterior edge of the perineum deviates only about 20° from the perpendicular. A line erected at a right angle to this points almost directly forward, and gives the axis of expulsion.

There are distinctive features existing between the male and female pelves. The male pelvis expands from before backwards, the brim being triangular. The female bones are smoother and less massive; the brim is much more expanded laterally, being oval

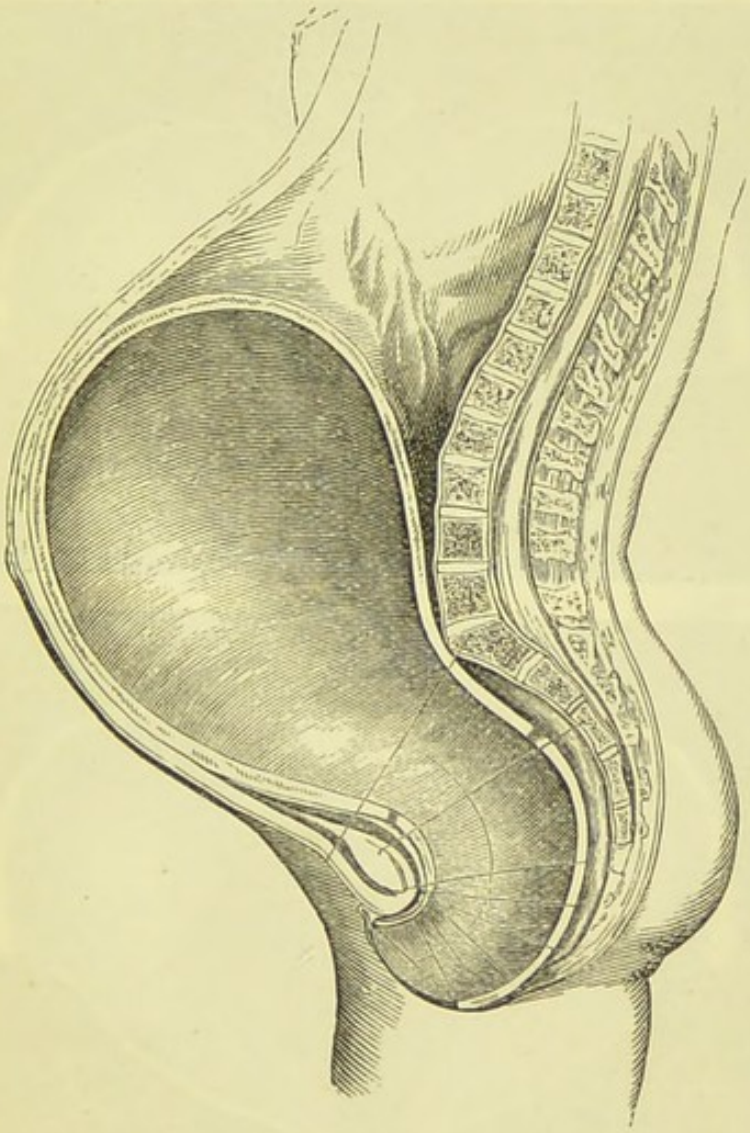


Fig. 10.—The Cavity of the Uterus, with the Parturient Canal fully dilated, showing the Axes.

in form; the ilia are spread out; the cavity is not so deep as in the male; the space between the pubes and the coccyx is greater in the female; the sacrum is broader and more concave, and inclines to the spine at a greater angle; the cartilage of the sym-

physis pubis is broader and shorter than in the male; the pelvic cavity being broader in women, the articulation of the thigh bones are farther apart. The distance between the anterior superior spinous processes of the ilia being greater in the female

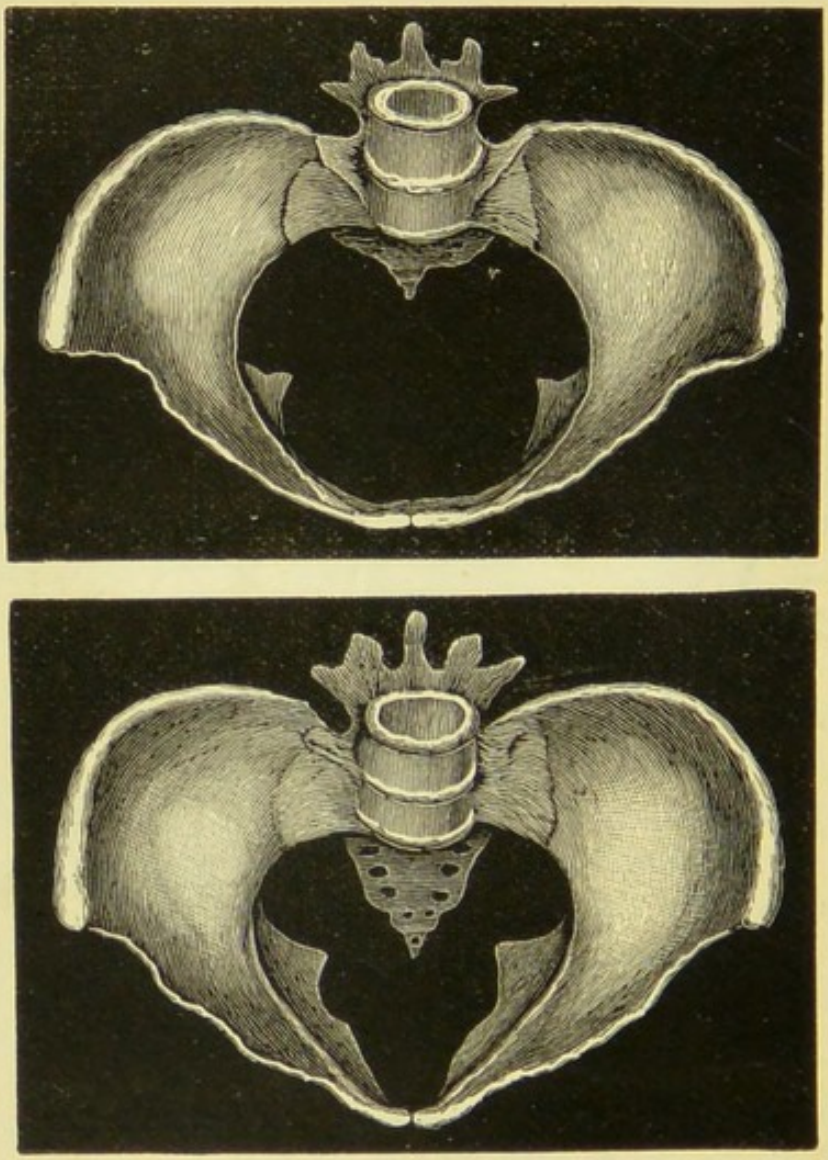


Fig. 11.—Female and Male Pelves from above.

pelvis, the capacity of the crural arch is greater, consequently there is less resistance to the abdominal viscera, which accounts for the frequent occurrence of femoral hernia in women. The tubera ischiorum are much wider apart, and the pubic arch describes

a more obtuse angle, the average for the female being 90°, whilst that of the male is 75°.

Before proceeding to mention pelvic deformities, it may be well to consider the difference between the pelvis at birth and in the adult. The importance of this is obvious, when we reflect that abnormality in shape and consequent difficulty in labour may arise from either too little or too great a change of form during its growth.

The *infantile pelvis* presents no marked sexual

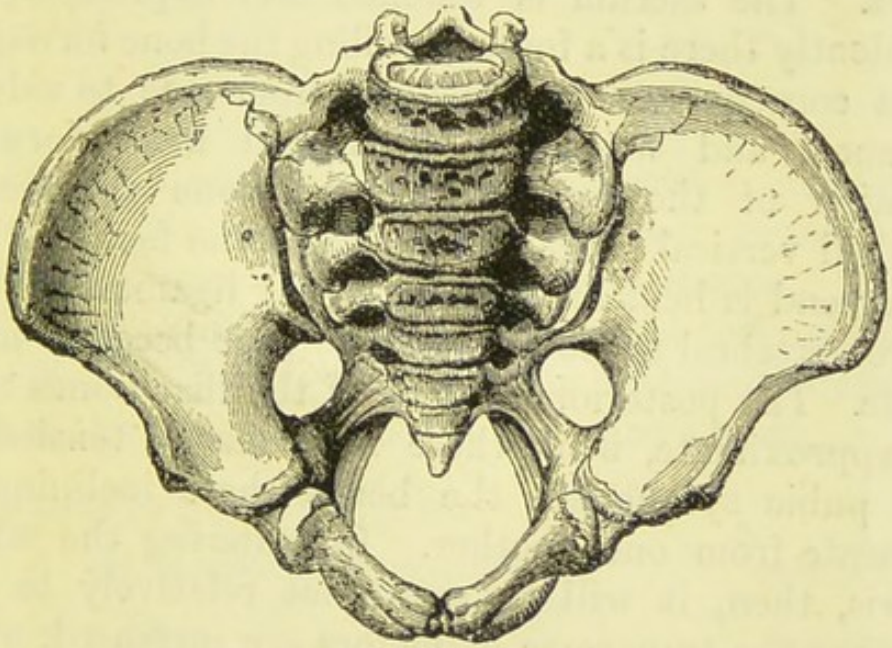


Fig. 12.—The Infantile Pelvis.

differences. In it the *sacrum* is narrow, has little or no vertical curve except at its lowest part, though it is considerably hollowed from side to side, and it is placed relatively very high up and much to the back. The iliac fossæ look much more forwards than inwards, and the largest intercristal diameter is the same or very little longer than the distance between the anterior superior spines. The horizontal rami of the *pubes* are short. The lateral walls of the pelvis approach each other below, the result being that the pubic arch is acute, and both

at the brim and in the cavity the antero-posterior diameters are as large or larger than the transverse. The factors which contribute to effect the change from the infantile to the adult pelvis are various.

The *size* becomes larger with the growth of the individual bones entering into the formation of the pelvis.

The *shape* is modified by several forces which merit consideration, the most important being the weight of the trunk.

The effect of the *body-weight* is shown in many ways. The sacrum is widened and depressed; coincidently there is a force impelling the bone forwards. As a consequence, its concavity from side to side is lessened, and with the lower and more forward position of the promontory the bone acquires a marked vertical concavity owing to the fact that the lower end is held in place by strong ligaments. The sacro-vertebral angle at the same time becomes more acute. The posterior portions of the iliac bones tend to approximate, while there is increased tension on the pubic symphysis, the bones there inclining to separate from one another. Considering the whole pelvis, then, it will be seen that relatively to one another the transverse diameters are increased, while the antero-posterior are diminished; a result which is also furthered by the action of the abdominal muscles, especially the recti.

Sitting widens the pelvis and rolls out its lower boundary, unless the tuber ischii are abnormally placed within lines drawn from the sacro-iliac synchondroses to the pubic symphysis, when the opposite effect ensues.

Femoral pressure in *walking* tends rather to narrow the pelvis. The wide contrast between the male and female pelves is hardly to be ascribed to the mere presence of different soft parts in the case of

the two sexes. Possibly later ossification in the girl contributes to the particular shape, but probably there is an inherited predisposition which causes disproportion in the rate of growth of various parts of the pelvis. Thus in the female the alæ of the sacrum and the horizontal rami of the pubes increase in size relatively more than in the male ; while, on the other hand, the depth of the pubes and the length of the sacrum attain a less marked increase in size, thus effecting the comparative wideness and shallowness of the female pelvis.

Abnormal Pelves.

Having described the characteristics and the growth of the normal pelvis, we now proceed to discuss the abnormal pelvis and its causation.

Various classifications of abnormal pelves have been given. The following table includes, perhaps, most of the abnormalities usually enumerated :—

I. *Anomalies of general type*—

1. Pelvis equabiliter justo major . . enlarged.
2. ,, ,, ,, minor
3. Infantile . . . } . contracted.
4. Masculine . . .

II. *Pelves contracted antero-posteriorly at brim* (flattened)—

1. The simply flattened—(*a*) non-rickety.
   (*b*) rickety.
2. The generally contracted flattened—(*a*) non-rickety.
   (*b*) rickety.
3. The pelvis of lumbar lordosis.
4. ,, double congenital dislocation of hips.

III. *Oblique pelves*—

1. The skoliotic pelvis.
2. The pelvis in unilateral hip-disease, femoral shortening, etc.
3. Naegelé's pelvis.

IV. *Transversely contracted pelves; and rarer forms where obstruction is most marked in cavity or at outlet—*

1. The kyphotic pelvis } transversely contracted.
2. Robert's pelvis }
3. The osteomalacic and pseudo-osteomalacic.
4. Spondylolisthetic pelvis.
5. The pelvis with growths, exostoses, fractures, etc.

Class I.—1. We need mention the *generally en-*

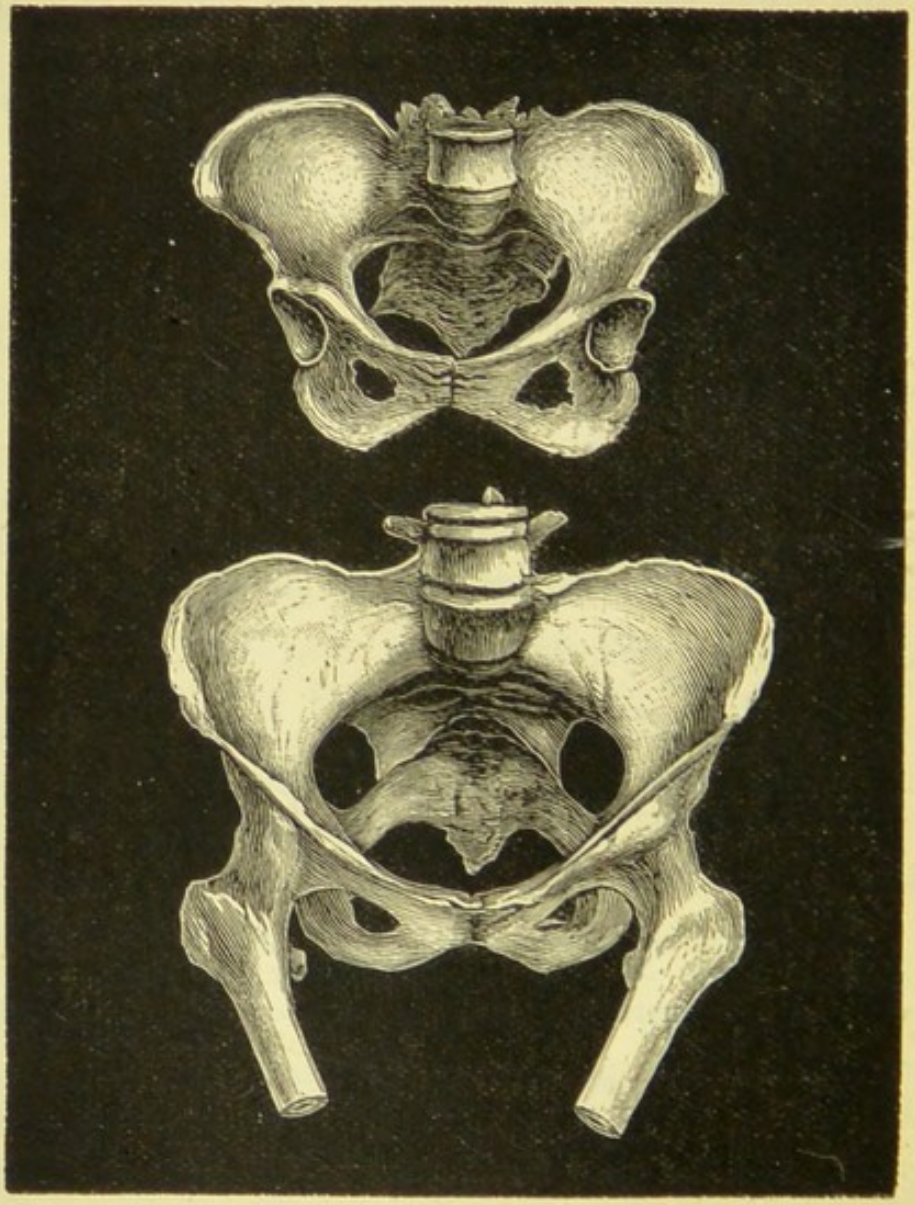


Fig. 13.—Generally Contracted and Normal Pelves.
From specimens in the Radford Museum, St. Mary's Hospital, Manchester.

larged pelvis, or *pelvis equabiliter justo major*, no further

than as being an occasional cause of precipitate labour ; it is of comparatively little obstetric importance. This large development results from a proportionate enlargement of the individual parts of the pelvis, and probably in many cases is only a local evidence of excessive development of the whole organism.

2. *Pelvis equabiliter justo minor*, or the generally contracted pelvis.—In shape this pelvis is normal, but in size it is small in all its diameters. Probably in many cases, as well as the generally enlarged pelvis, this pelvis is proportionate to the general size

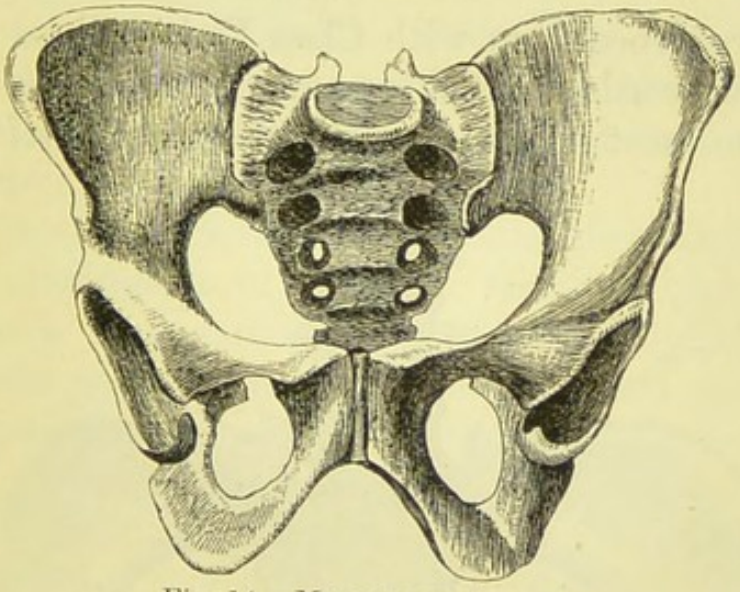


Fig. 14.—Masculine Pelvis.
From a specimen in my own Collection.

and configuration of the individual. Perhaps an early rickets of short duration, rapidly passing away, may have been the cause of the general arrest of development, without having left any marked deformity.

3. *The Infantile Pelvis.*—This pelvis retains juvenile characteristics, the sacrum being narrower and less curved than in the normal adult condition, and the whole pelvis being placed more obliquely.

4. *The Masculine Pelvis*, generally met with in tall muscular women, is so called from its approximation in build to that of the male. It is characterised by

rotundity of the brim, depth of cavity, and by narrowing of the outlet from closing in of the tuberosities and spines of the ischia, with consequent smallness of the angle formed by the pubic arch.

Measurements of a masculine pelvis in my own possession :—

	Antero-posterior.	Transverse.	Oblique.
Brim .	$3\frac{3}{4}$ in.	$4\frac{3}{4}$ in.	$4\frac{1}{2}$ in.
Cavity .	$4\frac{1}{2}$,,	$4\frac{5}{8}$,,	
Outlet .	$4\frac{3}{4}$,,	$3\frac{1}{2}$,,	

Before proceeding with Class II. it will be well to say a few words on Rickets and Osteomalacia—these being the most important causes of pelvic deformity.

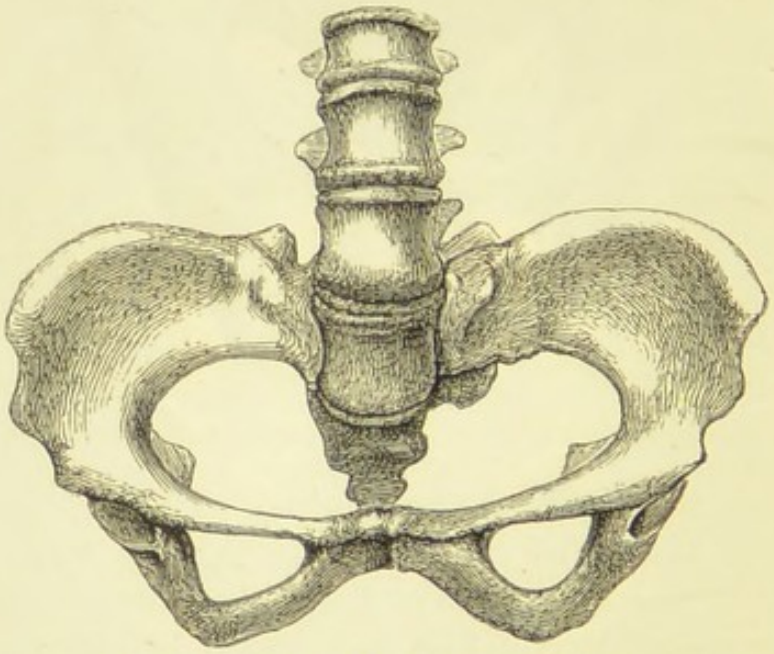


Fig. 15.—Pelvis deformed by Rickets.

Rickets attacks the osseous system whilst in process of development, causing by some disturbance of nutrition a diminution of the mineral constituents of the bones, which thus become preternaturally pliable. In normal infantile bone the organic and inorganic matters are present in about equal proportion, but in

rickets the organic matter represents about 80 per cent of the whole. There is a tendency, therefore, for the factors previously mentioned as governing the change from an infantile to a normal adult pelvis to produce exaggerated effects. As the child when labouring under this disease is unable to walk, the pelvis does not suffer from pressure transmitted by the lower extremities, but is principally affected by the weight of the trunk forcing the sacrum more than usually forwards into the pelvis so as to diminish its conjugate diameter.

When recovery takes place, this alteration in form is rendered permanent through the deposition of the earthy matters previously absent, and the consequent hardening of the bones.

Malacosteon is a disease of adult life; here also we have a diminution of inorganic matter which reduces the bones to a cartilaginous degree of pliability inconsistent with retention of their normal shape. In healthy adult bone the proportion the organic matter bears to the inorganic is as 33 to 66; in malacosteon the proportion is reversed, being as 76 to 23.

Malacosteon is a progressive disease, usually of considerable duration. In the early stage the patient is able to go about, but soon the pressure of the thigh bones on the acetabula causes the pelvis to yield in such a manner as to diminish the transverse diameter, and to give to the outline of the brim a beaked appearance (Fig. 16).

It will be observed that the contractions produced by *rickets* and *malacosteon* respectively are exactly opposed in direction, the rachitic pelvis being reduced antero-posteriorly, and the osteomalacic transversely. In the rickety pelvis the interspinous is as large or larger than the intercristal diameter; in malacosteon the intercristal is the larger. Consequently in the

rickety pelvis the iliac fossa is expanded and looks almost directly forwards, whilst in osteomalacia it is not so broad and looks more inwards. These are the characteristic deformities assumed by the pelvis in each disease, although, under exceptional circumstances, a more or less approximation in kind may take place.

Class II.—1. *The Flattened Pelvis without general contraction.*—By the term flattened is meant a condition in which the characteristic feature is a shortening of the conjugate diameter of the brim. This

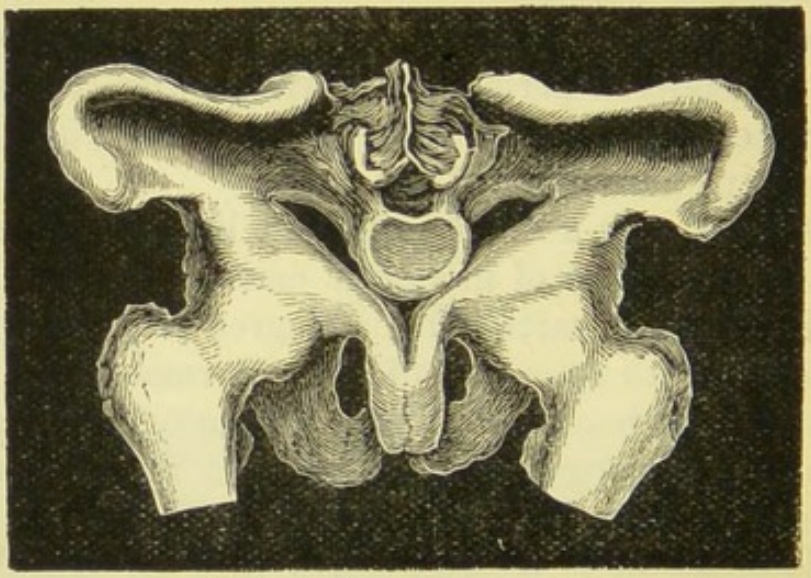


Fig. 16.—Malacosteon Pelvis.
From a specimen in the Radford Museum, St. Mary's Hospital, Manchester.

shortening is caused by an increased action of the body-weight on the position of the sacrum during the change from infantile to adult life. When the sacral promontory actually projects into the brim there follows what is called the reniform pelvis. Although two varieties of flattened pelves have been mentioned in the above table, viz. simple or non-rickety and rickety, in all probability both are due to rickets, and differ only in degree.

2. *The Flattened Pelvis with general contraction.*—As in the case of flattened pelves without contraction,

although two varieties of flattened generally contracted pelves have been given in the table, doubtless their etiology is the same, and due in each case to rickets. This pelvis presents shortening of the transverse and oblique diameters, as well as of the conjugate, though the lateral shortening is predominant. The flattening is caused by the undue sinking and projection forwards of the sacrum, and the general contraction is the result of want of development of the bones because of the rickety predisposition. The smallness of the individual pelvic bones is very noticeable.

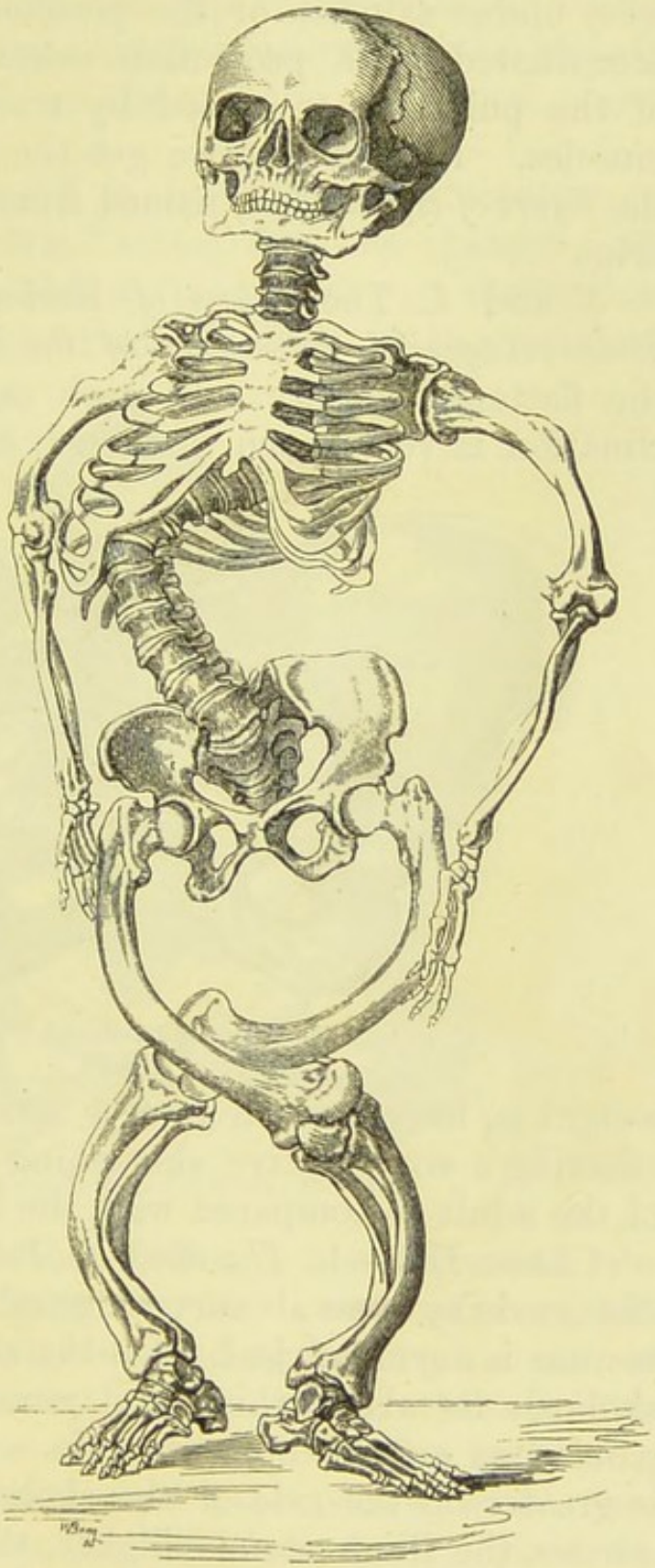


Fig. 17.—Skeleton of a Dwarf with Skolio-rachitic Pelvis.

Shortening of the conjugate in rickety pelves from undue salience of the promontory may also be accentuated by a projection inwards of the bodies of the pubic bones caused by traction of the recti muscles. In this case we get the variety known as the *figure-of-eight pelvis*, named from the shape of the brim.

3 and 4. The *pelves of lumbar lordosis* and of *double congenital dislocation of the hips* are both of the flattened variety. In each case the pelvic inclination is very much increased, causing the body-

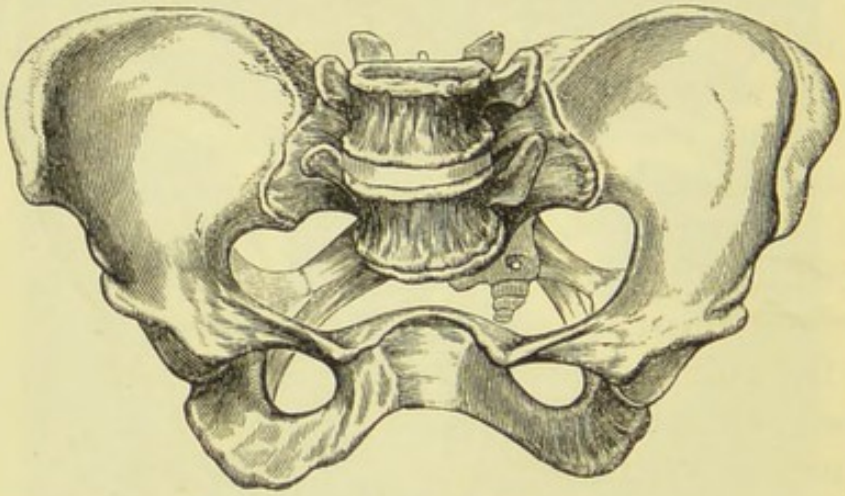


Fig. 18.—Figure-of-Eight Pelvis.

weight to have a much greater action than normal in effecting a comparative shortening of the conjugate of the adult as compared with the infant.

Class III.—1. *The Skoliotic Pelvis*—the pelvis as distorted by lateral curvature of the spine.—The sacrum is asymmetrical. On the side of the lumbar skoliosis its ala is thick and strong, but not so expanded as on the opposite side. Femoral pressure is greater on the side of the skoliosis, and in consequence the ilium stands higher, the iliac fossa looks more inwards, and the pelvic brim is elevated on the same side, whilst the symphysis is displaced to the

opposite side. The area of the brim is therefore much diminished on the side of the lumbar curvature. In many cases skoliotic pelves exhibit rickety flattening as well as the oblique distortion above described.

Dr. C. J. Leopold, in his exhaustive treatise on the "Ricketic Pelvis," states that the characteristic peculiarities of a rickety pelvis are not diminished by a more or less marked skoliosis of the vertebral

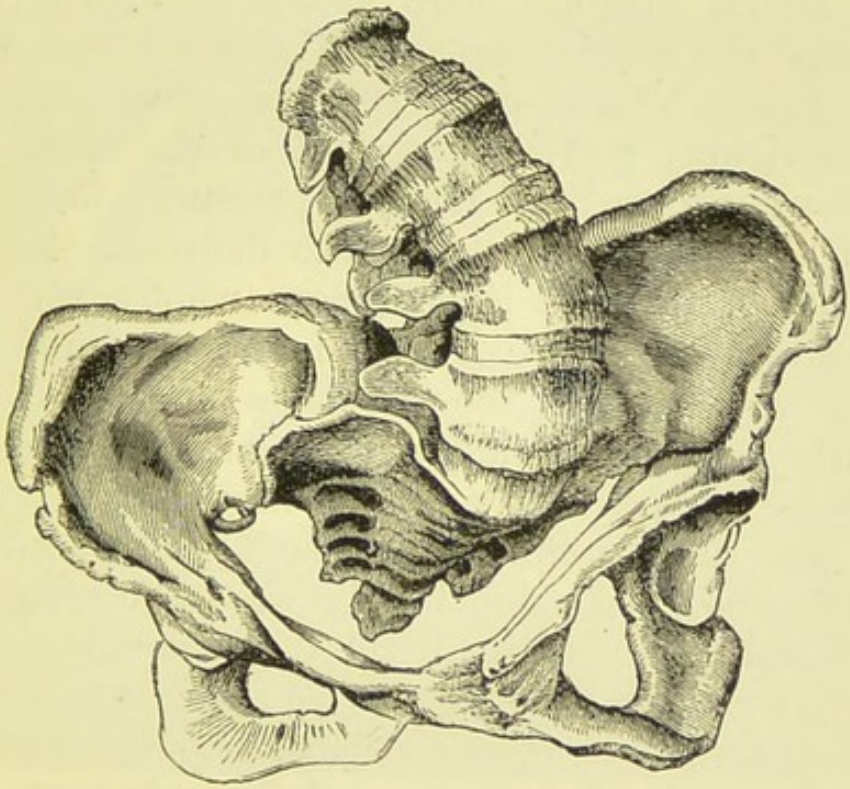


Fig. 19.—Skolio-rachitic Pelvis.

column; but, on the contrary, are increased, the pelvis, however, being rendered asymmetrical, the degree of asymmetry depending on the amount of skoliosis. The cavity of a skolio-rachitic pelvis has a definite shape—the inlet takes the form of a blunt, obliquely compressed heart shape, with more or less narrowing on the side of the lumbar skoliosis, and widening on the opposite side. The outlet, on the contrary, is wider on the side of the skoliosis,

and narrower on the other side. In the simple rachitic pelvis the antero-posterior diameter of the outlet is about 52 per cent larger than the conjugate of the brim; in the skoliotic form the difference ranges from zero to 34 per cent, the average being only 17 per cent. (In the kypho-skoliotic pelvis, on the contrary, these relations are reversed, the antero-posterior diameter of the outlet being less than the conjugate of the brim.) The asymmetry results from lateral pressure being associated with forward pressure, the relative amount of either factor determining the character of the deformity. In the simple rickety pelvis the weight of the trunk produces a downward and forward pressure; but when, as in skoliosis, the vertebræ are deflected sidewise, the line of pressure is no longer wholly vertically median; it takes also a lateral direction, and thus the balance between the two sides of the pelvis is disturbed. On the side of the lumbar skoliosis the distance between the anterior superior iliac spine and the tuber ischii is greater by $1\frac{1}{2}$ centimetre than on the other side; but between the symphysis pubis and the tuber ischii the distance is less. Dr. Champneys, in a very instructive analysis of a series of skoliotic pelves, draws attention to the necessity of studying the skeleton as a whole, as in some cases the lumbar skoliosis may be on one side and yet the weight fall on the other, due probably to skoliosis in the upper portion of the spine; also that both sides of the pelvis may show signs of pressure, due probably to alternate skoliosis of different dates in the upper part of the spine,—facts to be remembered in studying pelves apart from their vertebral columns.

2. *The pelvis in hip-joint disease, femoral shortening, etc.*—In cases where one leg is not used because of hip-joint disease, anchylosis, or amputation of the

thigh, the pelvis is obliquely distorted, being compressed on the *opposite* side. On the other hand, when a shortened leg is used the pelvis is oblique, being smaller on the *same* side.

3. *The oblique pelvis of Naegelé* is specially characterised by anchylosis of one sacro-iliac joint, either, as he thought, from original error of development, or, as others hold, from pathological changes after the formation of the joint. The corresponding side

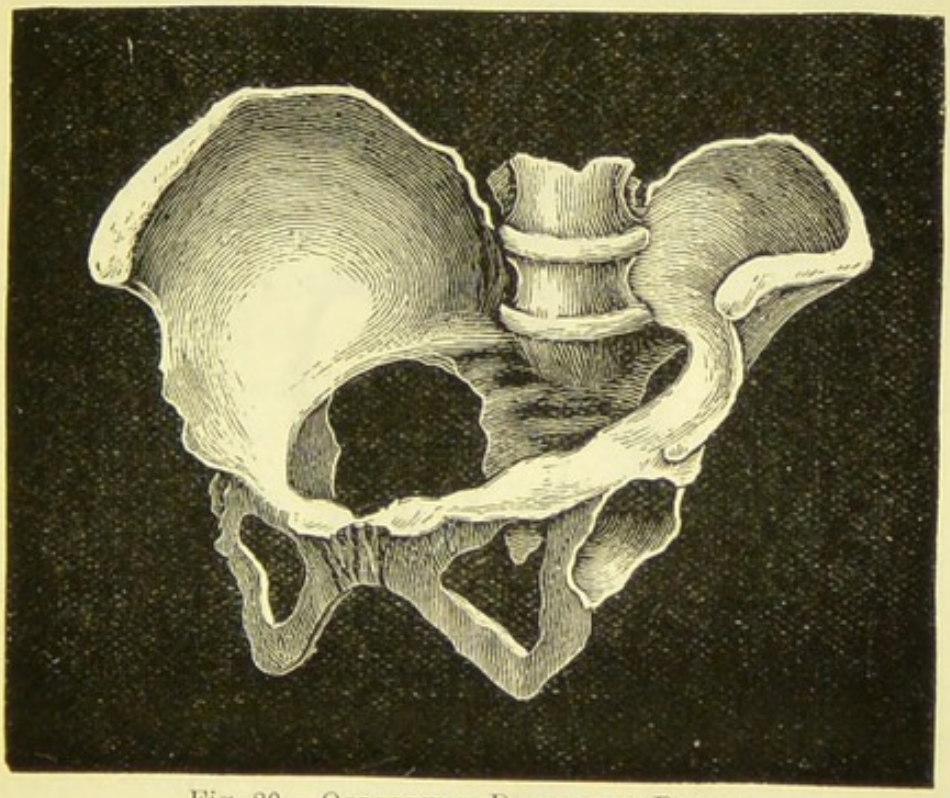


Fig. 20.—Obliquely Distorted Pelvis.
From a cast in the Museum of St. Mary's Hospital, Manchester.

of the sacrum and its foramina are small, the ischial spine and tuberosity are pushed upwards, inwards, and backwards, and the ilio-pectineal line on the affected side is almost straight, the symphysis pubis being diverted across the middle line. The oblique diameter from the sound sacro-iliac joint to the opposite ilio-pectineal eminence is much shortened, while the oblique diameter measured from the anchylosed joint is normal or elongated.

Class IV.—1. *Kyphotic Pelvis.*—The kyphotic pelvis (Fig. 21), as its name implies, is caused by curvature of the vertebræ backwards. When this takes place at the lumbo-sacral region, the sacral promontory ceases to exist save in name, the upper part of the bone curving directly backwards, the lower part projecting forwards, which changes the normal sacral curve into one of sigmoid outline. The antero-posterior diameter of the brim is greatly increased, as, to

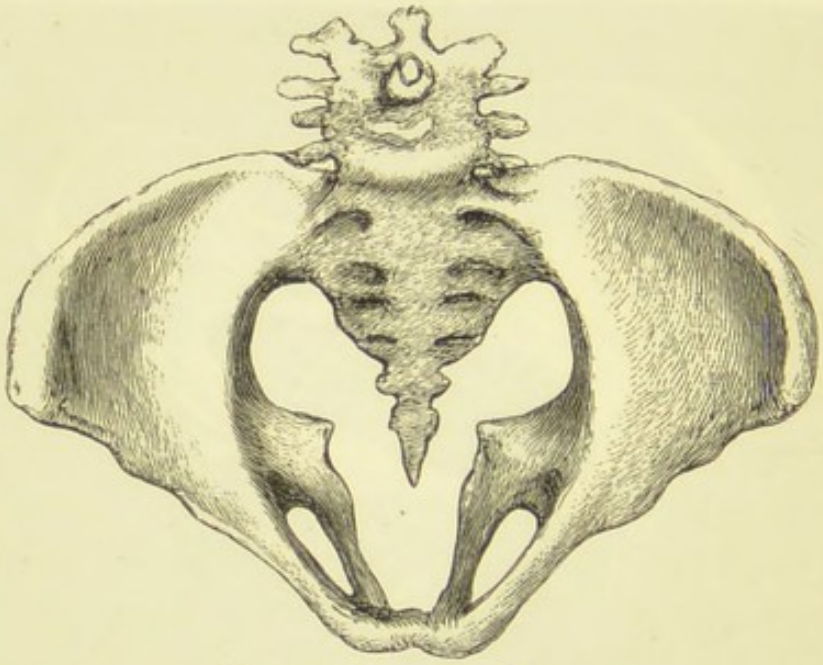


Fig. 21.—Kyphotic Pelvis.
From a specimen in my own Collection.

a lesser extent, is the oblique; the ischial tuberosities approach each other and the pubic arch is lessened, all the diameters of the outlet being diminished.

When kyphosis is associated with rickets, more or less skoliosis is likewise usually present; Dr. Leopold shows that in such pelves three abnormal influences are to be observed—(1) the signs of rickets; (2) the asymmetry following the skoliosis; and (3) the kyphotic changes which tend to diminish the effect of the rickets. The sacrum is rotated

backwards on its transverse axis, and is situated on a higher level than it usually occupies with respect to the ossa innominata ; it is also longer and narrower than normal, and presents, as in simple rickets, the usual convexity of the bodies of the vertebræ which compose it. Skoliosis exerts its special influence in producing asymmetry of the pelvis, but not to the extent met with in the skolio-rachitic pelvis. In the kypho-skolio-rachitic pelvis the inlet is more or less rounded, contracted eventually on one side, corresponding to the skoliotic type ; there is relative or absolute increase of the true conjugate, which, however, is always exceeded by the greater transverse measurement. The conjugate is enlarged as regards the skoliotic pelvis and approaches the pure kyphotic type. The antero-posterior measurement of the outlet is diminished, not relatively merely but absolutely. The sacrum, as before said, is narrower, and resembles the kyphotic form.

2. *The transversely contracted pelvis of Robert* is the rarest of all pelvic deformities. In this pelvis both sacro-iliac synchondroses are anchylosed, both sacral wings are ill developed, the sacral foramina being small, and the whole sacrum is rather quadrilateral than wedge-shaped. At the same time its vertical concavity is obliterated. The posterior portions of the iliac bones project considerably behind the sacrum, the ischia approach the sides of the sacrum and each other, and the margins of the pubic arch are nearly parallel ; the brim of the pelvis is oblong, the conjugate being greater than the transverse diameter. This disproportion increases inferiorly in the cavity which is deep, and is more marked still at the outlet. In a fine specimen of this form of pelvis in my possession, the ilia are so thin as to be translucent when held up to the

light. The dimensions of this pelvis are given below, and an account of the case from which it was taken

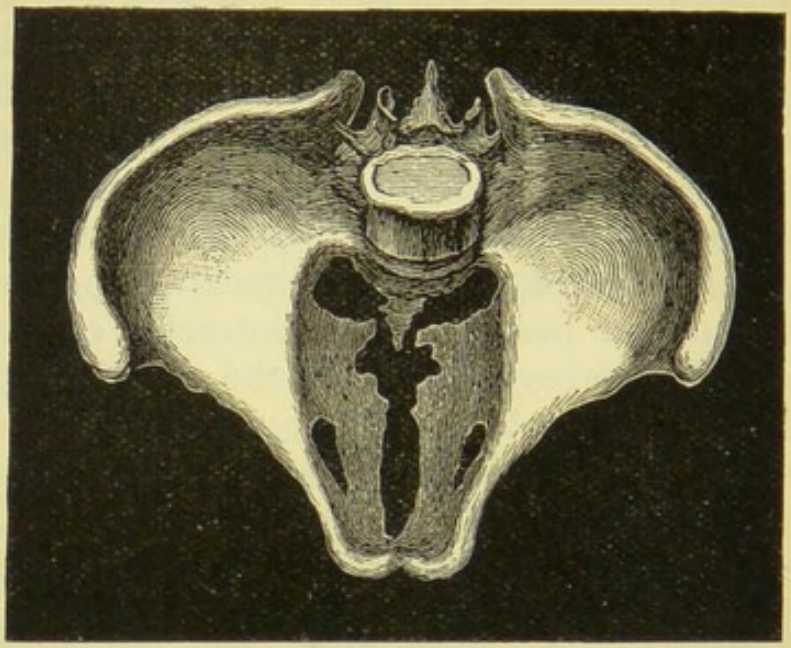


Fig. 22.—Transversely Contracted Pelvis of Robert.
From a specimen in my own Collection.

will be found in the ninth volume of the *Transactions* of the Obstetrical Society of London :—

	Ant.-Posterior.	Transverse.
Brim .	4 inches.	$3\frac{1}{4}$ inches.
Cavity .	$5\frac{1}{8}$ „	$2\frac{3}{4}$ „
Outlet .	$4\frac{3}{8}$ „	$1\frac{3}{8}$ „

3. *The Osteomalacic and Pseudo-osteomalacic Pelves.*—As already noted, osteomalacia attacks the bones of adult, generally multiparous, women. The disease ordinarily appears associated with child-bearing, and is generally progressive, the deformity increasing with every pregnancy. Occasionally, however, there may be a cessation of the disease with a return of the normal constitution of the bone, and permanence of any deformity present. Etiologically considered, mollities ossium is met with in the poor who have

insufficient and unsuitable food, and who live and work hard under bad sanitary conditions. I have never seen or heard of a case in the well-to-do. Further, whereas dystocia from mollities ossium was not infrequent in earlier days in connection with the maternity work of the St. Mary's Hospital, I only know of four cases having occurred there between 1858 and 1894, during which period 81,468 deliveries took place. I therefore cannot give to climatic conditions as important a position in the causa-

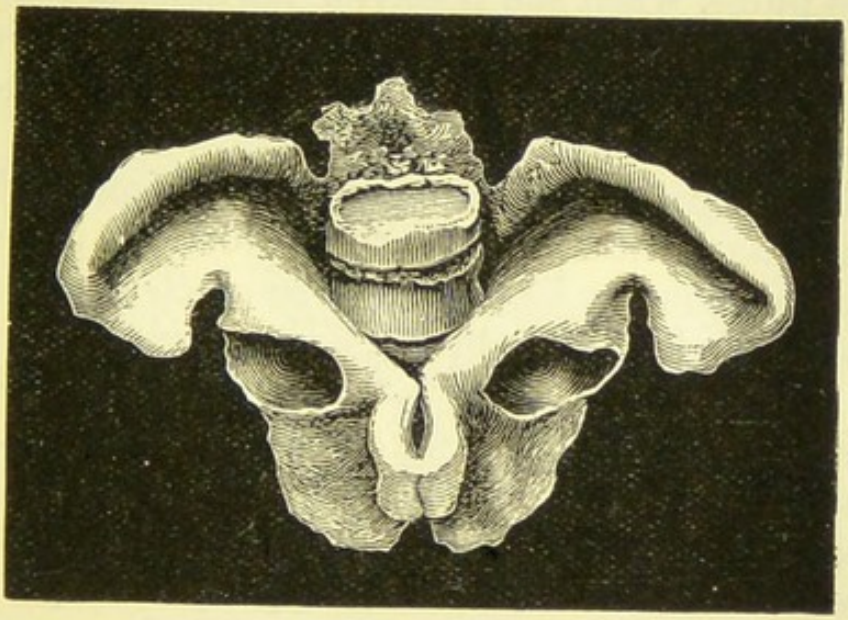


Fig. 23.—Malacosteon Pelvis.
From a specimen in the Radford Museum, St. Mary's Hospital, Manchester.

tion of the disease as various authorities have done. Pathologically the bones show proliferation of the soft medullary tissue, with absorption of the bone salts, and when very advanced the consistence has been likened to wax or rubber. The student may not inaptly compare it with that of softened *gutta-percha* splints.

The pelvic deformity of mollities ossium is due to the combined effect of the body-weight and femoral pressure on the softened bony girdle. The marked typical difference between typical rickety and malacos-

teon pelves is to be ascribed mainly to two causes—first, that in rickets the malformation originates before the child walks, whilst in malacosteon the patient walks or stands for some time after the onset of the disease; secondly, that in rickets the growing edges of the bones are the parts particularly involved, and the innominate bones are not so wholly and completely softened as to be devoid of the leverage action which tends to cause the anterior parts of the two bones to separate from one another at the symphysis pubis, when the posterior portions are drawn towards each other by the sacro-iliac ligaments owing to the downward and forward pressure on the sacrum caused by the body-weight.

The osteomalacic sacrum is narrow from side to side, and its vertical concavity is considerably increased by the promontory being driven so much downwards, forwards, and inwards by the body-weight. The vertical height of the bone is much lessened, and the obstetrical conjugate is taken, not from the sacral promontory, but from one of the bodies of the lumbar vertebræ to the pubes. Walking and standing has caused the acetabula to approach the promontory and each other. The pubes, therefore, assumes a beak-shape, and as the anterior part of the iliac expansion on each side nears the middle line, the iliac crest is more than usually concave on its inner aspect. The iliac fossa is small but deep, and looks inwards, and the interspinous diameter is considerably less than normal and smaller than the distance between the iliac crests; the tubera ischii are also pushed inwards, and occasion very great obstruction about the outlet.

The Pseudo-osteomalacic Pelvis.—It has been intimated previously that while ordinarily rickets and osteomalacia produce different characteristic deform-

ities, there may be under special circumstances an approximation in shape. In cases of very severe prolonged rickets, where the bones are more generally softened and the disease persists until after the child stands and walks, the pelvis assumes a tri-radiate form, the acetabula being pushed upwards, backwards, and inwards, as well as the promontory being driven downwards, forwards, and inwards. There is thus produced the variety named by Michaelis the pseudo-osteomalacic pelvis. It is distinguished from

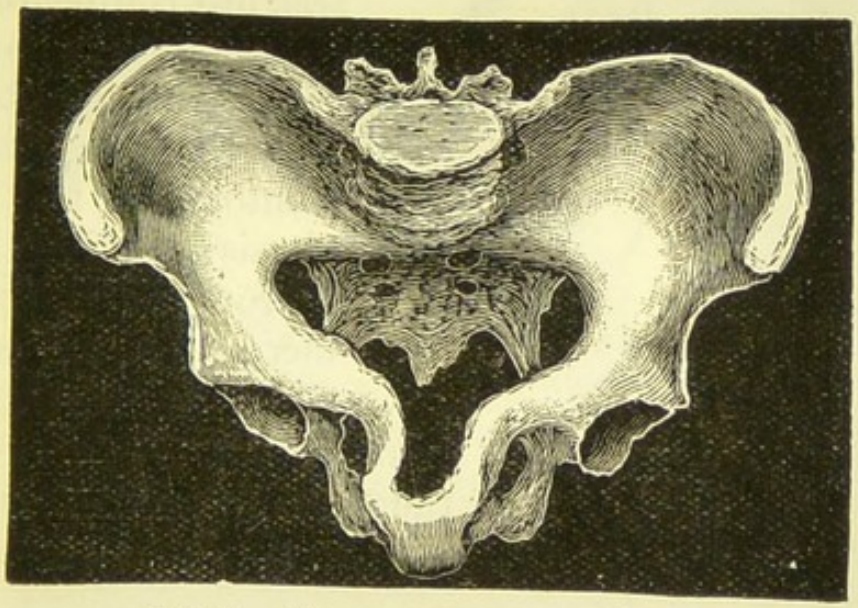


Fig. 24.—Pseudo-osteomalacic Pelvis.
From a specimen in the Radford Museum, St. Mary's Hospital, Manchester.

the true osteomalacic pelvis by its rigidity, its small size, especially as regards the iliac bones, and by the different deformity of the iliac fossæ already mentioned as typical of the two diseases—rickets and malacosteon. In the pseudo-osteomalacic pelvis, as is usual in rickets, the iliac fossa looks forwards, and the distance between the antero-superior iliac spines exceeds that between the iliac crests.

4. Amongst the rarer forms of pelvic contraction is the *Spondylolisthetic*, in which the lumbar vertebræ

glide forwards in front of the upper part of the sacrum, pushing that bone backwards, and at the same time causing its apex to project forwards into the pelvis, and so to lessen the antero-posterior diameter of the outlet. The brim is narrowed transversely, and the obstetrical conjugate has to be taken from one of the lumbar vertebræ and not from the promontory to the symphysis pubis. The narrowing of the pelvis increases towards the outlet by the approximation of the tubera ischii, and also the strong projection forwards of the coccyx. The difficulty during labour, therefore, increases towards the outlet.

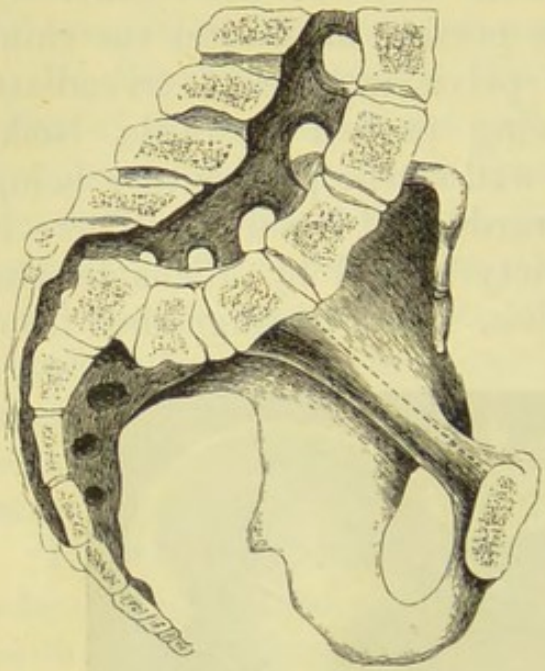


Fig. 25.—Spondylolisthetic Pelvis. (After Kilian.)

5. *Pelves deformed by growths, fractures, etc.*—An osseous growth may render an otherwise normal pelvis unfit for the passage of a child. Such growths most commonly affect the sacrum, and Fig. 26 illustrates a cast in the museum of St. Mary's Hospital, Manchester. Cæsarian section was performed by M'Kibbin. A variety called the thorny pelvis is beautifully illustrated by a specimen in my possession. There is a projecting spiculum of bone from each ilio-pectineal line on the sides of the brim, and the lumbar intervertebral substances are cased in by arched processes of bone extending from side to side. The adventitious growths caused the rupture

of the lower segment of the uterus during labour, from which the woman died.

Fractures of the pelvis may heal with the production of irregularities such as may considerably impede labour. A mild deformity of such origin is illustrated in Fig. 27 from a specimen in the museum at St. Mary's Hospital.

Other non-bony growths, as fibromata, enchondromata, or malignant tumours, may lead to various irregular deformities. Litzmann has given the name

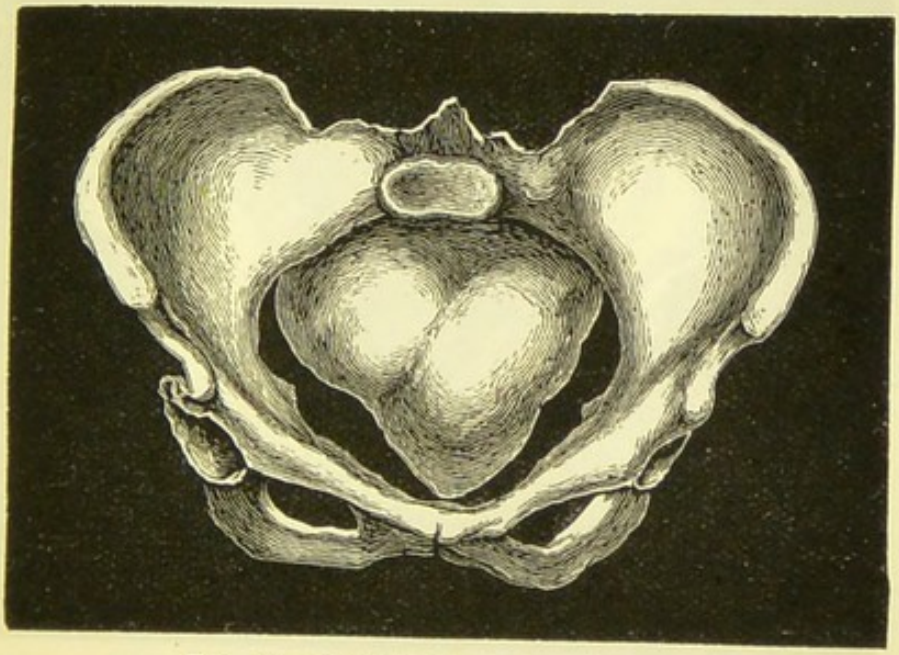


Fig. 26.—Exostosis of the Sacrum.

of split pelvis to cases of congenital absence of the symphysis. The deformity is generally attended by coexistent anomaly of the soft parts, as ectopion vesicæ. The pelvis is a somewhat flattened one, with transverse expansion, but the deformity causes little interference with the progress of labour.

Pelvimetry.—In the living subject the diagnosis of the size and shape of the pelvis is made by measurements taken externally or internally.

External pelvimetry is not so important as internal pelvimetry. Baudelocque's pelvimeter is the instru-

ment generally used. It consists of a large pair of callipers with semicircular metallic blades, and is furnished with a scale indicating the distance between the bulbous extremities of the blades.

As mentioned when considering the dimensions of the normal pelvis, the chief measurements to be taken are the external conjugate, the interspinous, and the intercristal.

The external conjugate (from the last lumbar

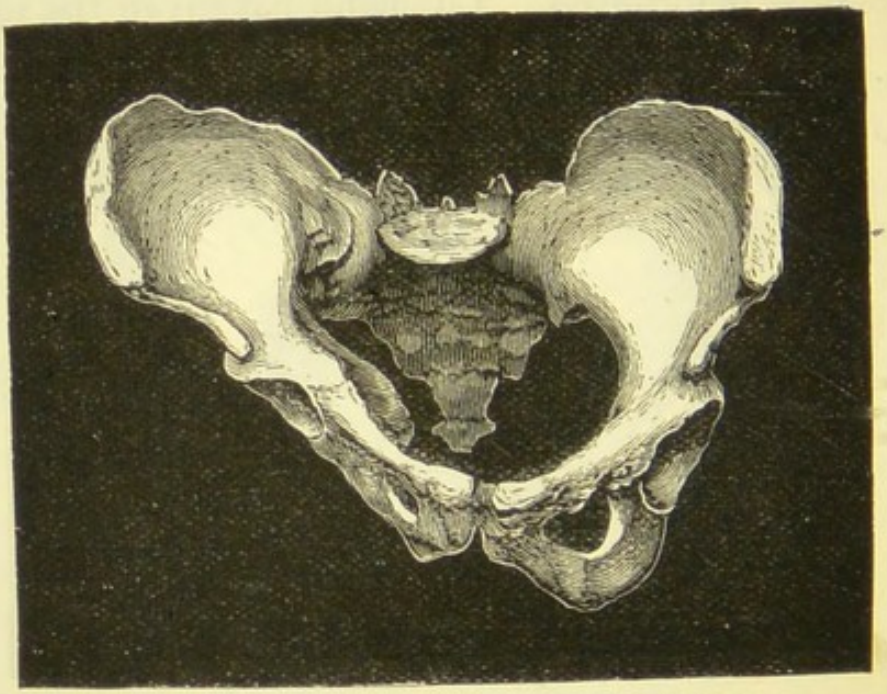


Fig. 27.—Deformity produced by Fracture.
From a specimen in the Radford Museum, St. Mary's Hospital, Manchester.

spine to the top of the pubic symphysis) measures normally $7\frac{1}{4}$ inches. It is generally stated that this measurement exceeds the true conjugate of the brim by about 3 inches, consequently an external conjugate markedly less than normal indicates flattening of the pelvis ; and, on the other hand, a conjugate larger than $7\frac{1}{2}$ inches points to an increased antero-posterior diameter of the brim.

The interspinous diameter (from one anterior

superior iliac spine to the other) and the intercristal (taken between the centres of the iliac crests), measuring normally about $9\frac{1}{2}$ and $10\frac{1}{2}$ inches re-

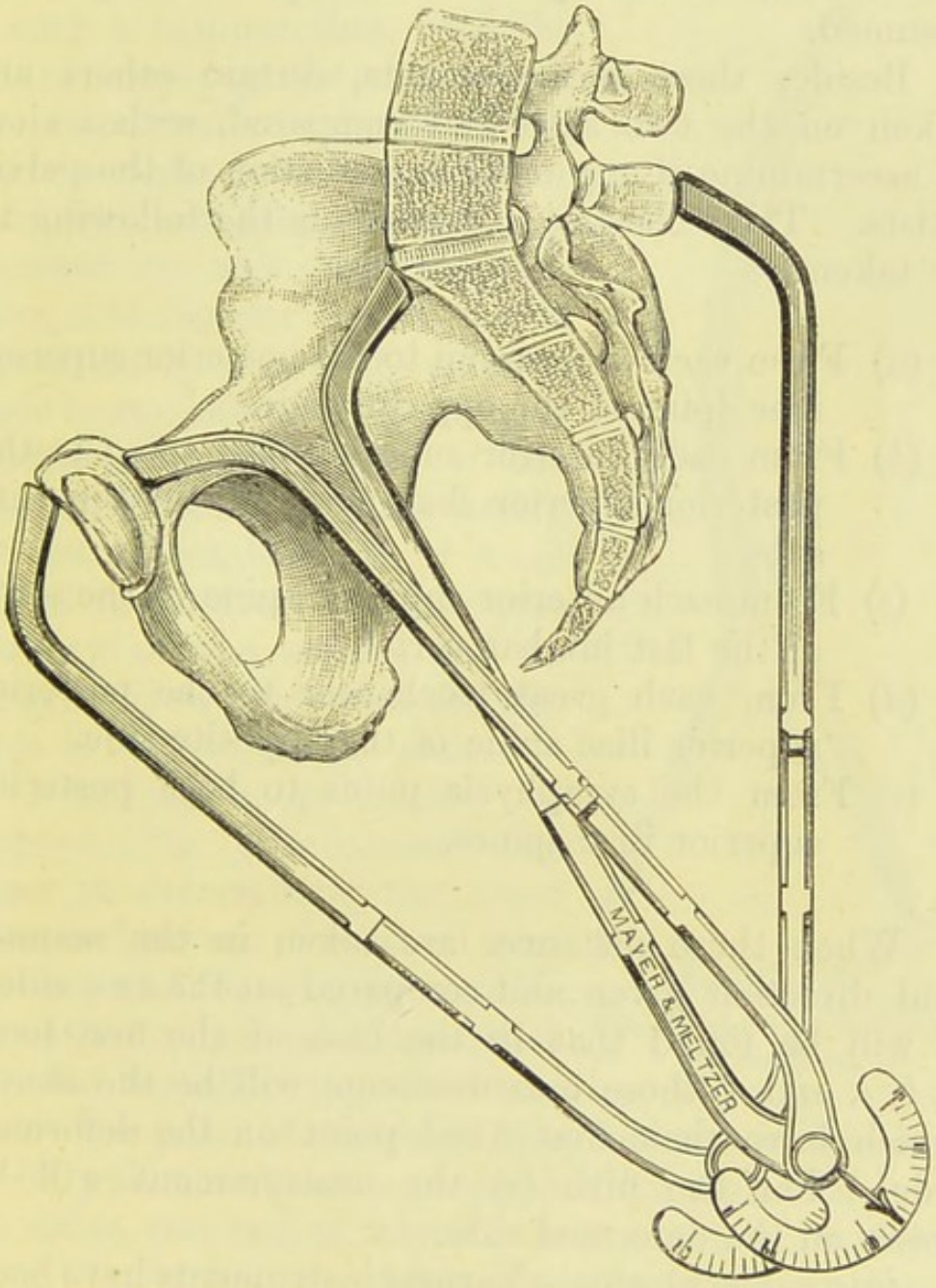


Fig. 28.—A Modified Pelvimeter suitable for both Internal and External Pelvimetry.

spectively, must be considered with regard to both their absolute and relative size. Should both be smaller than normal, but still having their normal

relation to one another, a generally contracted pelvis would be indicated. On the other hand, should the interspinous diameter be as large or larger than the intercristal, a rickety deformed pelvis might be assumed.

Besides these measurements, certain others are taken on the two sides and compared, with a view of ascertaining if any oblique distortion of the pelvis exists. Thus Naegelé recommends the following to be taken :—

(*a*) From each tuber ischii to the posterior superior iliac spine of the opposite side.
(*b*) From each anterior superior iliac spine to the posterior superior iliac spine of the opposite side.
(*c*) From each anterior superior spine to the spine of the last lumbar vertebræ.
(*d*) From each great trochanter to the posterior superior iliac spine of the opposite side.
(*e*) From the symphysis pubis to both posterior superior iliac spines.

When these distances are taken in the manner and direction given and compared on the two sides, it will be found that in the case of the first four, *a*, *b*, *c*, and *d*, those measurements will be the *shorter* which have their first fixed point on the deformed side. For the fifth (*e*) the measurement will be *longer* on the deformed side.

Internal pelvimetry.—Various instruments have been devised for use as internal pelvimeters. We shall mention them only briefly, because none has any advantage over the fingers or hand of the operator. Coutouly's pelvimeter, one of the earliest, working on the principle of the shoemaker's rule, but with

an indicating scale at the handle, is used to measure the true conjugate.

Lumley Earle's pelvimeter is shown in Fig. 29. Two curved blades are centred in such a manner that, with the aid of a spring, the ends which are introduced into the pelvis are kept in contact with each other until, by closing the handles, they separate to any required distance, and register the amount of separation by means of an index made to move along the graduated quadrant on which one of the handles slides. In introducing the instrument, the ends of it are guided respectively on to the promontory of the sacrum and to the symphysis pubis, and the distance is read off on the scale.

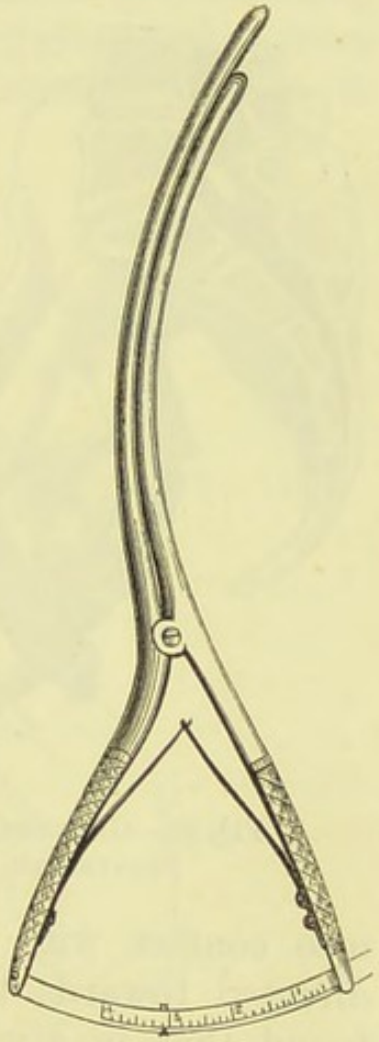


Fig. 29.—Lumley Earle's Pelvimeter.

Greenhalgh's pelvimeter is adapted (Fig. 30) to assist the finger in determining the exact distance between the sacral promontory and the symphysis pubis in contracted pelves. It consists of a flat metallic ring which encircles the palm of the hand, the instrument having on its palmar aspect a projection through which a rod slides, one end of which is curved, so as to glide along the forefinger. After adapting the instrument to the hand, the forefinger is passed up the vagina until it reaches the sacral promontory, when the rod is drawn out until the curved part which moves along the finger touches the symphysis pubis. The hand is now withdrawn, and the distance between the

end of the rod and the tip of the finger equals the inclined conjugate.

For all practical purposes, however, the hand of the obstetrician is the best pelvimeter. It can be used to measure the inclined conjugate, the true conjugate of the brim, and the antero-posterior and transverse diameters of the outlet; and by its means also a fairly accurate knowledge of any existing obliquity can be obtained.

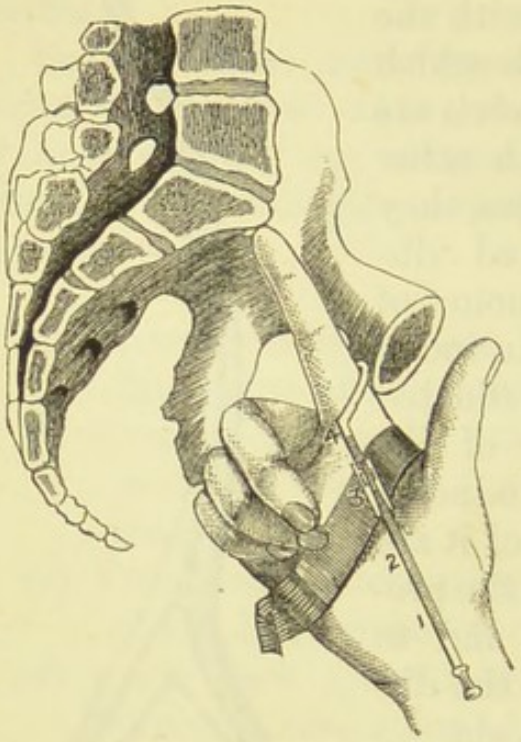


Fig. 30.—Greenhalgh's Pelvimeter.

The inclined conjugate can be measured in two ways. If the forefinger of the right hand is passed up the vagina until the knuckles come into contact with the buttocks, and the finger-tip directed towards the sacral promontory, it will be found that in a well-formed pelvis the promontory cannot be reached. If, therefore, the finger *does* touch it, the pelvis, so far as its antero-posterior diameter goes, is under the normal standard. The length of the inclined conjugate is obtained by measuring with a tape from the point of the finger to that portion of its radial border on which the symphysis pubis is felt to impinge.

The other method is carried out by introducing the first two fingers of the left hand. The tip of the second finger is placed on the promontory, and the side of the first is made to touch the lower edge

of the symphysis, the distance, as in the previous method, being taken by a tape-measure.

Having thus measured the inclined conjugate, the true conjugate can generally be obtained by subtracting two-thirds of an inch. Spiegelberg gives rather more precise instructions because of certain sources of

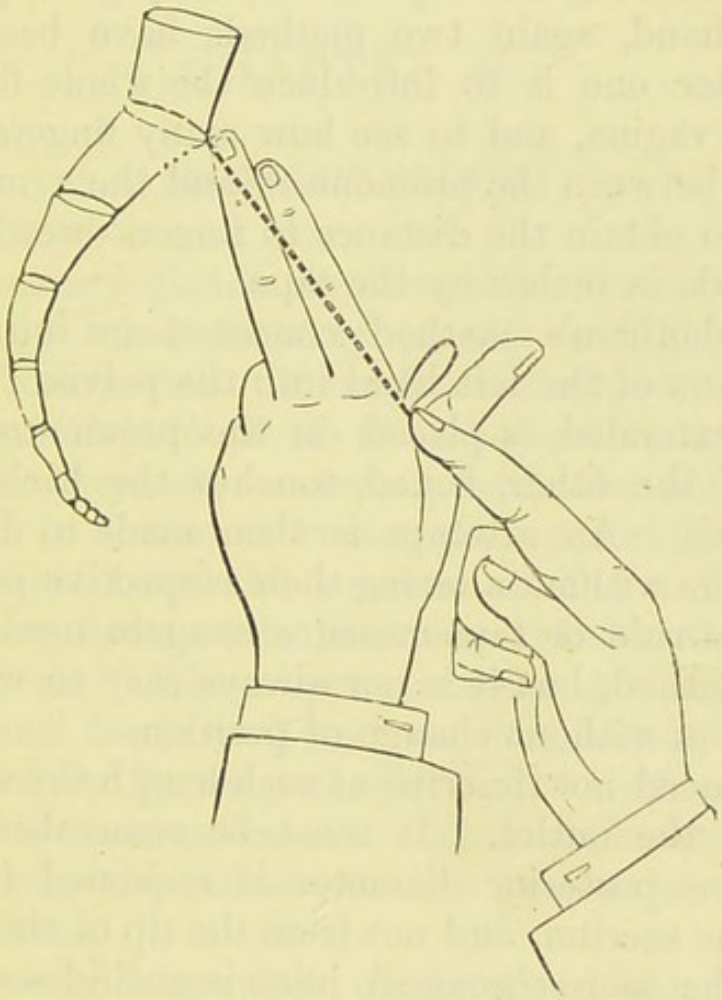


Fig. 31.—Left Hand measuring the Inclined Conjugate.

fallacy in various pelves. Thus in some cases the symphysis pubis is deeper than in others, and he recommends that this should be measured by one finger through the anterior vaginal wall. He states that with a length of 1·5 inch and less the amount to be subtracted is about 0·6 of an inch; with a greater length, about 0·75 of an inch. He also

directs that a little allowance should be made when the pubic symphysis is unduly inclined to be horizontal (in which case rather less should be subtracted), and when the sacral promontory is very high compared with the pubes (in which case rather more should be subtracted).

In measuring directly the true conjugate by means of the hand, again two methods have been used. The better one is to introduce the whole flat hand into the vagina, and to see how many fingers can be inserted between the promontory and the symphysis; that is, to obtain the distance in fingers'-breadths and afterwards in inches by the tape.

Ramsbotham's method consisted in introducing two fingers of the left hand into the pelvis. The tip of one, extended, is placed on the promontory; the point of the other, flexed, touches the back of the symphysis. An attempt is then made to draw out the fingers without altering their respective positions, when the rule or tape-measure is again used. Such is the method, but it is not always easy to withdraw the fingers without change of position.

One need not describe at such length the measurement of the outlet. It must be remembered that the antero-posterior diameter is reckoned from the tip of the sacrum, and not from the tip of the coccyx, unless the sacro-coccygeal joint is anchylosed. The transverse diameter is taken between the two tubera ischii.

Finally, there only remains to be added that if the whole hand be introduced, a tolerable exploration of the space on each side of the promontory can be made; if any obliquity exists, the available area will be found smaller on the affected side.

CHAPTER II

MAMMARY GLANDS

The mammary glands are normally two in number; occasionally supernumerary nipples and glands are seen in both sexes. In the human subject they are situate on the front of the chest-wall; in other mammalia they are connected with the abdominal parietes. In the adult woman they generally extend on each side from the sternum to the axilla, and from above downwards from the third to the sixth or seventh rib. The proper gland tissue is supported by a fibrous framework and capsule, and is further surrounded by an amount of fat, the different sizes of the whole mamma as met with in different women being chiefly dependent on the proportion of the adipose tissue.

The fascial framework of the gland isolates each lobe almost completely from the others; hence the fact that mammary abscesses are so often multilocular, necessitating several incisions and the breaking down of septa before the pus can be satisfactorily evacuated.

In shape the gland is almost hemispherical, being nearly circular when viewed from the front, and plano-concavo-convex on section, perpendicular to the chest-wall. The nipple is a projection situate

a little below the centre of the mamma. It is surrounded by the areola, which is a pigmented patch of skin, on the surface of which is a number of small prominences corresponding to sebaceous glands, the secretion of which serves to lubricate the part during lactation.

The nipple has a certain amount of erectile power, due to its possessing a considerable quantity of muscular tissue, which is chiefly circular in arrangement under the areola, and radiating in the nipple itself. In the virgin the nipple is conoidal, and, as well as the areola, is of a rose-pink colour, the tint being somewhat darker in brunettes than in blondes. During pregnancy the whole gland undergoes enlargement, and the pigmentation becomes darker; other changes occur which will be discussed in the chapter on the signs of pregnancy.

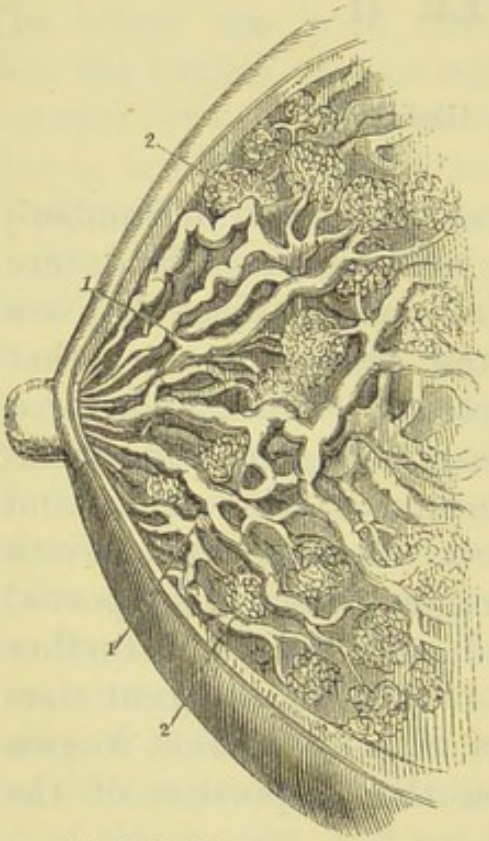


Fig. 32.—Mammary Gland.
(Tyler Smith.)
1.—Lactiferous ducts.
2.—Lobuli of the mammary gland.

After lactation in multiparæ the gland is pendulous, and the pigmentation of the nipple and areola, though becoming lighter than in pregnancy, never regains its virginal rose-pink hue. The nipple is also cylindrical rather than conoidal in shape.

Each mammary gland is made up of from 15 to 20 *lobes*, which are further subdivided into *lobules*, formed by the aggregation of the ultimate secreting *acini*.

These acini on section appear as polygonal spaces lined by cubical epithelium, to the activity of which the mammary secretion is due. Each acinus has a minute duct. These small ducts join together to form the lobular ducts, and these again inosculate to form the lobar or lactiferous ducts. The lactiferous ducts are about 15 to 20 in number, and approach the nipple without communicating with one another to any large extent. Immediately before entering the nipple they become dilated into the lacteal sinuses, and again become somewhat constricted before opening on the surface of the nipple. The ducts generally are lined by cylindrical epithelium. The blood-supply of the breasts is derived from the external and internal mammary and intercostal arteries, and the glands are innervated by the intercostal nerves.

CHAPTER III

ORGANS OF GENERATION

THE female organs of generation are divided into external and internal. Externally we have the component parts of the vulva and perineum. The internal organs comprise the vagina, uterus and its ligaments, the Fallopian tubes and the ovaries.

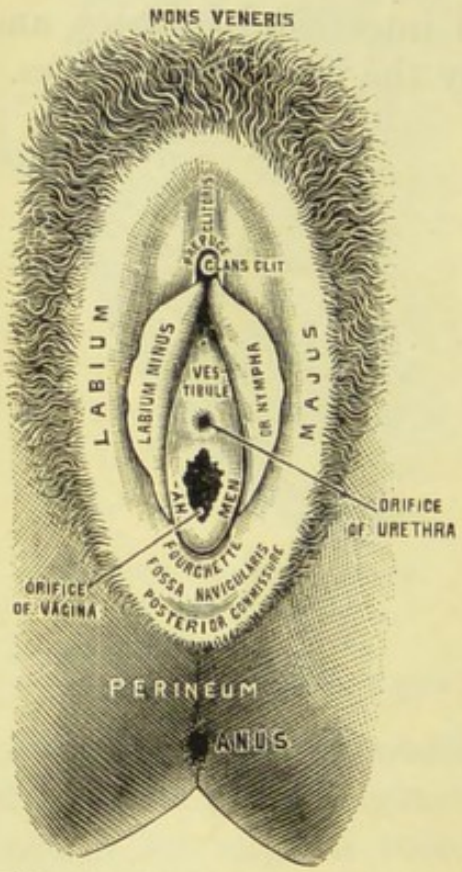


Fig. 33.—EXTERNAL ORGANS OF GENERATION.
(Modified from Gray.)

The *mons veneris* is the triangular, cushiony portion of the integument situated above the symphysis pubis, covered, in the adult, with short curly hair. It varies in size according to the development of the woman, and is composed of adipose and cellular tissues. From the *mons veneris* the *labia majora* extend backwards, and form the outer boundary of the genito-urinary opening. They approximate each other

before sexual intercourse, but afterwards become longer and more separated. The junction of the labia above is called the superior commissure, their union below the inferior commissure. A fold of the lining membrane stretches between the labia just in front of the inferior commissure; this is called the *fourchette*, and between it and the perineum is a depression called the *fossa navicularis*. The fourchette is nearly always ruptured in the first labour. The labia are composed of cellular and adipose tissues and a peculiar structure analogous to the *dartos* of the scrotum, and within each labium is a muscle called the constrictor vaginæ. The round ligament of each side terminates in the corresponding labium. The external surface is covered with skin like that of the scrotum, having hair and large sebaceous glands; internally the skin is hairless and smooth. Both surfaces of the labia are studded with sebaceous follicles, the secretion from which occasionally becomes so acrid as to cause a considerable amount of excoriation. The *labia majora* are further liable to abscesses, serous, cystic, and blood collections, varices, hernial and malignant tumours.

Within the superior commissure, and about half an inch below it, is a sensitive erectile body analogous to the *corpora cavernosa* of the penis, called the *clitoris*, which is attached by two roots to the ischio-pubic rami, the urethra passing between them. The extremity of the clitoris is tuberculated, and is called the glans, and, like the glans penis, is provided with a prepuce derived from the labia minora. Attached to each crus or root is a muscle called the erector clitoridis, and a suspensory ligament connects the clitoris with the pubes. The clitoris receives its supply of blood from the internal pudic arteries, and its nerves from the internal pudic nerves. It has a

dorsal vein, which is the analogue of the vena dorsalis of the penis. The clitoris is perhaps the organ principally concerned in the sexual feeling, and, when morbidly excited, is sometimes the cause of retention of urine in hysterical females. The clitoris is subject to syphilitic, fibroid, and malignant enlargements. The *labia minora* or nymphæ are two folds of modified skin which descend from the clitoris, and are lost each in the corresponding labium majus, near the middle. Anteriorly each labium minus bifurcates to enclose the clitoris before joining its fellow. The upper divisions on the two sides form the præputium clitoridis, the lower the frænulum clitoridis. The nymphæ have numerous sebaceous follicles, whose secretion serves to lubricate the ostium vaginæ. They are well provided with nerve filaments, and serve to extend the sensory and secretory surfaces of the ostium vaginæ, and to help to enlarge and expand the vaginal orifice during labour. Deeply seated beneath the nymphæ and on each side of the clitoris are two pyriform bodies of erectile tissue called the bulbi vaginæ, consisting of reticulated veins covered with fibrous membrane, which are analogous to the corpus spongiosum of the penis. The lower and larger portion of each is known

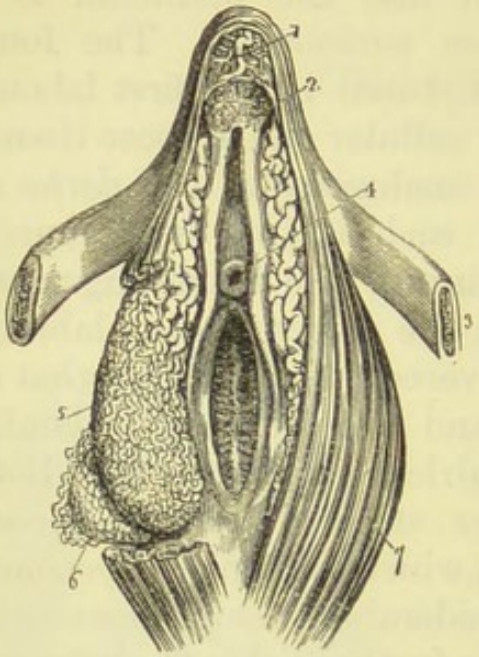


Fig. 34.—1. Vena dorsalis. 2. Glans clitoridis. 3. Crus clitoridis. 4. Meatus urinarius. 5. Bulbus vestibuli. 6. Vulvo-vaginal gland. 7. Sphincter vaginæ. The plexus of veins, constituting the *pars intermedia*, is seen on each side of the nymphæ.

as the bulb. The upper and narrow part joins its fellow underneath the glans clitoridis, forming the *pars intermedia.*

Below the clitoris and bounded by it above, by the vaginal orifice below, and by the nymphæ at the sides, is a triangular smooth space called the *vestibule*, which is lined by mucous membrane and has numerous mucous glands. At its lower boundary a little prominent central fold of mucous membrane indicates the meatus urinarius. The urethra, a vascular membranous canal formed by cellular tissue and muscular fibres, is an inch and a half in length, and is capable of great distension. This canal, contracted at its orifice, is destitute of prostate gland or bulb; it is lined with mucous membrane continuous with that of the bladder, and contains numerous lacunæ, which sometimes impede the introduction of the catheter. Since the operation of *catheterism* may be necessary to draw off the urine during pregnancy, during labour, and after parturition, the student should make himself acquainted with the necessary steps for its accomplishment. A No. 8 *male* gum-elastic or celluloid catheter is the best, a long catheter being essential in many cases where the bladder is abnormally distended and dislocated upwards, *e.g.* in retention of urine, due to retroversion of the gravid uterus, and in other cases given below. The woman being placed on her back or on her left side, the catheter, well cleansed, warmed and oiled, is taken in the right hand, then the labia are separated with the fore and middle finger of the left hand, and the orifice of the urethra is sought by the forefinger of the right hand; when the meatus is found the instrument is gently introduced, the finger being still retained immediately below the orifice until the bladder is fairly reached. The catheter at first is

pushed almost horizontally under the arch of the pubes to the neck of the bladder, when at this point a slight depression of the free end causes it to glide easily into the bladder; the end of the catheter is now depressed towards the vessel placed in readiness to receive the urine. The principal difficulties attending this operation are mechanical obstructions which change the course of the urethra. The development of the gravid uterus, by pulling the bladder with it into the abdomen, or distortion of the pelvic brim, by causing the bladder to be pushed over the symphysis pubis, will in each case produce elongation and curvature of the urethra; in procidentia uteri the position of the bladder is reversed, being drawn below the pubes, so that a downward and backward direction must be given to the catheter. Moreover, after delivery the urethra is often inflamed and swelled, so that it is difficult to find the orifice. on catheterisation in tedious labours where the head If the child is closely packed in the pelvic cavity, the urethra may be so compressed as to require that the head of the child should be pushed upwards and backwards out of the way by the index finger of the left hand while the instrument is slipped into the bladder. Occasionally, during the passage of a proportionately large head through the pelvis, the bladder may become so compressed at a point behind the pubes as to divide its cavity into two chambers, when care should be taken to empty both before withdrawing the instrument, as rupture or sloughing of the viscus may otherwise ensue. Many cases of vesico-vaginal fistula are doubtless produced by this circumstance.

A few lines behind the urethral orifice is the vaginal aperture, through which pass the menstrual blood and mucous discharges from the uterus and

vagina; the opening varies in size according to the presence or absence of a fold of vaginal mucous membrane called the hymen.

The *Hymen* itself when present varies in shape, the three most common forms in order of frequency being the semilunar, circular, and cribriform. The semilunar hymen is a lunated membrane projecting from behind over the vaginal aperture, with a concave edge forwards. The circular or oval form has a rounded opening about the centre of the membrane; while in the cribriform variety there are several irregular small holes. The presence of this membrane is not a proof of virginity, nor its absence a proof of the converse. It may be absent even in a newborn child, and it may be lacerated by very slight violence, as a fall on the perineum, etc. Intercourse, as a rule, ruptures the hymen, but it may be so flaccid that perfect coitus may take place without lacerating it. On the other hand, it may be so tense that it may be necessary to incise it. A firm unruptured hymen is no barrier to pregnancy, for impregnation may take place through a single minute opening, and the resisting structure remain until the advancing head during labour sweeps it away.

The hymen may be imperforate, a condition of little import until puberty, after which period the continued accumulation of menstrual fluid behind the membrane causes pelvic and abdominal distension. In this case the proper treatment is to divide the membrane and evacuate the pent-up fluid.

Carunculæ myrtiformes is the term applied to four or five little bodies round the vulvo-vaginal orifice, which are the remains of the torn hymen, and correspond to the number of shreds into which it happens to have been broken.

Subjacent to the posterior part of the labia majora,

on each side are two little bodies, described first by Duverney in the cow, Bartholin in woman, and further carefully examined by Huguier. They are commonly known as *Bartholin's glands*, and correspond to Cowper's glands in the male, in each case being situate between the two layers of the triangular ligament. They are about the size of small almonds, and partake of the nature of salivary glands, having lobes, lobules, acini, and an excretory duct half an inch long, capable of admitting a small probe, and opening on the internal surface of the nymphæ, just outside the attached margin of the hymen. The limpid viscid secretion poured out by these glands has a peculiar odour, and flows more freely during intercourse or sexual excitement.

From the posterior commissure to the anus is the *perineum*, a musculo-membranous structure about an inch and a half from front to back, and extending about a couple of inches upwards between the vagina and rectum. It is triangular on section antero-posteriorly in the middle line, being covered by vaginal mucous membrane in front, rectal mucous membrane behind, and skin underneath. Laterally the perineal body has the fat of the ischio-rectal fossæ in relation to it. The muscles of the perineum are the levator ani, the transversus perinæi, and the sphincters of the vagina and anus, for the most part attached by one of their extremities to tendinous structures and fasciæ, one extremity only of each muscle having a bony attachment (Fig. 35).

During labour the perineum, stretched by the progressive advancement of the child's head, becomes as attenuated as parchment; but in a few hours after labour this structure reassumes its normal condition.

The *vagina* is a tube forming the channel of communication between the uterus and external parts.

It gives exit to the menses, fœtus, and lochia, and is the female organ of copulation. It curves upwards from the vulva nearly in the axis of the pelvic outlet until it meets the uterus, with which it forms a considerable angle; the cervix uteri being inserted into the top of the anterior vaginal wall almost at a right angle to the direction of the canal. There is thus formed around the uterine neck a circular cul-de-sac,

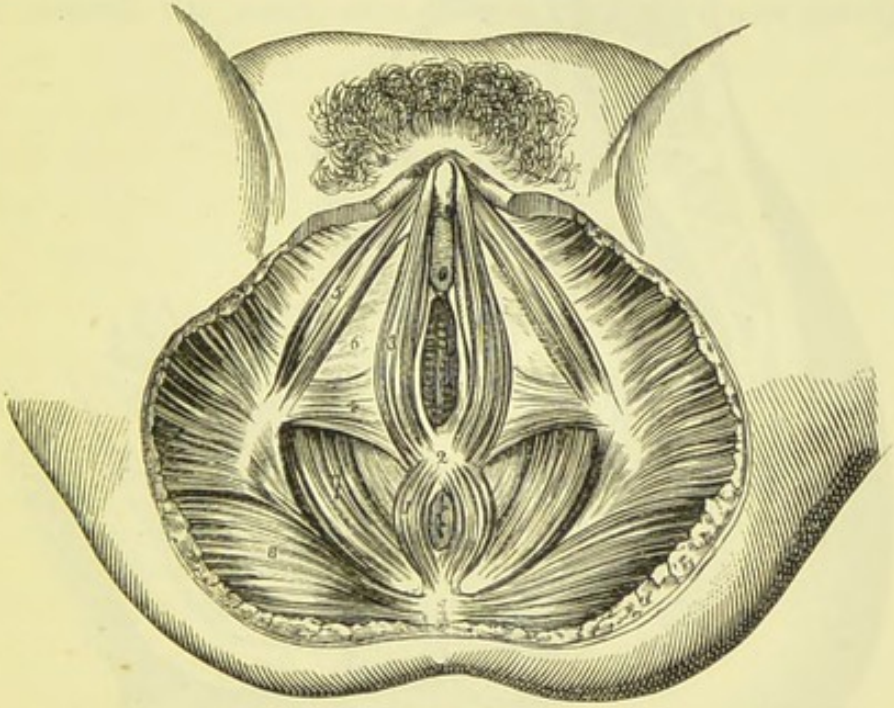


Fig. 35.—1. Sphincter ani. 2. Tendinous point of perineum. 3. Sphincter vaginæ. 4. Transversus perinæi. 5. Erector clitoridis. 6. Aponeurosis. 7. Levator ani. 8. Gluteus maximus.

which is deepest at its posterior part, and this manner of attachment of the vaginal tube to the cervix accounts for the fact that the posterior wall, $3\frac{1}{2}$ inches in length, is at least an inch longer than the anterior. In women who have borne children the canal is shorter than in the adult virgin. It is narrowest at its mouth, and under ordinary circumstances its front and back walls are in contact, but they readily separate on the introduction of any

substance, collapsing again as it is withdrawn. The mucous membrane of the vagina is continuous with that of the uterine cervix; each wall presents a single longitudinal column and numerous transverse rugæ, the anterior column and rugæ being the more pronounced. These foldings of the lining membrane are much more prominent before than after child-

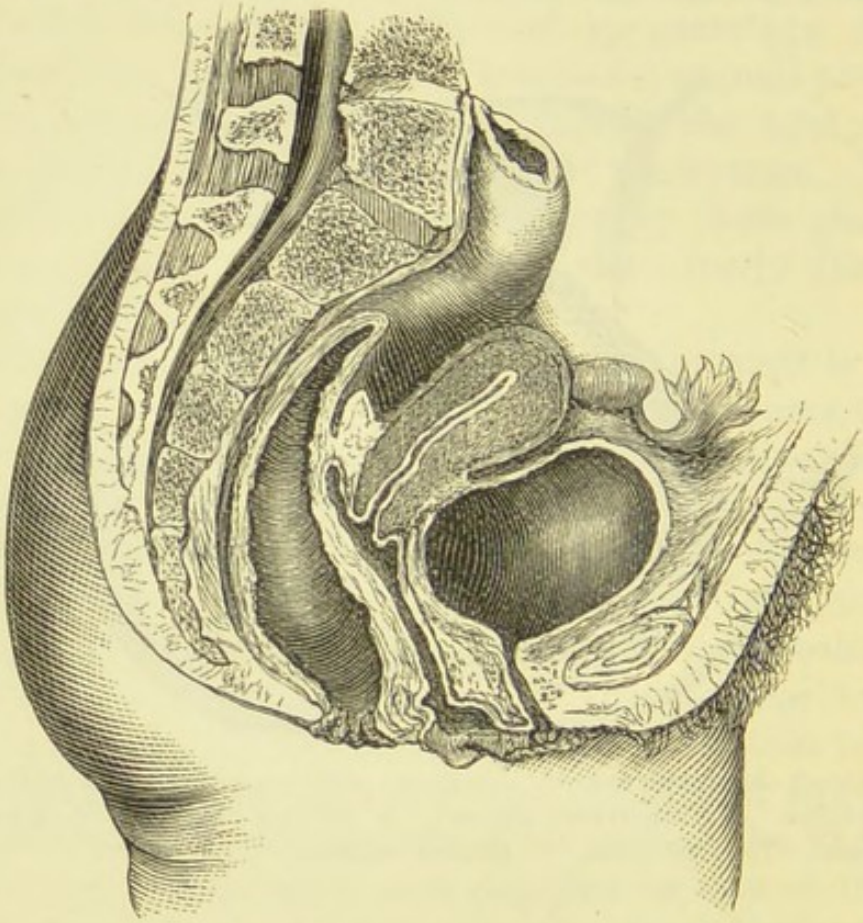


Fig. 36.—Section of Female Pelvic Organs.

bearing. They serve the purpose of allowing for the necessary dilatation during labour.

During pregnancy the mucous membrane changes from red to dark purple, owing to congestion of its capillaries. It is covered with squamous epithelium, and is furnished with follicles, which secrete sub-acid mucus, and with papillæ, supposed to be sensory.

External to the mucous membrane come the muscular and fibrous coats of the vagina, the former being continuous upwards with the muscle of the cervix, and the involuntary fibres of which it consists developing to a large extent during pregnancy, like those of the uterus. The vagina is connected anteriorly by loose cellular tissue with the bladder above, and more intimately with the urethra below. Behind it is related to the rectum, the perineal body intervening for about an inch and a half at the lower part, and

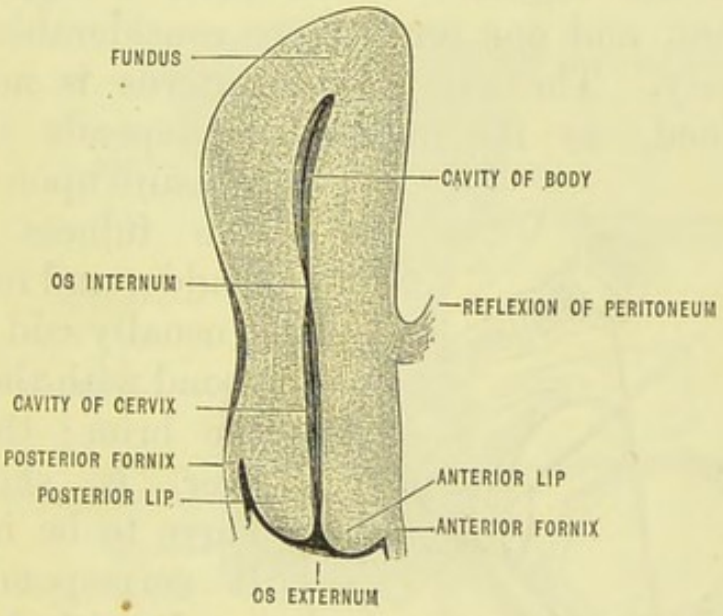


Fig. 37.—Sagittal Section of Uterus. (After Morris.)

the recto-vaginal pouch of peritoneum separating them for a similar distance above. Collections of fluid in the abdomen gravitating into the pouch of Douglas may be felt through the posterior vaginal fornix. The vagina is supplied with blood from the internal iliac artery, and its nerves are derived from the hypogastric plexus and the fourth and fifth sacral nerves.

In its unimpregnated condition the *uterus* is a small pear-shaped organ slightly flattened in front. The following measurements of the nulliparous uterus

are taken from a table given by Edis in the *Obstetrical Transactions*, vol. xviii.—Length externally, $2\frac{5}{8}$ inches; length of cavity, $2\frac{1}{8}$ inches; breadth of fundus, $1\frac{1}{2}$ inch; breadth of cervix, about 1 inch; width of os, $\frac{3}{8}$ of an inch; weight, nearly two ounces. The uterus occupies the centre of the pelvis between the rectum and bladder, its lower portion or cervix is attached to the vagina, its body and upper portion or fundus lying free in the pelvic cavity; it is loosely retained in position by its ligaments and by its attachment to the vagina. These allow a slight lateral movement, and one much more considerable antero-posteriorly. The axis of the uterus is not easily determined, as its inclination depends in great measure upon the relative fulness of the bladder and rectum. It is usually said to correspond with the axis of the brim; this, however, is shown by Farre to be incorrect. It corresponds more nearly with that of the mid-pelvic plane.

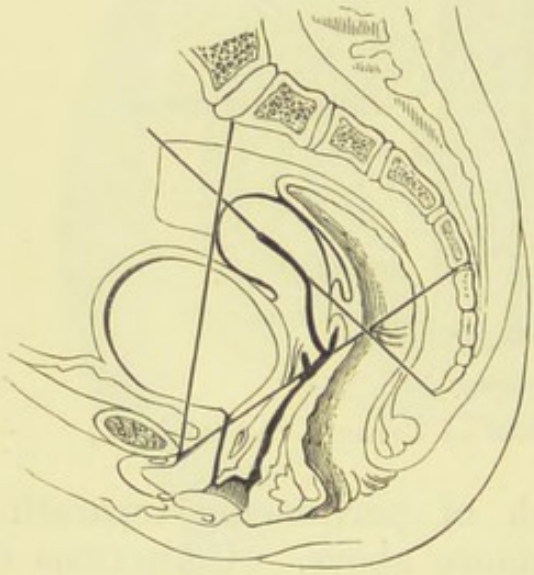


Fig. 38.—Sectional Diagram to show the Normal Position of the Uterus in the Pelvis. (After Farre.)

The uterus is divided into body and cervix, their point of junction being known as the isthmus, to which part several of the peritoneal ligaments of the uterus have their attachment. The fundus and body of the uterus are covered front and back with peritoneum, and from its lateral edges these two layers pass outwards to the sides of the pelvis, forming the broad ligaments.

The cervix is described as consisting of three parts, and the attachment to the vagina is so arranged that the lower third only in front projects into the vagina, while posteriorly the lower two-thirds are vaginal. Anteriorly the upper two-thirds are in relation with the bladder, and the posterior upper one-third is covered by peritoneum.

The *os uteri externum* is the opening in the cervix seen from the vagina. In the nulliparous uterus the os is linear in form and transverse in direction; the

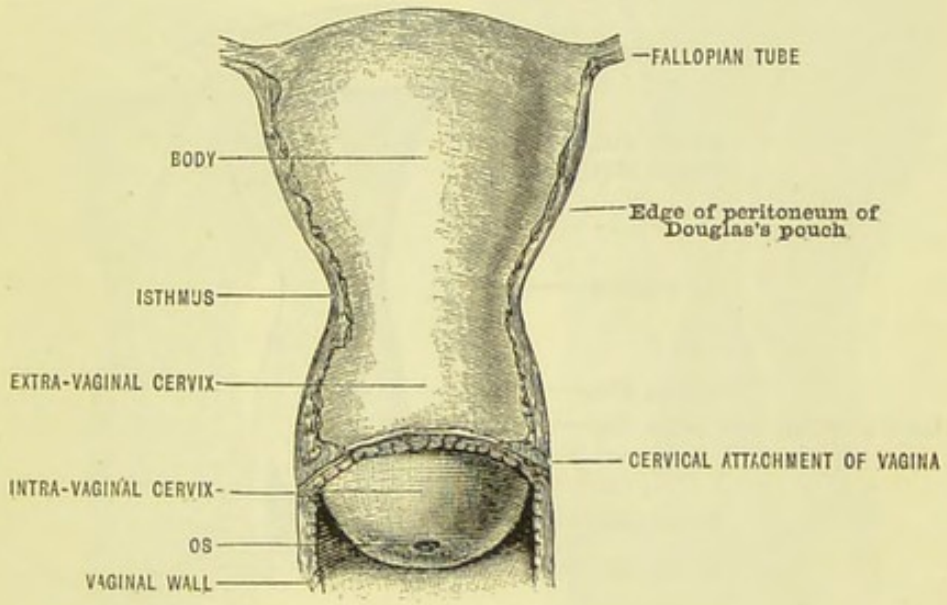


Fig. 39.—Posterior View of Uterus. (After Morris.)

posterior lip is hidden by the anterior, owing to the angle of junction of the uterus and vagina. The older anatomists, with their usual sprightly imagination, saw here a resemblance to the mouth of a fish, and accordingly called it *os tincæ*. In the multiparous uterus the shape of the os is changed into an irregularly-puckered opening of somewhat circular outline.

The cavity of the cervix is spindle-shaped, being wider in the middle than at either end. It is bounded below by the os uteri externum, and above

by the os uteri internum, which is of smaller size than the os tincæ, and gives rise to the difficulty often experienced in introducing the uterine sound. The lining of the cervical canal presents an anterior and a posterior longitudinal fold, from which diverge reduplications of the mucous membrane forming the *arbor vitæ ;* this appearance is, however, very variable. The folds of mucous membrane present a large surface for glandular secretion, and make provision for the dilatation necessary during labour.

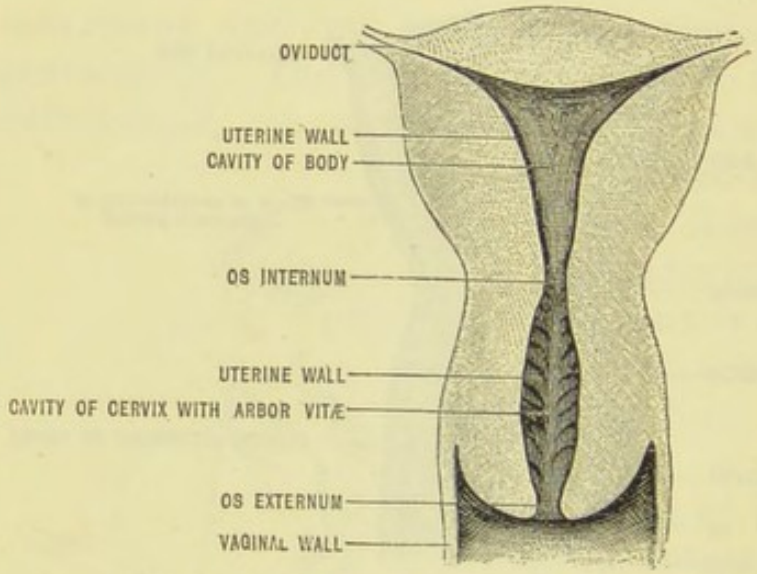


Fig. 40.—Coronal Section of Uterus. (After Morris.)

The closure, with subsequent dilatation from pent-up secretion, of some of these cervical mucous glands gives rise to small prominences known as *ovula Nabothi.* According to Henle, the epithelium from the middle of the cervix upwards is ciliated cylindrical, and below stratified squamous attached to vascular papillæ ; the secretion of the upper portion is alkaline, that of the lower part acid. De Sinéty states that the epithelium in the furrows is of the non-ciliated columnar variety.

The cavity of the body is triangular, the apex

being below at the os uteri internum. The sides of the triangle are convex to the cavity, and encroach somewhat upon it.

The mucous membrane is smooth and soft, and is directly attached to the muscular coat without the intervention of the usual submucous tissue. It is about an eighth of an inch thick, and owing to the

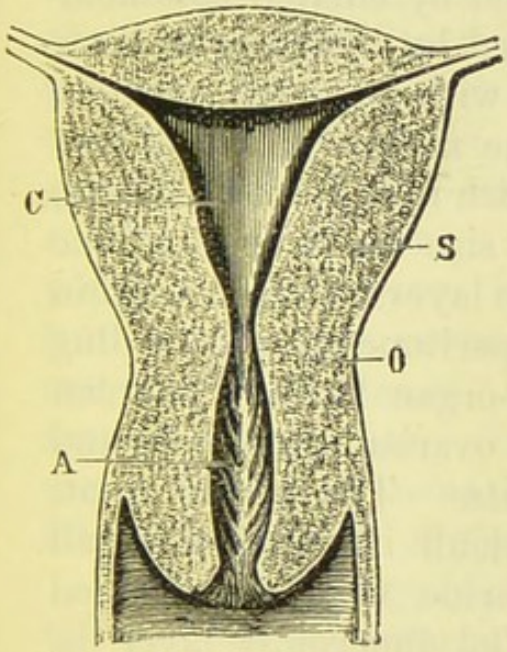


Fig. 41.—Longitudinal Section of a Nulliparous Uterus.
(Barnes, after Tarnier.)

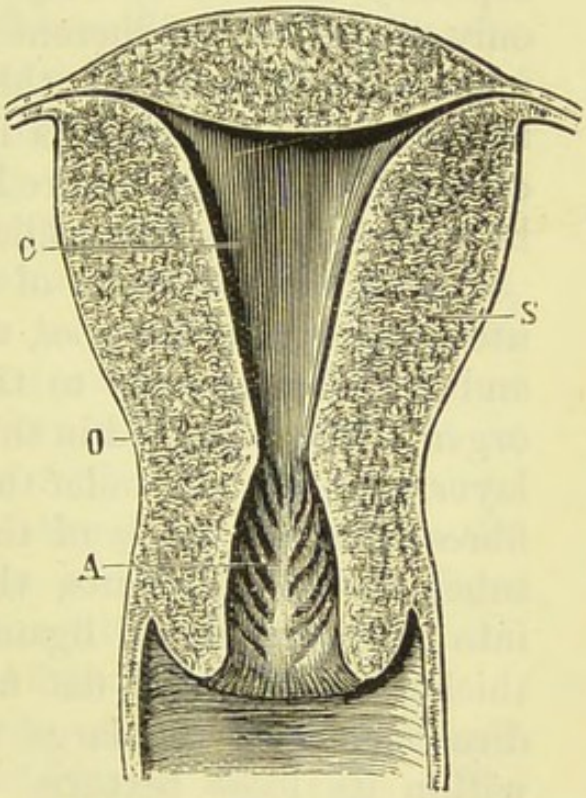


Fig. 42.—Longitudinal Section of a Multiparous Uterus.
(Barnes, after Tarnier.)

A. Cavity of the cervix and arbor vitæ. C. Cavity of the body. O. Constriction between body and cervix, the os uteri internum. S. Wall of fundus.

abundant supply of capillaries is of a brighter red than the muscular walls. With the aid of a lens the openings of the utricular glands are visible. These glands are described by Reichert as involutions of the mucous membrane. They extend almost perpendicularly from the surface, and terminate in closed extremities at the junction of the muscular

and mucous coats. The ground tissue consists of spindle-shaped cells traversed by fibres, between the meshes of which are large lymph spaces. Capillary vessels of large size ramify between the glandular canals, spreading out in a fine meshwork on the surface of the mucous membrane, and having the glandular openings in the centre of the meshes. This capillary network is very superficial, being covered only with loosely adherent epithelium, which is shed more or less at each monthly period. The surface of the mucous membrane is lined by ciliated columnar cells. The gland-tubes are lined by similar cells, their blind extremities being filled with irregular cells.

Immediately outside of the mucous lining of the uterus is the *muscular coat*, which is of great thickness, and contributes most to the size and weight of the organ. It is arranged in three layers. An outer, thin layer, immediately under the peritoneum, and sending fibres from the body of the organ to the Fallopian tubes, round ligaments, the ovarian ligaments, and into the utero-sacral ligaments. The middle coat, thicker, consists of flat fasciculi interwoven in all directions with the large uterine vessels embedded within its loose texture. The innermost layer is, properly speaking, to be regarded as a very thickened muscularis mucosæ, though there is no submucous tissue separating it from the middle layer described above. The fibres are chiefly arranged circularly, with well-marked concentric rings round the various openings into the uterus. As before stated, the blind ends of the uterine glands penetrate the innermost part of this layer. The ultimate composition of the muscular coat includes fusiform fibres, having oval nuclei with free nuclei interspersed, some round and some oval, appearing to be embryonic conditions of the fusiform fibres.

The *peritoneal coat* covers the fundus and body completely, except for a narrow longitudinal portion on each side where the broad ligaments pass off to the sides of the pelvis. In front, the peritoneum leaves the uterus to be reflected on to the back of the bladder about the junction of the body and cervix, and two slightly-defined antero-posterior folds of peritoneum running to the bladder from the sides of the isthmus uteri bound laterally a slight dip, the utero-vesical pouch. These folds are the *utero-vesical ligaments.* Behind, the peritoneum runs a little lower than the isthmus covering the upper third of the posterior aspect of the cervix before passing on to the upper part of the posterior wall of the vagina, which it soon leaves to be reflected upwards on the rectum. In this way the recto-uterine or Douglas' pouch of peritoneum is formed, and again, as in front, two antero-posterior folds of the peritoneum run from the sides of the isthmus backwards to the rectum and sacrum. These are the *utero-sacral* ligaments, or recto-uterine ligaments, and they form the lateral boundaries of the pouch of Douglas.

The *vascular supply* of the uterus is derived from the ovarian and uterine arteries on each side. The ovarian arteries, corresponding to the spermatic arteries of the male, and arising from the abdominal aorta, course downwards to the pelvis, enter the upper part of the broad ligaments, and reach the uterus after sending branches of supply to the ovaries, the Fallopian tubes, and the round ligaments. The uterine arteries arise from the anterior divisions of the internal iliacs, and pass to the uterus in the lower part of the broad ligament on each side.

The ovarian and uterine arteries join freely on each side of the uterus, and send branches front and

back to communicate with the vessels of the opposite side.

The *veins* from the uterine plexus mainly join those from the ovarian or pampiniform plexus. Those on the left side join the left renal vein, whilst those of the right side open into the inferior vena cava.

The *lymphatics* of the body of the uterus join the

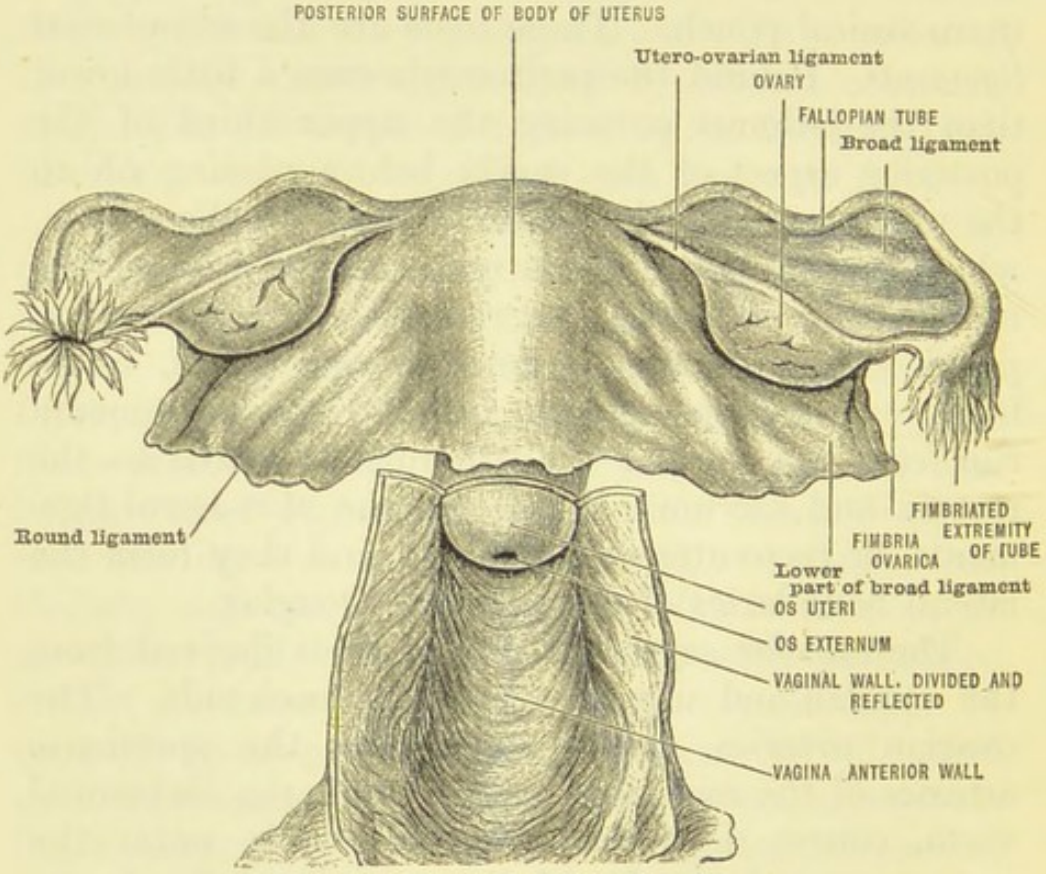


Fig. 43.—Uterus and Broad Ligaments. (After Morris.)

lumbar glands, whilst those of the cervix communicate with the pelvic and sacral glands.

The *nerves* are supplied in part from the spinal, but more freely from the sympathetic system. The spinal nerves come from the third and fourth sacral; the sympathetic from the inferior hypogastric plexus of each side.

The *ligaments of the uterus* are eight in number, viz. the broad and round ligaments on each side, the utero-vesical ligaments in front, and the utero-sacral ligaments behind. The utero-vesical and utero-sacral ligaments have been described above. It now remains to mention the broad and round ligaments.

The *broad ligament* is formed by the well-marked fold of peritoneum which passes from the side of the uterus to the lateral boundary of the pelvis. It is made up of an anterior and a posterior layer of peritoneum, covering various structures, and enclosing a considerable amount of connective tissue, in which are embedded blood-vessels, lymphatics, and nerves.

In the upper free margin of the broad ligament for some little distance from the uterus there runs the Fallopian tube, to be described later. Beyond the extremity of the Fallopian tube each broad ligament is continued to the side of the pelvis, and is known as the *infundibulo-pelvic ligament* of the ovary, and serves to attach the ovary and tube to the lateral pelvic wall.

A little lower and more anteriorly the round ligament of the uterus runs from the upper angle of the uterus in the tissue of the broad ligament to the side of the pelvis, and thence to the inguinal canal. Posteriorly, and still lower down, is the ovary with the ovarian ligament running inwards to the uterus. The ovary projects considerably on the posterior aspect of the broad ligament, and, except at its hilum, is covered with modified peritoneum of the posterior layer of the broad ligament.

In the tissue of the broad ligament, between the Fallopian tube and ovary, are seen a number of fine tubes converging to the hilum of the ovary, and joined above by a long transverse tube parallel with

the Fallopian tube. A few of the outer vertical tubules end blindly at their ovarian extremity, and are known as Kobelt's tubes. The system of tubules forms the *Parovarium* or organ of Rosenmüller. This rudimentary structure is the remains of the Wolffian body in the woman. The connecting tube represents the Wolffian duct, which is a less rudimentary struc-

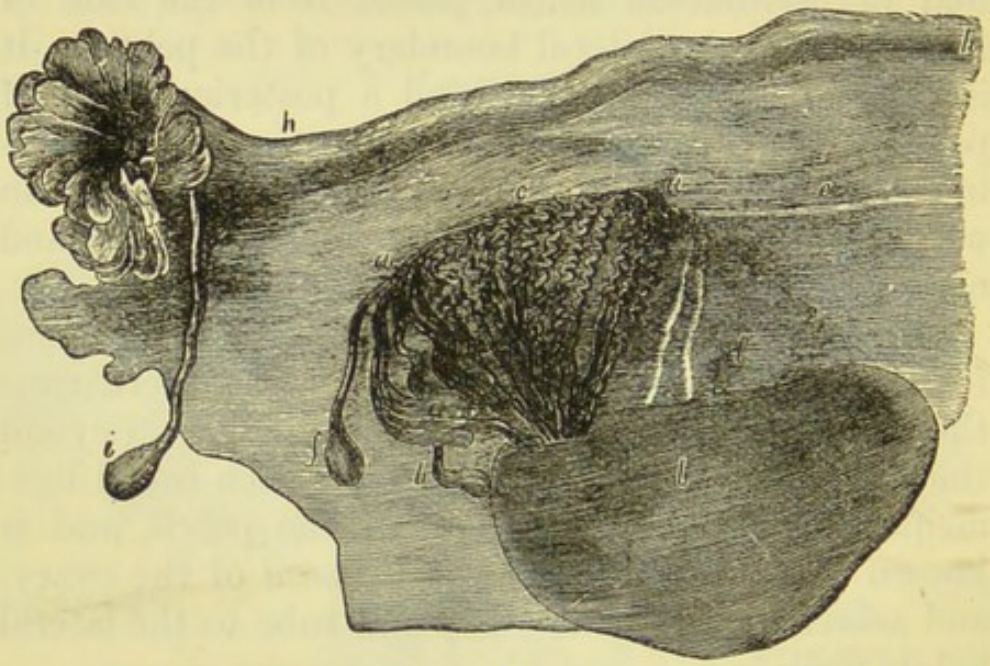


Fig. 44.—Adult Ovary, Parovarium, and Fallopian Tube.

a, *a*, Parovarium, formed from upper part of Wolffian body. *b*, Remains of uppermost tubes, sometimes forming hydatids. *c*, Middle set of tubes. *d*, Some lower atrophied tubes. *e*, Atrophied remains of Wolffian duct. *f*, The terminal bulb or hydatid. *h*, Fallopian tube. *i*, Hydatid attached to end of Fallopian tube. *l*, Ovary. (From Barnes, after Quain.)

ture in the cow, where it may be traced to the vagina as the canal of Gaertner.

The *round ligament* is a cord composed of involuntary muscle and connective tissue. It runs from the anterior part of the upper angle of the uterus under the front layer of the peritoneum of the broad ligament to the side of the pelvis, and curving forwards enters the internal abdominal ring, and

traverses the inguinal canal to become lost in the mons veneris or labium majus. In the young subject the peritoneal covering of the round ligament, as a short blind tube, is continued for some little distance into the inguinal canal. This process is called the canal of Nuck, and corresponds to the processus vaginalis of the male. It usually disappears in the adult.

Abnormalities of the Uterus.—The uterus may be *absent* or it may be *imperfectly developed*, with the resulting formation of one of the varieties of bifid uterus; or the growth of the uterus after birth may be arrested, so that in adult life it maintains its *infantile* condition, in which the cervix is large in proportion to the body; or, lastly, a uterus which has attained the adult virgin type may undergo *atrophy*.

In connection with imperfectly developed uterus, it must be remembered that the uterus and vagina are derived from the conjunction of the hinder ends of the Müllerian ducts of the two sides—the anterior portions of these tubes being persistently separate as the Fallopian tubes. Owing to some defect in development, this dual formation sometimes persists in varying degrees, and is met with in the adult. In some cases a median septum may divide both vagina and uterus (see Fig. 45).

A lesser degree of the deformity is met with in the case where the vagina is single but the uterus double, this being the *uterus bilocularis*, which externally differs but little from the perfectly formed organ. In very rare cases there may be no junction at all of those parts of the Müllerian ducts which normally join to form the uterus. This results in the formation of two completely separated halves of what is known as the *uterus didelphys*.

In other cases, while the lower part of the uterus

is normal, the upper part, both externally and internally, gives clear evidence of its development, inasmuch as it may have a *bicornate* condition. Some-

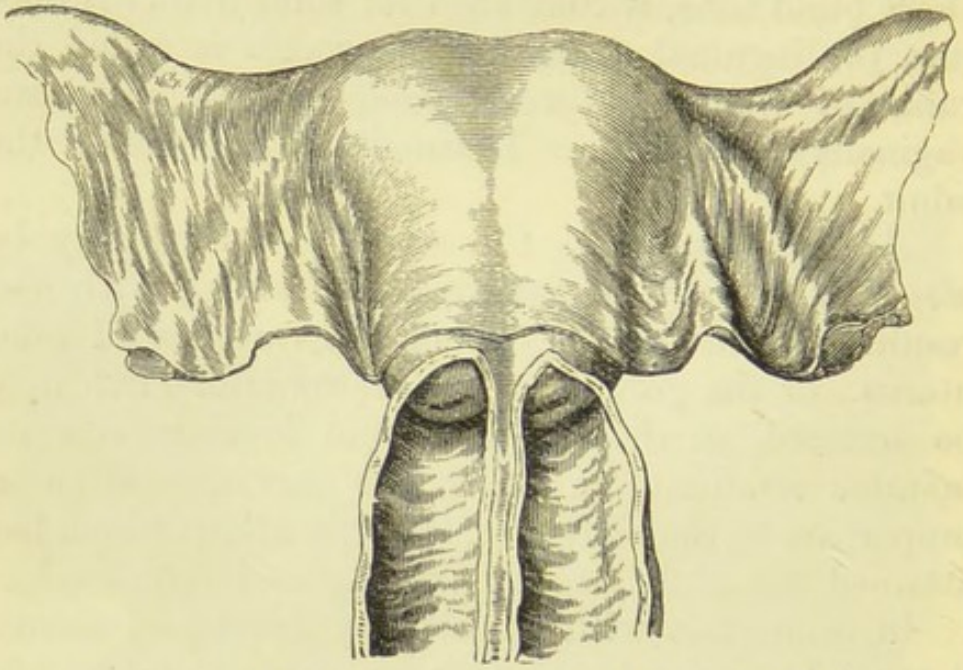


Fig. 45.—Bifid Condition of Uterus and Vagina.

times only one of the cornua develops, while the other is rudimentary, producing the *uterus unicornis*. The insertion of the round ligament on each side is

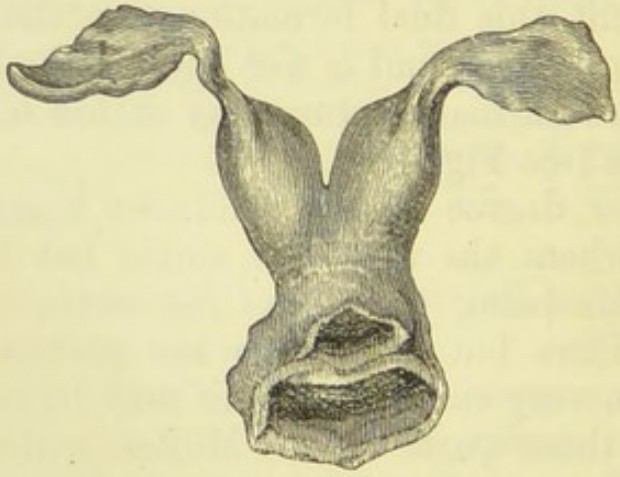


Fig. 46.—Bicorned Uterus.

taken as separating Fallopian tube from uterus or uterine cornu.

In cases of entire absence, or of an infantile state of development, menstruation is absent, excepting perhaps in a vicarious form, although if the ovaries are normally developed, the menstrual molimen may become periodically manifest. In the other forms of malformation, provided the ovaries are present, menstruation takes place as usual. The effects produced by these abnormalities upon conception and utero-gestation will be treated of in the section on superfœtation.

The *Fallopian tubes* may be regarded as the excretory ducts of the ovaries, and represent the upper parts of the ducts of Müller. Each tube is attached by one extremity to the superior angle of the uterus, into the cavity of which it opens by a minute aperture. The length of the tube is about 4 inches; it is contained in the upper border of the broad ligament, being covered by peritoneum, except on its inferior aspect, which is in relationship with the cellular tissue of the broad ligament. The inner third of the tube is narrow, and its wall is thick, and it is directed outwards and forwards. The outer portion increases in size, and its walls are thinner. It is termed the *ampulla*. It curves round the outer end of the ovary, the ovary as it were resting in the bend of the tube. The free end of the tube, where the tube-cavity communicates with the peritoneal sac of the abdomen by means of the *ostium abdominalis*, is provided with a kind of tentacular apparatus known as the *fimbriated* extremity, which during ovulation grasps the ovaries, facilitating the passage of the ovule to the uterus. One special process, known as the *infundibulo-ovarian fimbria* (or tubo-ovarian ligament), is directly attached to the ovary, and a longitudinal groove on this leads from the surface of the ovary directly to the abdominal ostium

of the Fallopian tube. Histologically, the Fallopian tubes have three coats: first, a serous coat, derived from the peritoneum; secondly, a muscular coat, consisting of unstriped muscle arranged in two layers, an outer longitudinal and an inner circular; and thirdly, a mucous coat, which is thrown into longitudinal folds, especially well marked towards the fimbriated extremity, where they become continuous with the various fimbriæ. The epithelial lining of the mucous membrane, which is continuous with the uterine mucosa, is like this made up of columnar ciliated cells, which are also seen on the inner aspect of the fimbriæ. The cilia vibrate towards the uterus, and with the vermicular action of the muscular coat assist the ovule in its transit. When owing to defective propulsive action the ovule fails to reach the uterus, its arrest (if impregnation takes place) gives rise to one or other form of extra-uterine pregnancy.

The Fallopian tubes receive their supply of blood from the ovarian artery, and return it into the plexus of ovarian veins. Their nervous supply is derived from the ovarian plexus and from the uterine nerves.

In connection with the fimbriated extremity of the Fallopian tubes there are to be noticed the hydatids of Morgagni, which is a name given to small stalked cysts about $\frac{1}{12}$ of an inch in diameter, which are regarded as the remnants of the terminal sacs of the Müllerian duct.

The *ovaries*, the analogues of the testes in the male, are small oval bodies of whitish colour, lying behind and below the Fallopian tubes, projecting from the posterior layer of the broad ligament, and situate in a pouch on the back of the broad ligament, known as the ovarian sac. At the attached edge or hilum the fibrous tissue contained between the layers of the

broad ligament is continuous with the stroma of the ovary; it is at this part that the vessels enter. The outer end of the ovary (in relation to the uterus) is rounded, and to it is attached one of the fimbriæ of the Fallopian tube, and the infundibulo-pelvic ligament derived from the posterior layer of the broad ligament connects it with the lateral pelvic wall; the inner portion is somewhat pointed, and is attached to the uterus by the ligamentum ovarii. The average ovary is $1\frac{1}{2}$ inch long, $\frac{3}{4}$ inch wide, $\frac{1}{2}$ inch thick, and weighs about 80 grains. After puberty the surface of the ovary, which has hitherto been smooth and polished, indicates by small translucent elevations the presence of more or less matured Graafian follicles; corpora lutea, in various stages of atrophy, afford evidence of recently ruptured follicles; whilst minute pits or scars scattered over the surface of the ovary mark the spots where ova of older date have been discharged, the resultant corpora lutea having in these instances been entirely absorbed. During the menstrual periods the ovaries become turgid, and increase considerably in size; after the menopause they shrivel up and become wrinkled and uneven on the surface. Formerly the ovaries were said to be covered by peritoneum, but recent investigations show that this membrane ceases at the hilum, where the proper epithelial covering of the ovary begins; the epithelium of the ovary is of the cylindrical variety, whereas that of the peritoneum is tesselated, and a raised white line separates one from the other. In structure the ovary consists of a connective tissue basis or stroma, in which are embedded the Graafian follicles. Near the hilum this connective tissue is very vascular, and contains many smooth muscular fibres. This portion is called the medulla of the ovary, and here the tissue is not broken up by the

presence of Graafian follicles. External to the medulla the cortical portion of the ovary has its stroma much subdivided by Graafian follicles, but immediately beneath the germ epithelium the stroma is again collected somewhat densely, forming the *tunica albuginea.*

This tunica albuginea is not, as was formerly supposed, a distinct fibrous membrane, but consists merely of connective tissue, continuous with the stroma of the ovary.

The *Graafian follicles* are small vesicles enclosed in the stroma of the ovary. Each young follicle presents an ovum surrounded by imbricated follicle cells. The ova themselves are developed from the germ epithelium covering the ovary. According to Waldeyer and Balfour the surrounding cells also originate in early fœtal life from tubular depressions (Pflüger's tubes) of the epithelial covering of the ovary, within which are contained the primordial ova. The communication of these tubes with the surface of the ovary is subsequently cut off by constriction of the necks of the tubules and by the branching of these included cell groups, and by ingrowth of the ovarian stroma cell nests result, from each of which arises a Graafian follicle with its ovum. Foulis believed that the ovule was surrounded by cells derived from the ovarian stroma, but the general

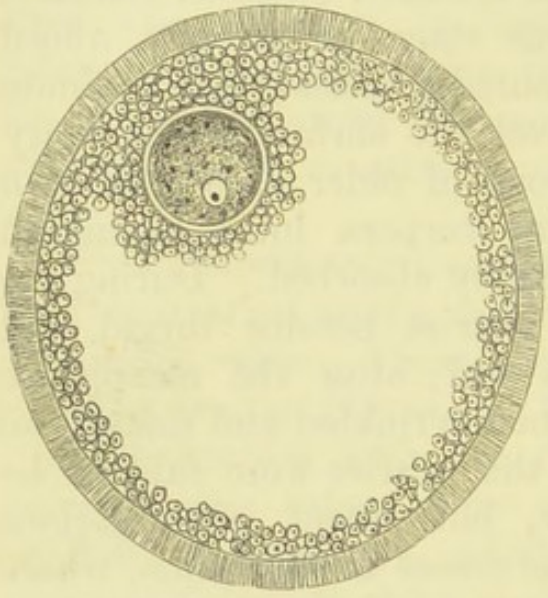


Fig. 47.—Graafian Follicle and Ovule with Proligerous Disc.

opinion is that both ovum and follicle cells come from the germ epithelium. The number of follicles contained in the ovaries is very great, and it is estimated by Foulis that not less than 30,000 exist in each ovary at birth, no fresh ones being formed afterwards. Of this vast number, however, comparatively few mature, the rest undergoing atrophy at various stages of development. According to Waldeyer they range in size from $\frac{1}{800}$ to $\frac{1}{2}$ an inch in diameter. The smallest are disposed near the surface of the ovary, larger ones deeper, and the largest of all project on the exterior of the ovary. The walls of a mature follicle present an external vascular covering, the *tunica fibrosa*, derived from the ovarian stroma. The vessels ramifying on this covering form a network all round it, except at the most projecting part, called the *stigma* or *macula folliculi*. This marks the spot where rupture of the vesicle takes place, as will be described later. Internal to the *tunica fibrosa* is the true ovisac or *membrana propria*, and lining this is the *membrana granulosa*, a layer of columnar epithelial cells presenting at one part an aggregation of similar cells, forming the *discus proligerus* in which the ovum lies embedded. The mature follicle is fitted with a transparent, alkaline, slightly albuminous fluid, supposed to be secreted by the follicular cells lining the follicular membrane.

The mature human *ovule* is a globular body, about $\frac{1}{120}$ of an inch in diameter; it consists of a yelk or *vitellus*, and its envelope, the *vitelline membrane*, a thin, structureless, but tough membrane, which is immediately surrounded by a broad transparent covering, the *zona pellucida*. In many of the lower animals pores exist in the zona pellucida, and in some (osseous fishes, for example) there has been found a large single aperture to which the name micropyle has been given.

These apertures are supposed to afford ingress to the spermatozoa, which, as we shall presently see, penetrate into the interior of the ovule. In the human ovule such openings have not as yet been demonstrated, though their presence may be fairly assumed; for in sections of the ovum examined under very high magnifying powers the zona pellucida exhibits radial striæ, which are supposed to be pores,

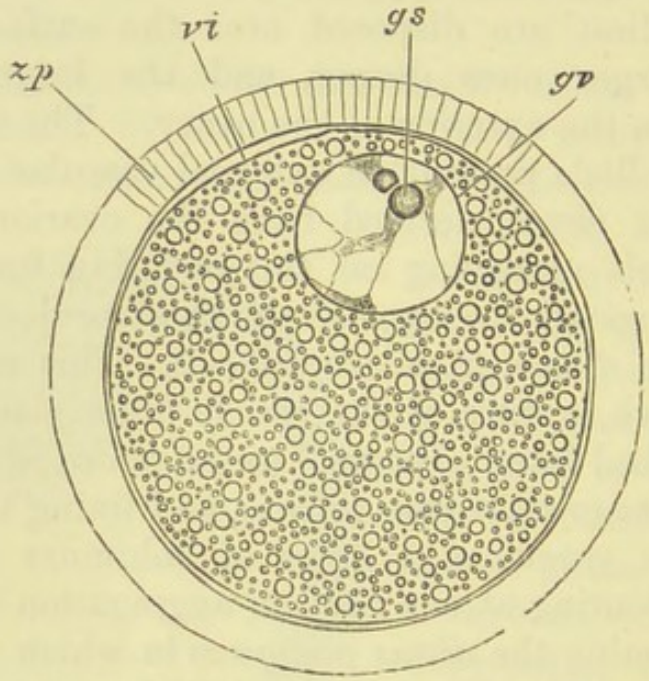


Fig. 48.—Ovum of the Cat, highly magnified. Semi-Diagrammatic. (Schäfer.)

zp, Zona pellucida, showing radiated structure. *vi*, Vitellus, round which a delicate membrane is seen. *gv*, Germinal vesicle. *gs*, Germinal spot.

the function of which is to admit of the nutrition of the ovum before rupture of the Graafian follicle, and probably afterwards to facilitate the entrance of the spermatozoa.

The vitellus consists of a mass of colourless albuminoid matter, containing a quantity of granules and globules which strongly refract light; lodged in the vitellus is a small, delicate, transparent vesicle about

$\frac{1}{500}$ of an inch in diameter, called the vesicle of Purkinje, or the *germinative vesicle.* This is the matured nucleus of the primordial ovule. Within the germinative vesicle is a minute point, the *germinal spot,* measuring, according to Wagner, $\frac{1}{3600}$ of an inch in diameter. The analogy between the ovule and an ordinary nucleated cell is marked—the germinal vesicle representing the nucleus and the germinal spot the nucleolus.

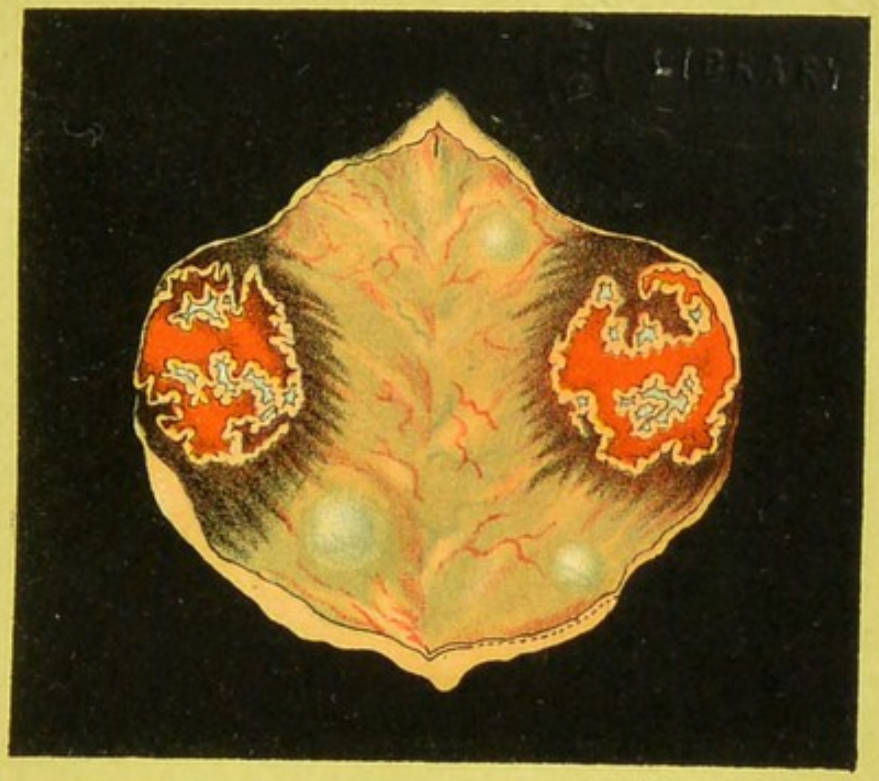
CHAPTER IV

OVULATION AND MENSTRUATION

THE discharge of an ovule from the Graafian follicle is effected in the following manner:—The maturing follicle increases in size, owing to secretion of fluid into its cavity, and presents itself on the surface of the ovary as a rounded protuberance surrounded by a network of vessels, except at the most superficial part, the *macula folliculi*, where the ovisac is non-vascular; it is here that the follicle eventually gives way and discharges its contents. As the follicle enlarges the macula becomes infiltrated with oil-globules, the result of fatty degeneration. Further secretion of fluid, together with a slight effusion of blood into the follicle, from rupture of some of the capillaries lining its inner surface, increases the pressure, until finally the weakened follicular wall gives way, and the ovule escapes with its surrounding mass of cells, the proligerous disc. The ultimate cause of rupture of the Graafian follicle in the lower animals is attributed in many cases, though not universally, to sexual excitement; in the human female it may occasionally result from this cause. Both His and Rouget are strongly of opinion that the muscular fibres contained in the medullary portion of the ovary, by their contraction, contribute largely to the expulsion of the ovule; and

PL. I.

CORPUS LUTEUM *(AFTER DALTON)*



Menstruation – 10 days.

Pregnancy – 2 to 6 months.

West, Newman & Co chromo. lith.

it is not difficult to imagine that such contraction may be induced by the stimulus of sexual excitement; at the same time it is probable that in the majority of cases rupture of the ovisac takes place spontaneously; at any rate we know that coitus is not necessary to produce it.

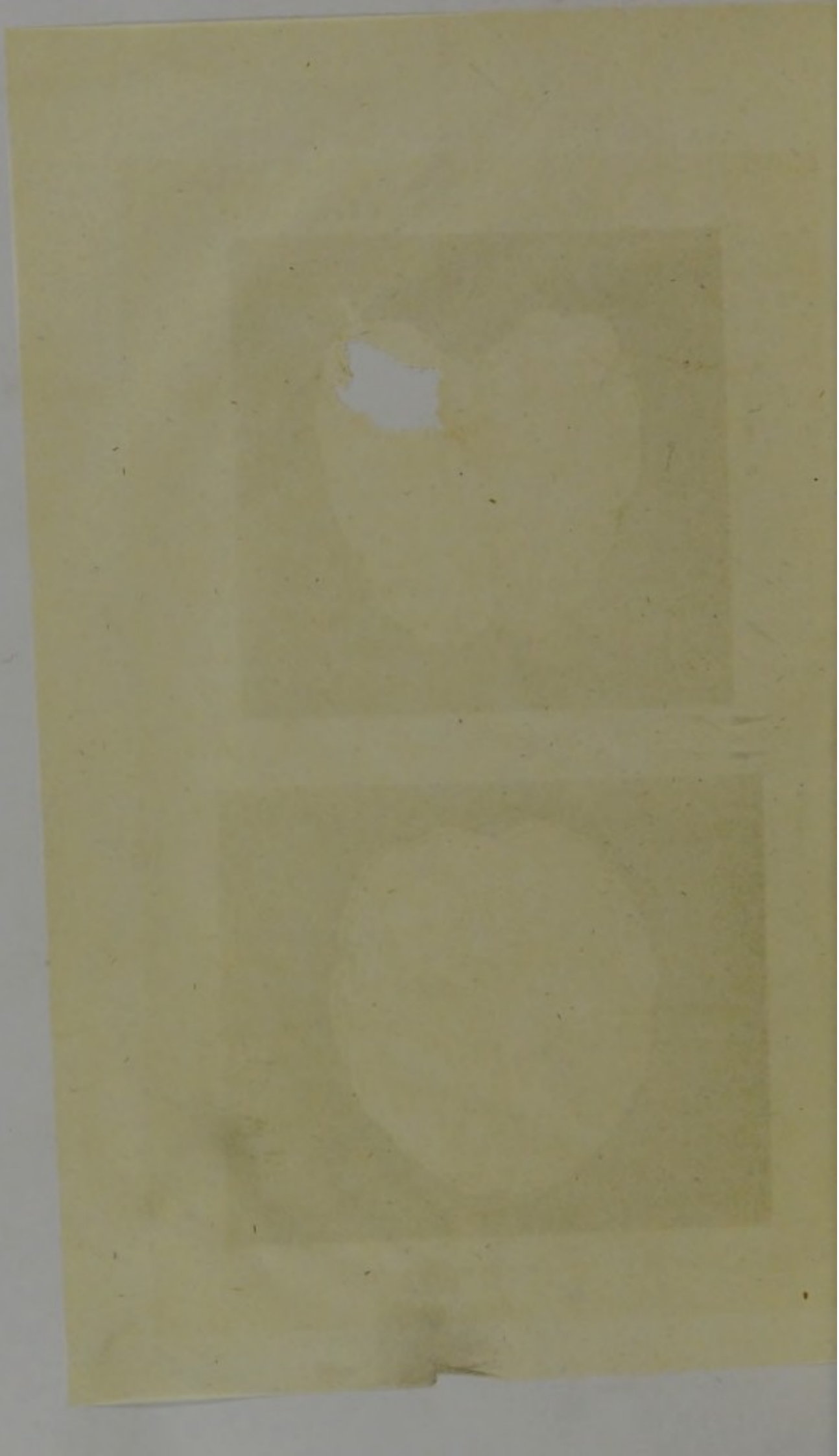
At the time of rupture of the Graafian follicle the fimbriæ of the Fallopian tube grasp the ovary in such a manner as to apply themselves over the precise spot where the ovule is about to escape; the ovule is thereby received into the tube and propelled by vermicular and ciliary action towards the uterus. The time occupied by the ovule in traversing the Fallopian tube is not known; the fertilised ovum, however, has never been found in the uterus earlier than the tenth day after impregnation.

After discharge of the ovule the Graafian follicle undergoes certain changes, which result in the formation of what is known as a *corpus luteum*. Formerly much stress was laid on the difference between the corpus luteum of pregnancy and that of ovulation unaccompanied by impregnation, the former being called the *true*, the latter the *false* corpus luteum. That a marked difference does exist between the two is obvious, as will presently be shown; still the difference is one entirely of development, the corpus luteum of pregnancy undergoing processes more prolonged than the corpus luteum of simple ovulation, the processes in each case, however, being substantially the same.

We will direct our attention first to the corpus luteum of ovulation, or of menstruation, as it is sometimes called. After the escape of an unimpregnated ovule a fibrinous exudation tinged with blood takes place within the ruptured follicle, the walls of which become hypertrophied, convoluted, and vascular; the

hypertrophy is due to increase of the cells lining the ovisac, a process which commenced prior to rupture of the follicle. It is most marked at the part of the follicle opposite to the opening through which the ovule escaped; as the membrane approaches this spot it decreases in thickness. The convolutions of the membrane are due simply to its increase in bulk, the area of the follicular cavity remaining the same. This necessitates a plicated arrangement of the hypertrophied membrane, to pack it, as it were, in a space otherwise too small to contain it. The hypertrophied membrane continues to increase in thickness from multiplication of the cells and from deposition of fat globules and granules of pigmentary matter, which conjointly impart the yellow colour, whence the name *corpus luteum* is derived. About the end of the second week the corpus luteum has arrived at the climax of its development, after which it diminishes in size and grows paler from absorption of the fat globules and disintegrated cells; at the end of seven or eight weeks it has disappeared, leaving behind a small depressed, permanent cicatrix.

The corpus luteum of pregnancy originates in precisely the same manner as the corpus luteum of menstruation, but instead of commencing to degenerate after the third or fourth week, it continues to develop until the fourth or fifth month, when it measures about one inch by $\frac{3}{4}$ of an inch, and occupies more than half the bulk of the ovary; this continued growth causes the two layers of the hypertrophied membrane of the follicle to coalesce and form a yellow mass with a small central cavity. About the sixth month the corpus luteum begins to diminish slowly, both in size and brightness of colour; after delivery, disintegration goes on with greater rapidity, only slight traces remaining at the end of



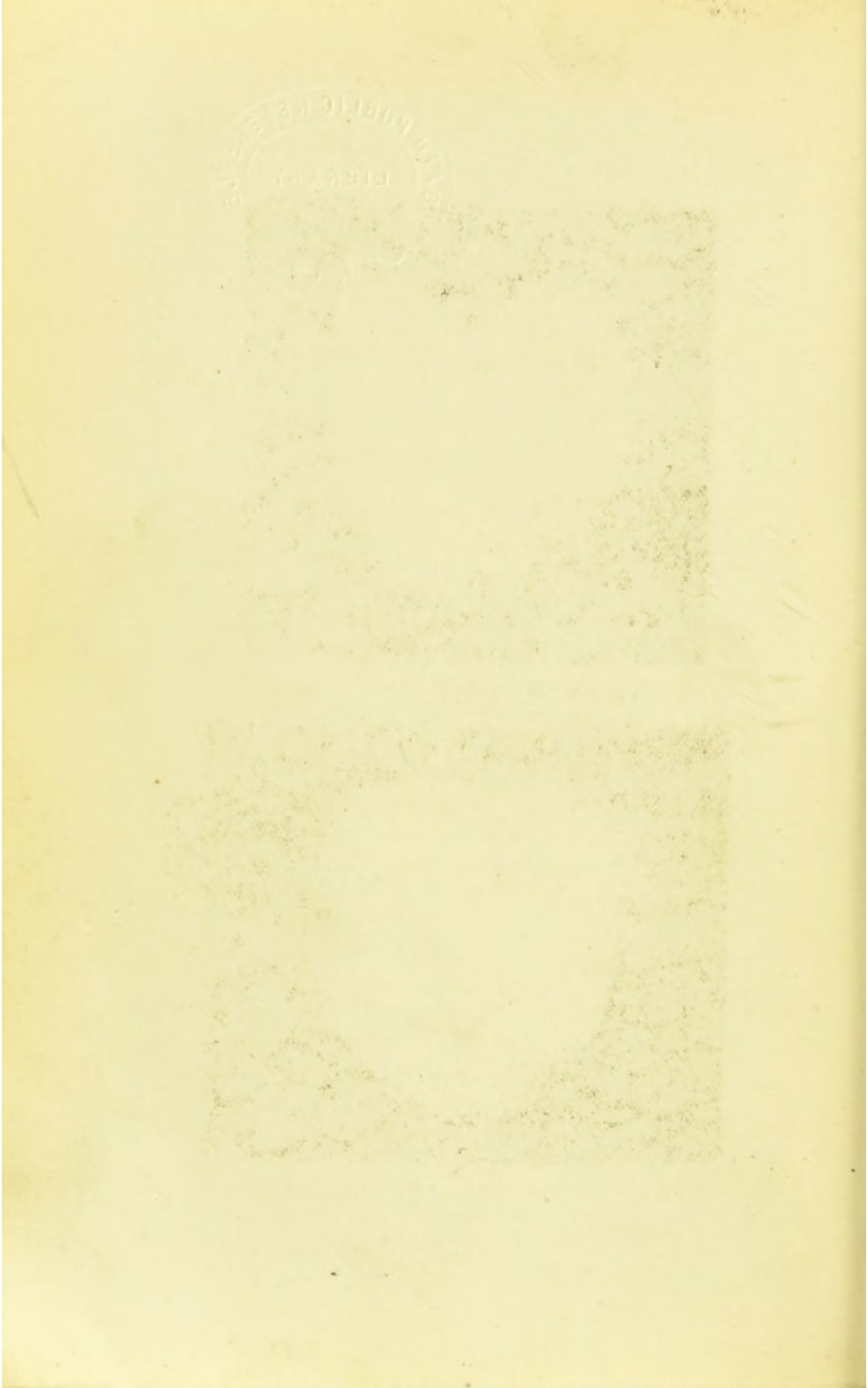
PL: II.

CORPUS LUTEUM *(AFTER DALTON)*

Pregnancy - at term.

Three days after delivery.

West, Newman & Co chromo. lith.



the second month, the whole generally disappearing about four or five months after delivery.

From the above description it will be seen that there is no real difference between the corpus luteum of menstruation and that of pregnancy, save in degree of development; the so-called true corpus luteum, therefore, can no longer be considered an absolute indication of pregnancy.

Puberty and Menstruation.—At a certain age the female undergoes a change, manifested by a periodical discharge of blood from the vagina, by development of the mammæ, growth of hair on the pubes, and a general amplification of the limbs and figure. She is then said to have arrived at puberty, and is competent to take part in the procreation of children. In addition to the physical changes above enumerated, the moral character undergoes a marked change; the girl's manner becomes more subdued, losing the vivacious freedom of childhood, and toning down to the reserved mien of womanhood. The age of puberty varies in accordance with differences of climate, race, constitution, and way of life. In this country the usual age is fifteen years, in the tropics it is about three years earlier, and in frigid countries one or two years later; and as a rule the progeny of the wealthy and town-reared children menstruate earlier than those of the poor or the country-bred. The commencement of this epoch is indicated ordinarily by more or less constitutional disturbance, as headache, tympanitic distension of the bowels, pains in the breasts, and general languor. These symptoms, known as the menstrual molimen, usually accompany, in a greater or lesser degree, the periodical recurrence of this function. According to the investigations made by Rabuteau the amount of urea contained in the urine diminishes more than twenty per

cent during the menstrual nisus; the pulse becomes slower, and the temperature is reduced by about 1° Fahr. Menstruation recurs at intervals of four weeks, but this regularity is subject to modification from certain constitutional and other causes. In a healthy woman it recurs with uniform periodicity, excepting during pregnancy and lactation, until its cessation at about the age of forty-five years, and thenceforth she becomes incapable of bearing children. During the cessation of the menses after conception, ovules are neither matured nor discharged from the ovaries.

The average duration of each menstrual flow is five days, and the quantity has been estimated by Meigs at from four to six ounces; but both the duration and amount of the menses are liable to considerable variation without disturbance of the general health. The source of the menstrual discharge is a subject which has long engaged the attention of physiologists. It is admitted on all sides that the menstrual fluid is derived from the mucous membrane lining the interior of the uterus; but the point in dispute is—How is it poured out? It is clear that at each monthly period the whole generative apparatus, including ovaries, Fallopian tubes, and uterus, becomes congested—the utricular glands and vascular network surrounding them especially participating in this engorgement; the uterine mucous membrane is thickened and tumefied, almost filling up the cavity, and is studded with numerous hæmorrhagic points. Pouchet holds that the mucous membrane exfoliates entirely or in part, and that the capillaries thus exposed furnish the blood; this being precisely what takes place during labour or abortion. In support of this view he instances the fact that in cases of membranous dysmenorrhœa portions of the

uterine mucous membrane are discharged. This phenomenon, however, is of exceptional occurrence, and is scarcely adequate to establish a theory. Tyler Smith likewise held that at each menstrual period the mucous membrane is cast off, discharged with the blood in a disintegrated condition, and in proof he adduces the post-mortem examination of the

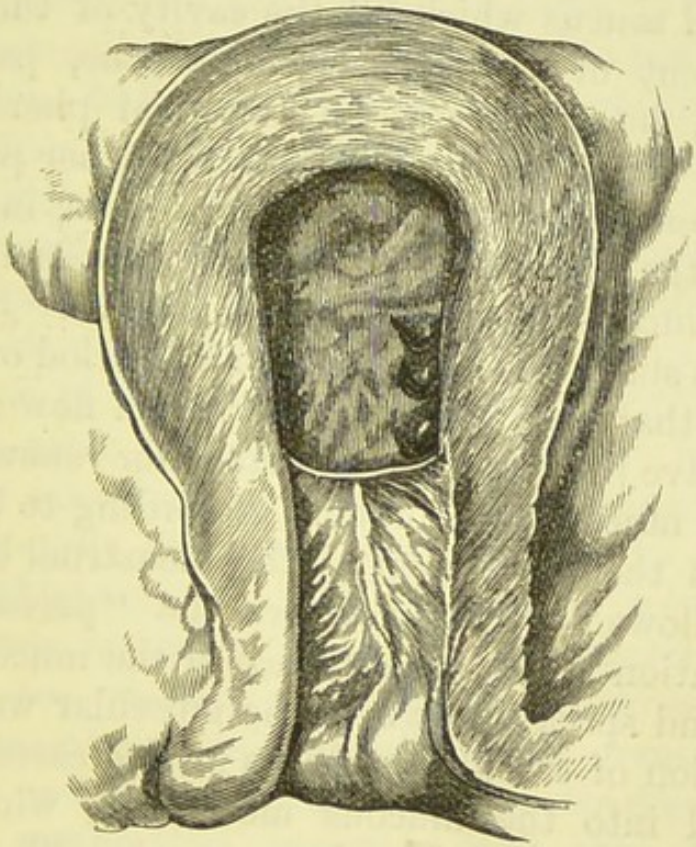


Fig. 49.—Uterus of a Woman who died from Apoplexy during the Catamenial Flow. The whole of the mucous membrane of the body of the uterus is wanting. (After Tyler Smith.)

uterus of a woman who suddenly died whilst menstruating. In this case the mucous membrane, as far as the cervix, was entirely wanting, and a microscopic examination made by Handfield Jones and Smith showed that there was no trace either of epithelium or of utricular glands. This and other cases led Smith to the conclusion that every month the

uterine mucous membrane is detached, becomes excrementitious, and forms part of the menstrual discharge, a new membrane being developed to supply the place of the old.

The view held by Kölliker is that the superficial capillaries being greatly congested, rupture takes place, and the epithelial lining of body and fundus is, for the most part, thrown off and mixed with the blood and mucus which fill the cavity of the uterus. Detachment of the mucous membrane, partial or complete, he regards as an abnormal phenomenon. Sir John Williams, in an exhaustive paper published in the *Obstetrical Journal* for 1875, traces, in a series of cases, the cycle of changes which he found to occur in the mucous membrane of the uterus. Sir John Williams states that there is no real period of uterine repose—that even when the menstrual flow is taking place active provision is being made for renewal of the denuded mucous membrane. According to Sir John Williams the mechanism of the menstrual discharge is as follows:—Shortly before the "period" fatty degeneration attacks the surface of the mucous membrane, and spreads down to the muscular wall; then contraction of the uterus drives an increased amount of blood into the mucous membrane, which gives way and allows the blood to escape. The mucous membrane now undergoes rapid degeneration, and is removed cell by cell. Whilst this destructive process is going on active proliferation takes place in the subjacent muscular wall, beginning like the disintegrative process immediately within the inner os and proceeding to the fundus, so that three days after the cessation of the menses the lower two-thirds, and in a week the whole of the body of the uterus is lined by thin mucous membrane. About the tenth day after the termination of the discharge an abrupt

distinction between the mucous membrane and the muscular wall commences near the cervix and spreads to the fundus, which it reaches a little before the bleeding recommences. The mucous membrane is now at its highest state of development attainable in the unimpregnated state, and is in a fit condition to receive the impregnated ovum. Failing impregnation, fatty degeneration sets in, and the whole process is repeated. Sir John Williams sums up by stating that menstruation is neither a congestion nor a species of erection, but a molecular disintegration of the mucous membrane of the body of the uterus, followed by hæmorrhage.

Whatever be the correct view, it is certain that the uterine mucous membrane is much thinner after menstruation than before. Dr. Galabin says that "if the uterus of a woman who has died within about ten days after the cessation of the last menstrual period be examined, the mucous membrane is found to be generally not more than from $\frac{1}{20}$ to $\frac{1}{10}$ of an inch in thickness. . . . If, however, a woman who menstruates normally has died very shortly before the expected onset of a period, the thickness of the mucous membrane is generally much greater, being often as much as $\frac{1}{6}$ inch at its thickest part." Different authorities maintain that this alteration is due to more or less complete shedding of the mucosa; or it may possibly be explained by the difference in amount of the vascular congestion and serous infiltration of the mucous membrane. Mr. Bland Sutton sums up the results of his observations in the statement that "in the human uterus the destructive change is limited to the shedding of the epithelium, and it is doubtful if this occurs normally."[1] He has examined Fallopian tubes removed by opera-

[1] *Surgical Diseases of the Ovaries and Fallopian Tubes*, 1891.

tion during menstruation, and finds that the tubal mucous membrane undergoes no structural change. He infers that the changes which have been described in the uterine mucous membrane were post

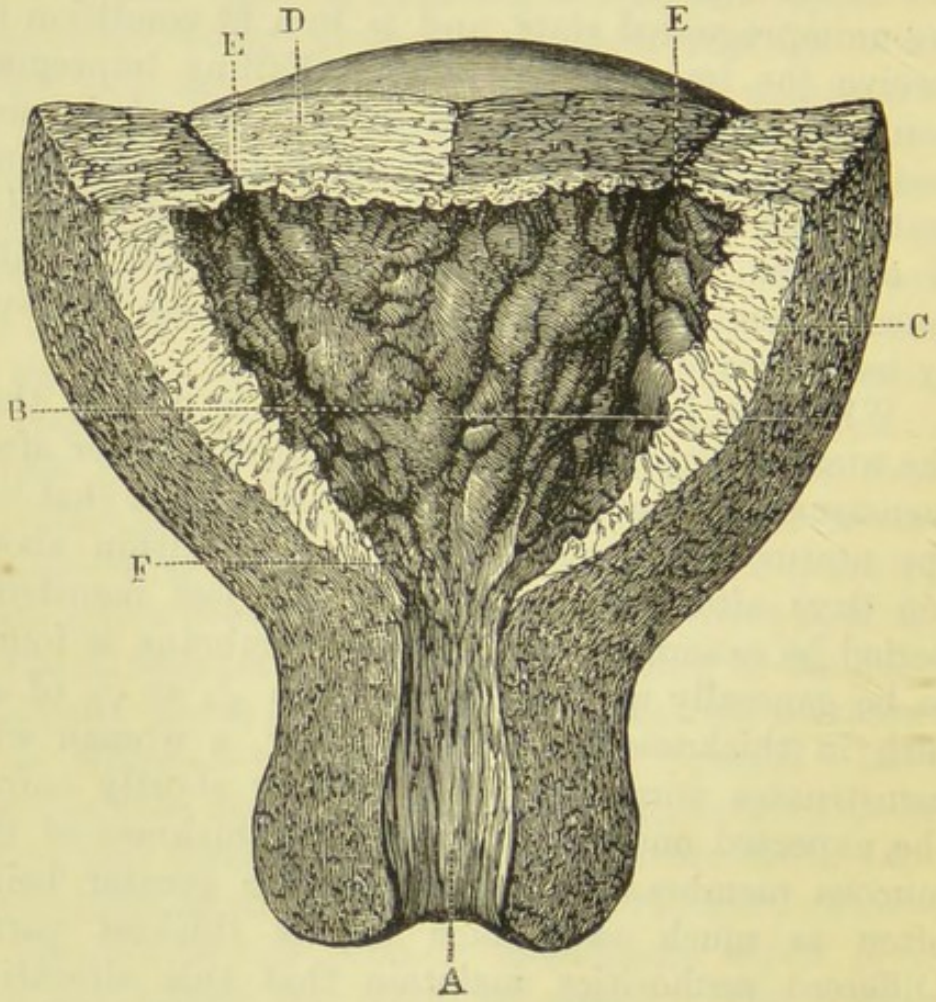


Fig. 50.—Uterus laid open to show the Hypertrophy of the Mucosa in Menstruation.

A, Mucosa of the cervix. B, Mucosa of the body, very turgid. C, Thickness of the section of the mucosa. D, Uterine tissue proper. E, F, Mucosa diminishing in thickness at os internum and openings of Fallopian tubes. (Barnes after Tarnier.)

mortem, and due to the method of preparation of the specimens. He has examined the tubal and uterine mucous membrane of Macaque monkeys and baboons, which are, so far as he has observed, the only

mammals which menstruate besides women. Some of these animals "were killed when the catamenia appeared, some at the full height, and others at its decline. In most cases the uterus was removed and placed in conservative media (Müller's fluid gave best results) the instant death occurred. This enabled me to obtain some beautiful and reliable specimens; in none of them could any trace of destructive change be detected either in the uterus or Fallopian tubes—not even shedding of the epithelium. The uterus of a Macaque monkey is very instructive for this purpose. In shape, and even in the structure of the mucous membrane and disposition of glands, it is so very similar to that of our own species that it may be described as a miniature human uterus. The glands and their ducts are lined with columnar ciliated epithelium."

Examined microscopically the normal menstrual discharge is found to consist of blood discs, mucous corpuscles, epithelial cells, and fatty granular matter; if the flow is abnormally rapid, the discharge assumes more the character of ordinary blood. In its chemical character menstrual blood does not materially differ from ordinary blood; it gives out, however, a peculiar odour which, in some women, manifests itself during the nisus in the breath and perspiration. It has long been known that menstrual blood does not coagulate, a peculiarity caused by its admixture with the acid mucus of the vagina; for if the discharge is allowed to flow through a speculum direct from the uterus, so as to escape contact with the vaginal mucus, the menstrual fluid is then alkaline, and readily coagulates. In cases, too, of menorrhagia, the blood, being poured out rapidly or in excessive quantity, does not become mixed with the vaginal mucus, and so retains its property of coagulation.

The occurrence of menstruation is dependent on the ovaries. Perhaps the Fallopian tubes and nervous apparatus in the tissue of the broad ligaments have also some influence. Congenital absence of the ovaries, or their removal in childhood, as is the custom in some Eastern countries, leads to a permanent state of primary amenorrhœa. Again, after the onset and continuance of menstruation for some time, removal of the ovaries and tubes is followed by a permanent cessation of the function. It is essential that this removal should be *bilateral and complete*, the latter especially in cases of fissured ovary, a condition which has given rise to the belief that supernumerary or third ovaries at times existed. For in a case of oöphorectomy, reported by Battey, *Transactions of the International Medical Congress*, 1881, page 284, where the removal was not quite complete, not only menstruation but also pregnancy followed the operation. The exciting cause of menstruation is generally supposed to be associated with the maturation of a Graafian follicle. This theory is termed the ovulation theory, but considerable objection has been raised to it, because it has been repeatedly observed during abdominal section that the ovaries exhibited one or more mature Graafian follicles, even in the intermenstrual period, at some distance of time from the close of one menstrual period or the advent of another. The dependence, therefore, of menstruation on ovulation wants further proof. Possibly the cause of menstruation, whatever it may be, gives rise to increased ovarian activity coincident with the marked external changes.

In connection with this we must mention the condition known as *rut* or *œstrus*. In the lower mammalia the discharge of ovules from the ovary happens only at certain recurrent periods. At these times the

genitals are turgid, and their secretion is odorous and sometimes coloured. It is at these periods only that the female will suffer the approach of the male, and also the only time when she can become impregnated. It would seem that menstruation in the human female might reasonably be taken as corresponding in some degree with the period of *rut* in the lower animals; the great difference being that in woman ovulation is not limited only to the menstrual period. Certainly in woman impregnation usually takes place during the first week after the cessation of the menses, but it may occur at any point of time between the menstrual periods. Costé, in explaining this on the ovulation theory of the origin of menstruation, states that it is the maturation and not the dehiscence of a Graafian follicle which initiates menstruation, and consequently that the escape of the ovule may not take place until after the menstrual period has ceased. Again, we do not know how long the ovule takes to reach the womb, or how long it will retain its vitality. The difference between rut and menstruation is not so pronounced, therefore, as would appear at first sight. The further question of periodicity in the sexual appetite is not worth discussing. Man's mental endowments, together with the artificial mode of life attendant upon civilisation, are adequate to account for great modifications in this respect.

A peculiar abnormality is occasionally met with, generally among women of a highly nervous organisation, known as vicarious menstruation, in which a periodic discharge of blood takes place from some part of the body other than the womb. The mucous linings of the lungs, stomach, nasal cavities, or anus when it is the seat of piles, and chronic ulcers, are the most usual sites of this phenomenon; more rarely

the hæmorrhage occurs on some external part of the body where the skin is intact.

"When such patients are carefully examined we will often find that the menses have ceased in consequence of the hæmorrhages (hæmoptysis, hæmatemesis, bleeding from hæmorrhoids), or else that the latter are by no means regular, and occur only at the time when the menses ordinarily appear. However, hæmorrhage from the nose or intestinal mucous membrane may occur simultaneously with a scanty menstrual flow, and in this case evidently acts as a substitute for the usual more profuse discharge from the uterus. Again, hæmorrhages from the nose, mouth, and lungs have been observed in connection with congenital atresia of the uterus, and with premature menopause; the name vicarious menstruation is here peculiarly applicable."[1]

[1] Winckel, *Diseases of Women*, translated by Parvin, 2nd ed. 1890, p. 478.

CHAPTER V

DEVELOPMENT OF THE OVUM

HAVING described the process of ovulation, with its related function menstruation, and the formation and disintegration of the corpora lutea, we now come to those wondrous series of changes in the impregnated ovule, ending in the production of a human being.

We must, first of all, mention that prior to fertilisation the ovum undergoes certain changes which result in its maturation—that is, in a state prepared to receive the spermatozoa. These changes consist in the extrusion of two polar globules. The first thing noticed is that the germinal vesicle approaches the periphery of the ovule, and becomes somewhat indistinct. Very careful observations have shown that it is becoming subdivided by a process called *karyokinesis*, and a portion of it is thrown off, and is soon extruded from the protoplasm of the egg into the perivitelline space. This is the *first polar globule*. A *second polar globule* is next separated and extruded in a similar manner, after which the remnant of the original germinal vesicle recedes towards the centre of the ovule, and is known as the *female pro-nucleus*. The egg is now mature and ready for fertilisation. The explanation of this method of maturation of the ovum is still *sub judice*. Formerly the polar globules

were supposed to indicate the pole or site at which segmentation first begins after impregnation; the later writings of Minot and Weismann should be consulted in relation to this question.

The semen—the fecundating medium—is developed in the testes of the male, and consists of a whitish viscid fluid containing a vast number of animated filaments called spermatozoa. In addition to the potential elements derived from the testes, secretions

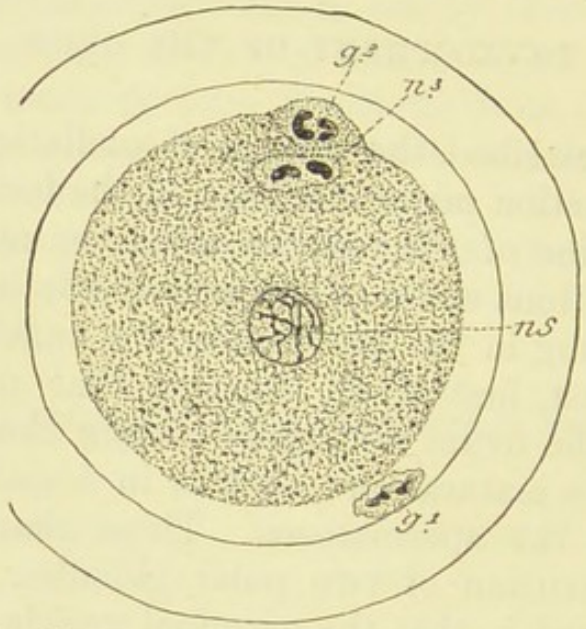


Fig. 51.—Formation of the Second Polar Globule.
g^1, First polar globule. g^2, Second polar globule. n^3, Remains of germinal vesicle, now the female pro-nucleus. *ns*, Male pro-nucleus.

from the vasa deferentia, vesiculæ seminales, and the urethral and prostatic glands enter into the composition of the seminal fluid; it is chiefly to the prostatic fluid that the whitish appearance of semen is due. Amongst its chemical constituents may be enumerated the phosphates and chlorides of magnesia, nuclein or nucleo-albumen, and lecithin. The most important of these bodies is the nuclein, and as the main solids of the semen are contained in the spermatozoa, the presence of such a large amount of nuclein, as Foster says, supplies chemical evidence of the nuclear nature

of the spermatozoon head. Histologically the development of the spermatozoon within the testis is thus described by Foster :[1]

"In a seminal tubule, a cell of the outer layer next or near to the basement membrane, undergoes the changes in the nucleus known as karyomitosis or karyokinesis, and gives rise to two cells, one of which remains to fill the place of the mother cell in the outer layer, while the other advances inwards towards the centre of the lumen. The latter undergoes repeated karyomitosis, and so gives rise to a number of cells characterised by the cell substance being small in bulk relatively to the nucleus. Whether each division of the nucleus is from the first accompanied by a complete division of the cell-body, or whether a number of nuclei are formed in a coherent mass of cell-substance, which is subsequently partitioned out among the nuclei, is a question we may leave on one side; the important thing is that a mother-cell by mitosis gives rise to a brood of small daughter-cells. Each daughter-cell soon assumes an oval or club-shaped appearance with the nucleus at one end. Changes then take place in the nucleus; into these we cannot enter, but may say that they appear to consist in the ejection or separation of a part of the nucleus, and a transformation of the rest, so that what was an ordinary nucleus becomes the differentiated head of a spermatozoon. At the same time the cell-body is transformed into the middle piece from which the tapering tail subsequently grows out.

"It may well be imagined that the transformations needed for the development of the potent spermatozoa are of a special kind, and that the changes within the seminal tubule are in more ways than one unlike those taking place in an ordinary epithelium;

[1] *Text-book of Physiology*, 1891, p. 1504.

but concerning the details of the changes there is at present great diversity of opinion. The important fact for our present purposes is that in the seminal tubules spermatozoa are developed out of some or other of the lining epithelium cells, and, further, are developed in such a way that a specialised nucleus becomes the head, while the body (middle piece) and tail appear to be of the nature of cell-substance."

The mature spermatozoon consists of a flattened oval *head*, from which is prolonged a fine tapering filiform process or *tail*; the head is about $\frac{1}{5000}$ of an inch long, $\frac{1}{8000}$ of an inch wide, by $\frac{1}{25000}$ of an inch thick; the tail being about $\frac{1}{500}$ of an inch in length. The tail, as stated above, is tapering, and its thickest part immediately behind the head of the spermatozoon is known as the *middle piece or body*. The characteristic movements of the spermatozoa by which they propel themselves along the genital tract of the female are produced by whip-like undulations of the filamentous portion. This peculiar movement formerly led to the supposition that the spermatozoa were animalcules, the prevailing opinion now being that their movements are due to the same cause as those of ciliated epithelium. It has been proved experimentally by Spalanzani, Prévost, and others, that the spermatozoa are the actual fecundating agents, the containing fluid acting only as a medium or vehicle. Under favourable conditions, as in the uterus and Fallopian tubes, the spermatozoa retain their activity for many days. In old age the procreative faculty ceases in the male, although many instances to the contrary are recorded, spermatozoa in active move-

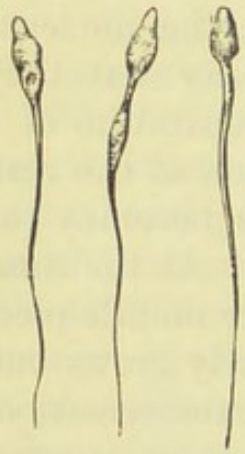


Fig. 52.
SPERMATOZOA.

ment having been found in the testicles and seminal fluid of men far advanced in life; Wagner, indeed, states that it is only in weakly individuals that the procreative faculty is really lost.

For the development of the ovum it is necessary that it should come in contact with the male seminal secretion. In some of the lower creatures—fishes, for example — impregnation is effected after the female has discharged her eggs; in others, as birds, impregnation takes place before the egg is extruded; in the higher order of mammals, including man, provision is made not only for fecundation of the ovum within the female organs, but also for its development.

In the human subject, after a fruitful intercourse, the male seminal fluid is ejected to the upper part of the vagina or even into the uterus; its spermatozoa —partly by their independent action, partly by the action of the uterine cilia, which vibrate upwards— come in contact with the ovule at some part of the genital tract, and impregnation is the result. The actual spot where the union of the ovule and the spermatozoa occurs is not known; that it may happen immediately after rupture of the Graafian follicle, or perhaps even before rupture, is proved by the occurrence of ovarian pregnancy. Probably in the great majority of cases contact takes place in the Fallopian tubes. The power of locomotion possessed by the spermatozoa is so considerable that ejaculation to the upper part of the vagina is not necessary for impregnation, for cases have occurred where the mere deposition of spermatic fluid on the vulva has been sufficient to produce fecundation of the ovule.

Having described the maturation of the ovum, and the male elements essential to fecundation, we now

come to the process of fertilisation itself. This consists essentially in the entrance of a spermatozoon

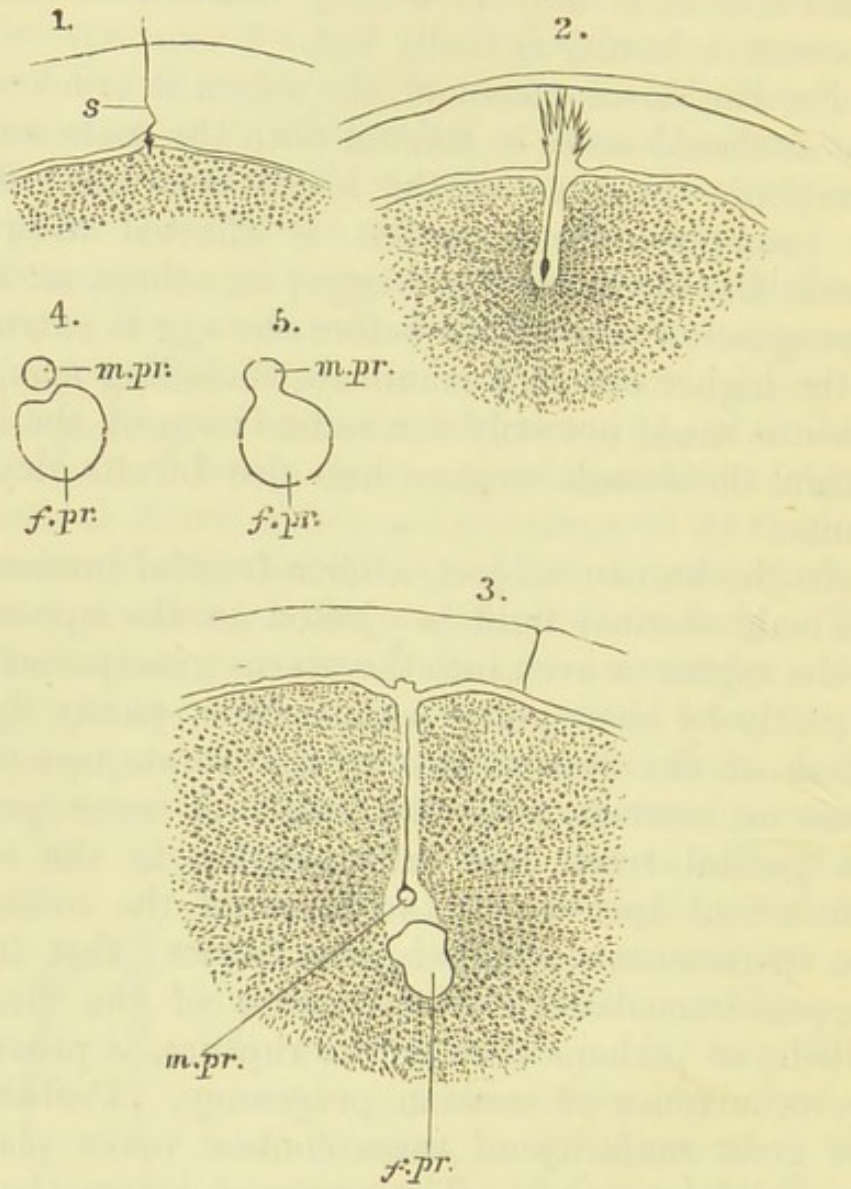


Fig. 53.—Fertilisation of the Ovum of an Echinoderm.
(Quain, after Selenka.)

s, Spermatozoon. *m.pr.* Male pro-nucleus. *f.pr.* Female pro-nucleus.

1, Accession of a spermatozoon to the periphery of the vitellus. 2, Its penetration, and the radial disposition of the vitelline granules. 3, Transformation of the head of the spermatozoon into the male pro-nucleus. 4, 5, Blending of the male and female pro-nuclei.

into the interior of the mature egg. An entrance, as we have said before, is probably facilitated by the

radial pores described in the zona pellucida. Several spermatozoa may penetrate the zona pellucida, and may be seen moving about in the perivitelline space. One only, in all probability, of these spermatozoa goes farther than this, and embeds itself in the vitellus, where its head soon becomes altered in character, and assumes the appearance of a nucleus, being now known as the *male pro-nucleus*. Thus we have within the vitellus a male and a female pro-nucleus, which soon fuse into a single nucleus — fecundation is completed and segmentation is ready to begin.

Before passing on to the further development of the ovum, it should be mentioned that spermatozoa have been seen actively moving about in fluids collected from the female passages from eight to ten days (Luschka) after coitus, so that the precise time of fecundation cannot be fixed, as it is only fair to consider the possession of mobility as evidence of coexistent power of fertilisation. Further, the time occupied by the ovum in its passage from the ovary to the uterus cannot be stated with any degree of definiteness, nor can the length of time during which an ovum extruded from a Graafian follicle still retains its capacity for fertilisation.

The first occurrence in the development of a fecundated ovum is the phenomenon known as *segmentation*. The whole cell contents take part in the process of division which, as in the division of any cell, commences in the nucleus. The primarily single mass within the vitelline membrane divides into two, and each of these again into two, the subdivision being continued through the various generations of descendant segments of cell substance, until the so-called *mulberry* stage is reached. Now the vitelline membrane is occupied by a mass of small cells, each

of which contains a nucleus formed of a segment of the original nucleus of the fertilised ovule. Early in the process of fission two types of cells are noticed, those of one kind are large and clear, the other being comparatively smaller and darker; and it is noticed that the cells are so disposed that the large clear cells are external surrounding the others. After the

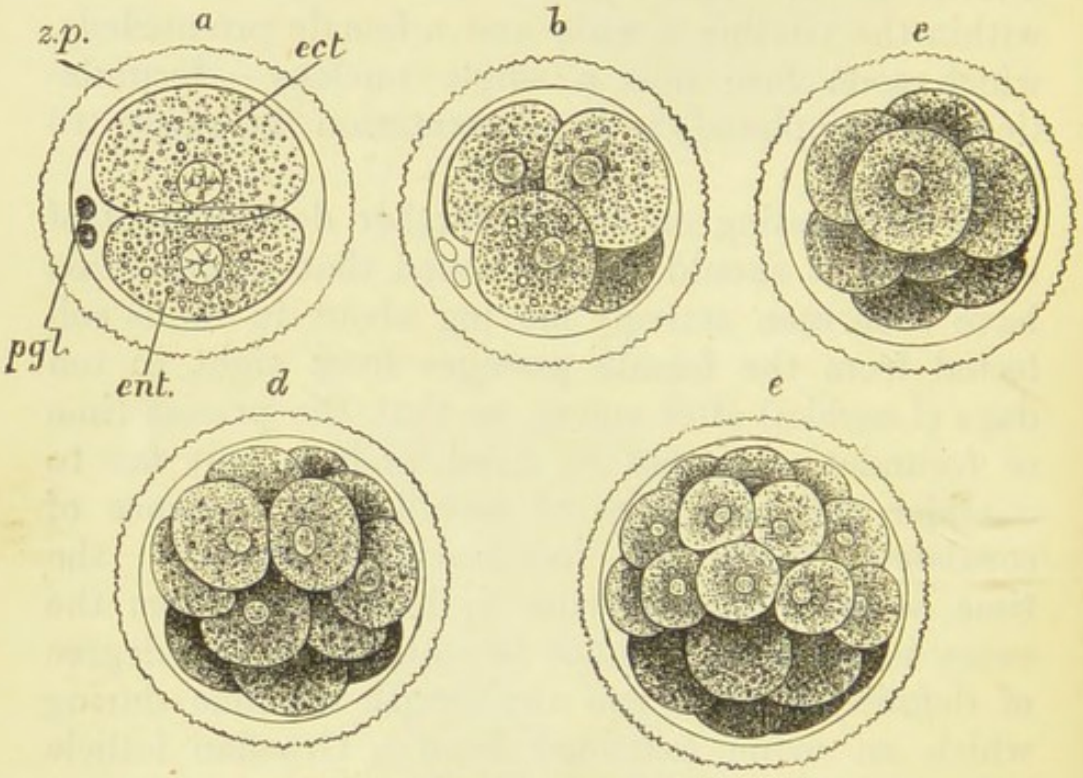


Fig. 54.—Segmentation. (Quain.)

a, *b*, *c*, Division into two, four, and eight segments. *d*, *e*, Later stages, showing more rapid division of the clearer segments, and the enclosure of the darker segments by them.

mulberry stage is reached, the large clear cells rapidly extend and become applied to the inner surface of the zona pellucida, which they completely invest, the cells being polygonal, and packed together so as to form a membrane within the zona pellucida. Meantime the darker cells have not developed at such a rate as to fill the cavity within this membrane, the larger part of the space being occupied by

fluid, the darker cells being adherent to one part

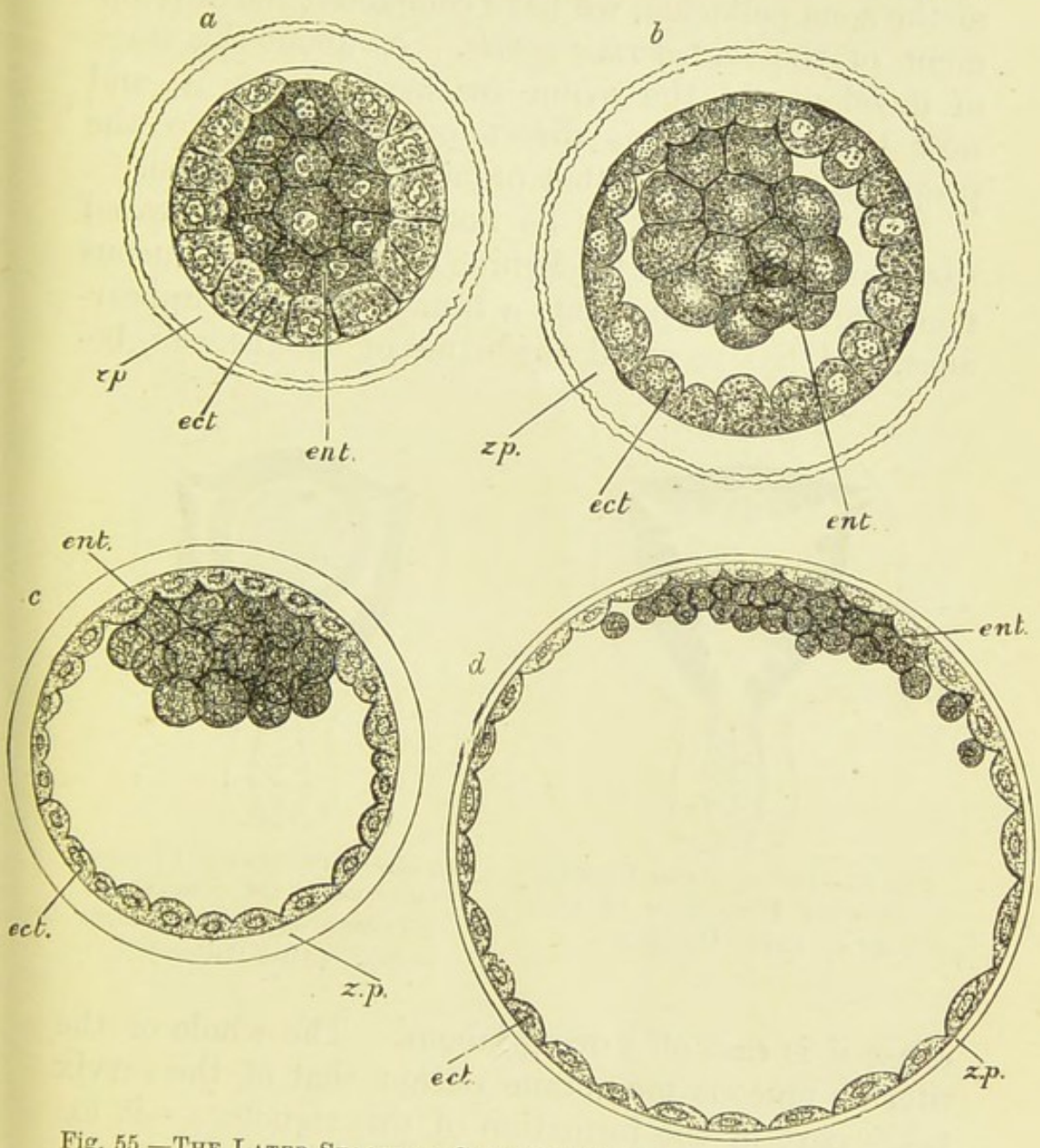


Fig. 55.—The Later Stages of Segmentation, showing the Formation of the Blastodermic Vesicles. (Quain, after Van Beneden.)

a, Section showing the enclosure of darker cells *ent.*, by clearer cells *ect.* *b*, More advanced stage in which fluid is beginning to accumulate between the inner and outer cells, the former completely enclosed. *c*, The fluid has much increased, so that a large space separates inner from outer cells, except at one part. *d*, Blastodermic vesicle, its wall formed of a layer of flattened cells, with a patch of dark granular cells adhering to it at one part. *z.p.* Zona pellucida.

of the lining formed by the outer cells. With the

extension of the large cells round the inner aspect of the zona pellucida, we have completed the development of the *blastodermic vesicle.* At about this stage of development the ovum reaches the uterus, and now therefore let us direct our attention to the preparations made in that organ for its reception.

The first feature to be noticed is the increased vascularity and great thickening of the uterine mucous membrane, which presents a tumefied velvety appearance, and has received the name of *decidua vera*, be-

Fig. 56.—Impregnated Uterus, showing Formation of Decidua. (After Dalton.)

Fig. 57.—Impregnated Uterus, showing Ovum completely enclosed by Decidua Reflexa. (After Dalton.)

cause it is cast off during labour. The whole of the uterine mucous membrane except that of the cervix takes part in the formation of this structure—it extends from fundus to os internum; the cervix meanwhile becomes blocked up by thick viscid mucus secreted by the cervical glands. The ovum on reaching the uterus becomes arrested near the opening of the Fallopian tube, and lodges in one of the numerous depressions in the decidua vera, which by degrees forms a kind of embankment round the ovum, extending over it until it is entirely covered in between

the decidua vera and this new formation, called the *decidua reflexa*. The decidua vera, then, is simply the uterine mucous membrane hypertrophied, the decidua reflexa being a new growth derived from it. During the first months of pregnancy the space between the decidua vera and decidua reflexa contains a small quantity of serous fluid—the hydroperione of Breschet—which is absorbed as the two deciduæ come into apposition. This union takes place between the third and fourth months of pregnancy, the two layers then forming one membrane. The existence of this space between the decidua vera and decidua reflexa probably accounts for the numerous cases in which menstruation after conception has continued until the third or fourth month of utero-gestation. The portion of decidua to which the ovum is attached is called the *decidua serotina*, the site, as was previously stated, of the placenta. Towards the end of utero-gestation the decidua becomes thinner, and is gradually loosened from the uterine parietes by fatty degeneration of the points of attachment, preparatory to its expulsion when the proper time arrives. About the fourth month a fine homogeneous layer begins to form between the decidua and the muscular coat of the uterus, which is the first step towards the formation of a new mucous membrane. Its growth is very slow, and is not completed until two months after delivery.

To return to the ovum. We have described two stages in its development, viz. the mulberry stage and that of the blastodermic vesicle. We now pass on to the formation of the *bilaminar blastoderm*. The localised inner mass of cells thickens centrally, and is known as the embryonic area. Next, as the cells of this inner mass extend round the vesicle, cleavage occurs in them, progressing outwards from the

embryonic area, and resulting in the formation of two layers, external and internal. The external one is applied to the surrounding layer derived from the

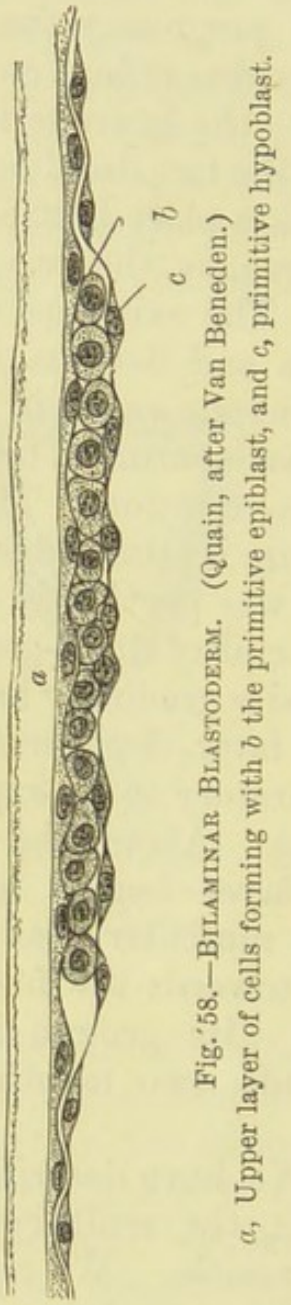


Fig. 58.—Bilaminar Blastoderm. (Quain, after Van Beneden.)
a, Upper layer of cells forming with *b* the primitive epiblast, and *c*, primitive hypoblast.

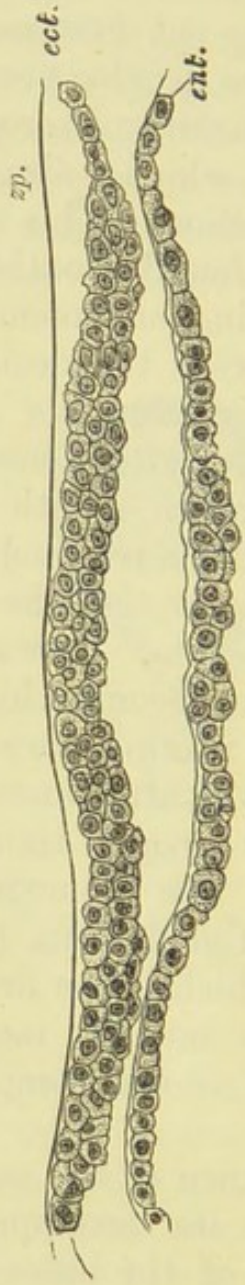


Fig. 59.—Bilaminar Blastoderm. (Schäfer.)
ect. Primitive epiblast. *ent.* Primitive hypoblast. *zp.* Thinned-out zona pellucida.

large clear cells, and fuses with it, forming the *primitive epiblast.* The inner layer, *primitive hypoblast,* takes somewhat longer to extend round the ovum when the bilaminar blastoderm is completed. We have

now arrived at a stage, that of the bilaminar blastoderm, when within the zona pellucida is a double-layered vesicle, at one portion of which, when viewed by transmitted light, the wall or walls appear dark and thick; that is, at the embryonic area. The formation of this double-layered condition is described

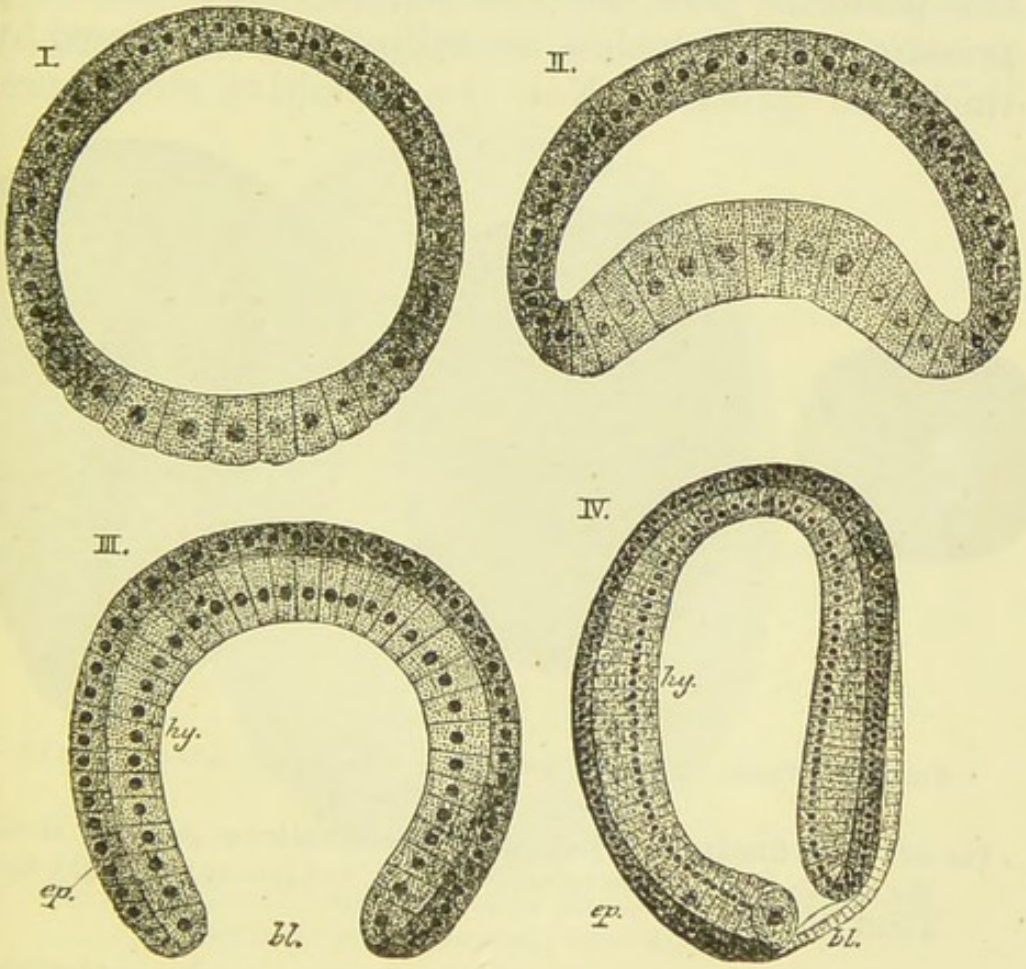


Fig. 60.—Formation of Gastrula in Amphioxus.
(Quain, after Hatschek.)

above as resulting from cleavage; but in some of the lower animals, *e.g.* amphioxus, the transformation of a vesicle surrounded by one membrane composed of cells into a vesicle surrounded by two such membranes (layers), results not by cleavage of the one layer starting from any particular spot, but by a process of invagination commencing at a spot which necessarily

presents an opening—the blastopore. The two-layered stage in amphioxus is known as the gastrula stage, and some authorities hold that the corresponding stage described above, that of the bilaminar blastoderm, is formed similarly. The embryonic area, at first round, becomes pear-shaped or ovoid. Towards the posterior end there is seen a dark streak, the *primitive streak*, which is, according to some, caused by thickened epiblast. Now this primitive streak pre-

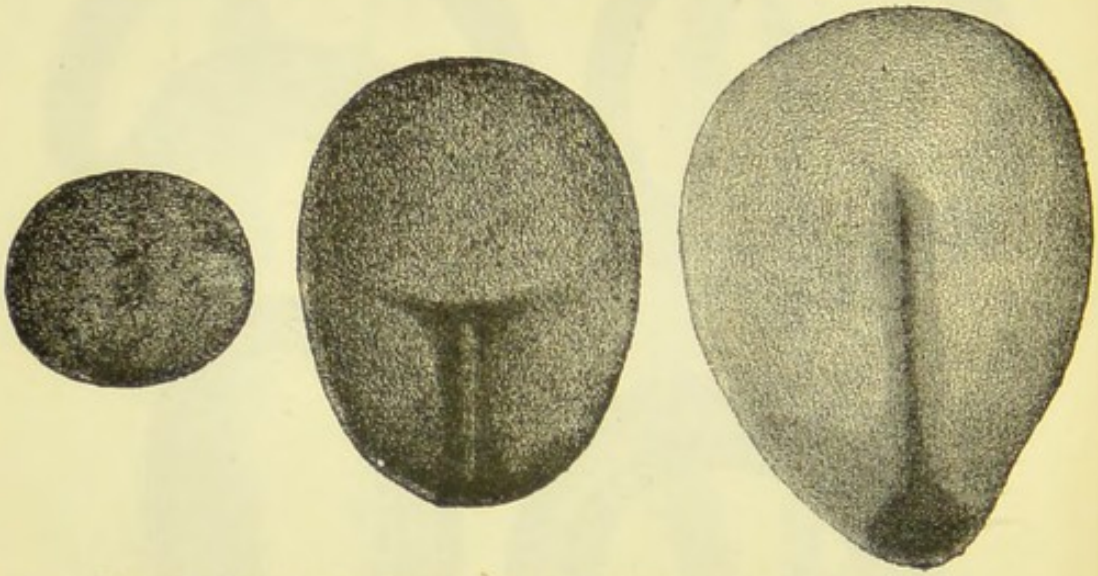


Fig. 61.—Stages in Development of Embryonic Area of Mole. (Quain, after Heape.)

The left figure illustrates appearance before formation of primitive streak; the middle figure shows primitive streak and groove; the right figure a still later stage.

sents on its upper surface a groove, the primitive groove, and according to these authorities the posterior portion of the primitive groove indicates the spot where invagination of the hypoblast took place, and this spot represents the blastopore of the gastrula. They say that the changes in the human embryo are too rapid at this stage to admit of exact demonstration, but they consider they have good grounds for inferring a parallel process in the human embryo to that of amphioxus.

About this period there is noticed in the region of the primitive streak a mass of cells intervening between the epi- and the hypoblast. This is the rudimentary *mesoblast*, and it would appear to have originated at the expense of both the epi- and hypoblast, though in some of the lower animals its formation has been described as resulting from hollow buddings of the hypoblast into the space between

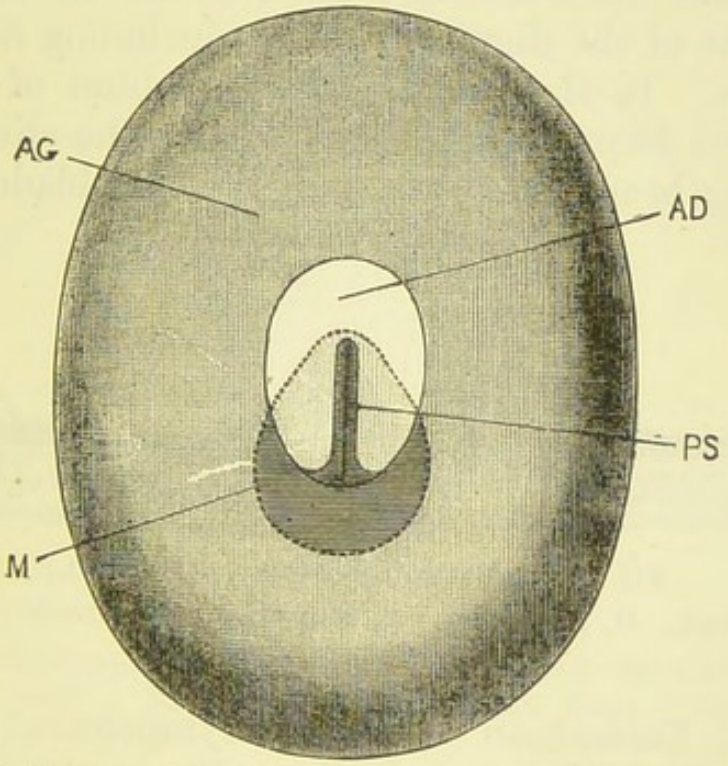


Fig. 62.—Blastodermic Vesicle of Rabbit, Seven Days, seen from above. (Marshall, after Kölliker.)

AD, Embryonal area. AG, Wall of blastodermic vesicle. M, Dotted line indicating boundary of mesoblast. PS, Primitive streak.

hypoblast and epiblast on each side of the primitive streak. However formed, the mesoblast, as will presently be seen, separates laterally into two distinct strata. The vitelline membrane still envelops the ovum, which thus possesses four tunics. The relations borne by these laminæ to the component parts of the fully-developed fœtus are as follows:—From the external blastodermic membrane—the *epiblast*—

are formed the epiderm, hair and nails, and the epithelium of the cuticular glands, sebaceous, sweat, and mammary, also the brain, spinal cord, and nerves, and the epithelial portions of the organs of special sense. The naso-pharynx, the upper and anterior portions of the mouth cavity, and the anus have epithelial linings similarly derived. From the *hypoblast* there result the epithelium of the floor of the mouth and the alimentary canal as far as the anus, with that of the digestive glands, including liver and pancreas. It also yields the epithelium of certain structures formed in connection with the alimentary tract, *e.g.* bronchial tubes and air sacs, bladder and

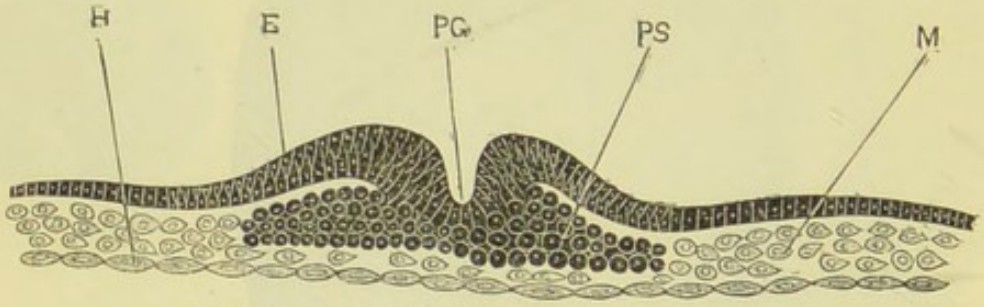


Fig. 63.—Showing Mesoblast. (Marshall.)
E, Epiblast. H, Hypoblast. M, Mesoblast. PG, Primitive groove. PS, Primitive streak.

urethra, Eustachian tube and tympanum, and the thyroid and thymus glands. From the *mesoblast* result the remaining structures of the fully-formed body, *i.e.* the osseous, muscular, vascular, and lymphatic systems, with the parts of the uro-genital apparatus not accounted for above.

We have described the development of the ovum as far as the formation of a vesicle covered by three blastodermic membranes, and enumerated the structures of the human body ultimately derived from each layer. It is not within the scope of this manual to enter into the mode of formation of the individual parts of the body, but a knowledge of the develop-

ment of the ovum, as far as we have given, is essential to a thorough comprehension of the origin of the fœtal membranes.

We may next mention how the embryo becomes differentiated from the blastoderm, which we have described with its three layers, the area germinativa, and the primitive streak; and as in point of time, just before the separation of the embryo is indicated,

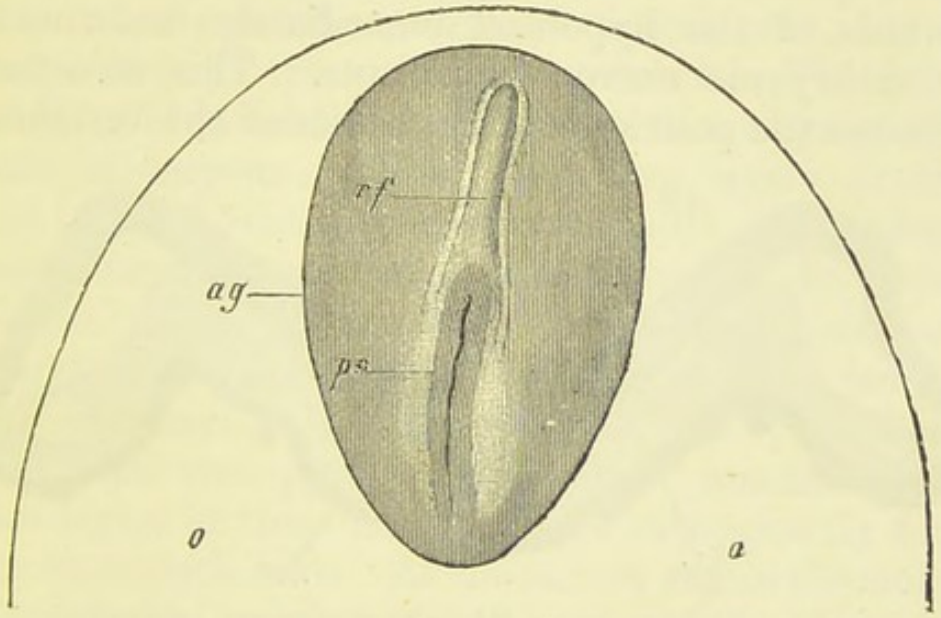


Fig. 64.—Embryonic Area, with Outline of Part of the Vascular Area, from a Rabbit's Ovum of Seven Days. (Quain, after Kölliker.)

o, *o*, Vascular area. *ag*, Embryonic area. *pr*, Primitive streak and groove. *rf*, Medullary groove.

there are formed the *neural canal* and *notochord*, these may be briefly referred to.

The neural canal, or primitive nervous system, is formed in the following manner. In the area germinativa, just in front of the primitive streak, is noticed a longitudinal groove in the epiblast, shallow behind where it comes into connection with the anterior end of the primitive streak. The ridges on each side of the groove are known as the dorsal

plates, and the contained groove is the medullary groove. The dorsal plates grow upwards and inwards, covering the medullary groove, and converting it into a canal—the *neural canal*—which is therefore a tube of epiblast running longitudinally under the external epiblast. From the differentiation of this tube the whole nervous apparatus, brain, cord, and nerves, ultimately results. The *notochord*, or chorda dorsalis, is a longitudinal rod of cells derived by projection upwards of the hypoblast immediately underneath the embryonic nervous apparatus. This structure indicates the position of the bodies of the vertebræ,

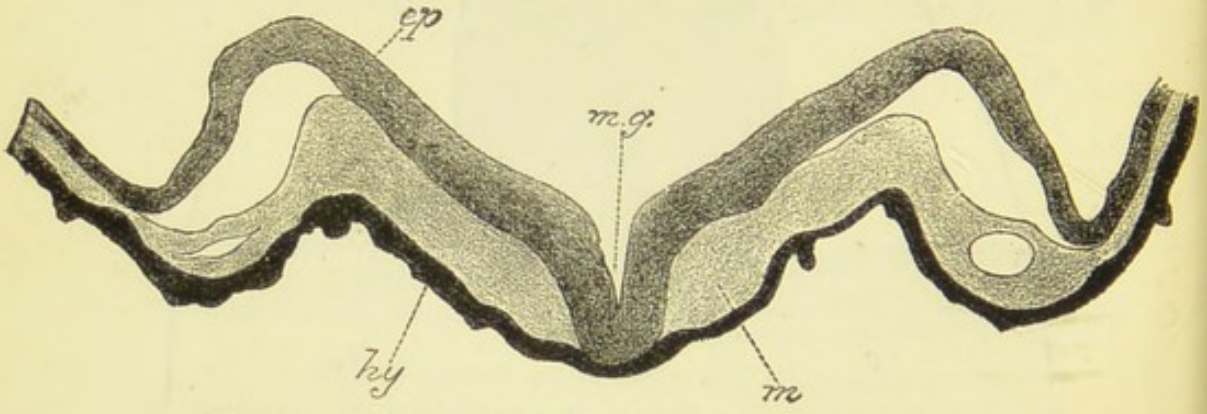


Fig. 65.—Section across Medullary Groove. (Schäfer.)
ep, Epiblast bounding *m.g.*, medullary groove. *hy*, Hypoblast. *m*, Mesoblast, with clefts representing commencement of cœlom.

which, however, are formed not from it, but from adjacent mesoblast, traces of the notochord being found in the vertebral bodies and intervertebral plates at a late period in fœtal life.

The portion of the blastoderm which takes further part in the formation of the embryo now becomes separated from the remainder by a groove. In front of the anterior end of the neural tube a furrow is noticed, and a similar one at the posterior end of the embryonic area. These are the *head* and *tail folds*, and they become united on each side by a lateral sulcus. The folds deepen until the embryo is attached

to the remainder of the blastodermic vesicle by a somewhat constricted pedicle.

To return to the embryonic layers. We have the epiblast with the neural tube running centrally underneath it from end to end of the embryo; the hypoblast with the notochord above it running longitudinally underneath the neural tube; the mesoblast is seen between the epi- and hypoblast, and on each side of the embryo the portion of mesoblast next the notochord separates from the lateral part, and has indications of the primitive vertebræ. The lateral portions of mesoblast, as briefly mentioned previously, have undergone a division into two layers, external and internal, which are united dorsally. The external one is next the epiblast, and is known as the somatopleure. The internal layer next the hypoblast is known as the splanchnopleure. The space between the two layers is the cœlom or primitive pleuroperitoneal cavity, and the point of junction of the two layers at their inner borders subsequently forms the mesenteric folds. As the furrow round the embryo deepens the original single cavity of the blastoderm lined by hypoblast becomes separated into two portions, communicating by a narrow neck. The embryonic portion of this cavity forms the rudiments of the intestinal canal. The extra-embryonic larger portion is the *umbilical vesicle* or yolk-sac, and this soon becomes so far separated as to be connected with the embryo by means only of a long narrow stalk, which consists of the vitelline duct and the omphalomesenteric artery and vein, the artery and vein being derived from that portion of the internal blastodermic lamina which surrounds the umbilical vesicle. The remains of the vitellus contained in the umbilical vesicle form a reserve of nutrient matter, which is conveyed by the vitelline duct to the developing

tissues of the embryo; after this reserve is exhausted, the umbilical vesicle, vessels, and ducts are obliterated; this occurs before the end of the fourth month. The epiblast and the outer layer of the mesoblast curve forwards and inwards, and unite enclosing the intestine; thus there is formed a tube within a tube —the inner tube is the embryonic intestinal canal, the outer one is the pleuroperitoneal cavity, which is subsequently divided by the diaphragm into abdomen and thorax. The next step is the formation of the *amnion* and the *allantois*.

On all sides of the embryo, at a little distance from it, folds of the epiblast and outer layer of the mesoblast (somatopleure) arise and curve over the dorsum of the embryo until it is entirely enclosed by the junction of these *amniotic folds*. These folds are necessarily duplex, that is, each fold consists of a double layer of epiblast and mesoblast. On their junction over the dorsum of the embryo the processes of the outer fold fuse together, as also do the processes of the inner fold; the septum which would naturally result from the union of folds of a double membrane is absorbed, and two separate cavities are formed—one between the outer and inner layers, and the other within the inner layer; the latter is the amniotic cavity, and within it lies the embryo. Of the two folds so formed, the inner one having epiblast internally and mesoblast externally, is known as the *true amnion*. The outer fold, having on the other hand epiblast externally and mesoblast internally, is known as the *false amnion*. The space between the false and true amniotic folds is, as will readily be seen, continuous with the cœlom. The external fold (false amnion) subsequently fuses with the vitelline membrane and forms the *chorion*—the external envelope of the ovum. The *amnion*, a tough fibrous

membrane, is lined with a single layer of pavement epithelium, and resembles a serous membrane except in being non-vascular. At the spot where the umbilical cord enters, the amnion is continuous with the integument of the fœtus, forming a closed sac in which is contained the *liquor amnii*. This fluid at first is clear and limpid, with a specific gravity little higher than that of water; as pregnancy advances it becomes turbid and slightly viscid, the specific gravity

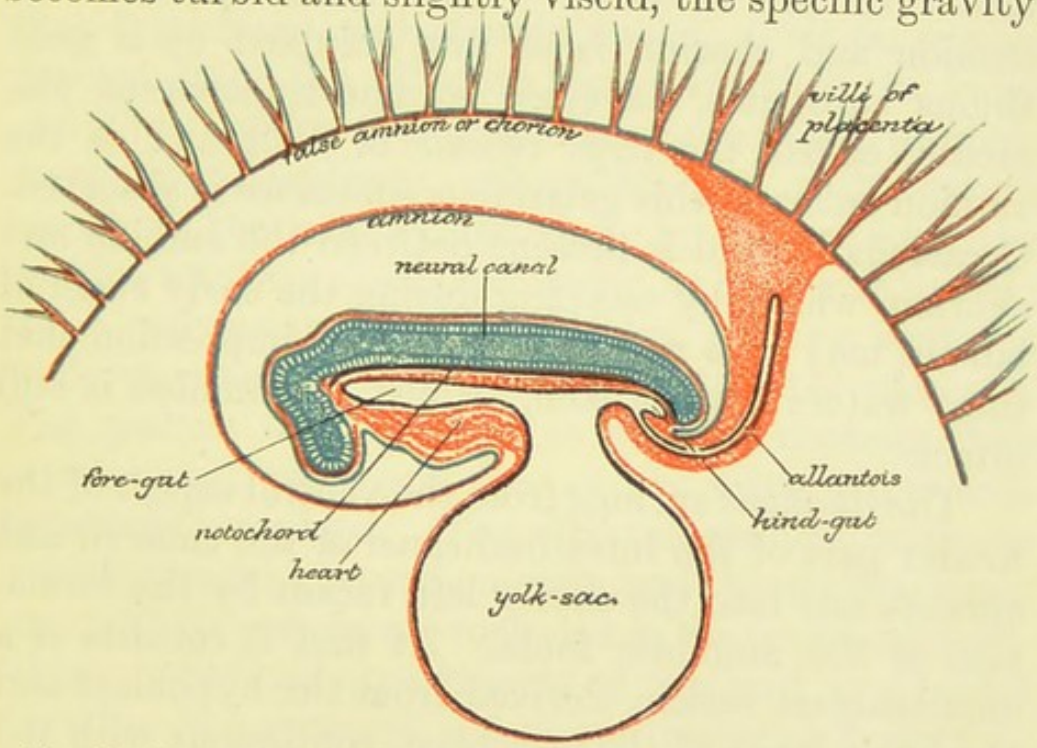


Fig. 66.—Longitudinal Section of Embryo after Completion of Amnion. (Quain.)

increasing a little. It contains albumen, urea, fatty matters, and small quantities of the phosphates and chlorides of calcium, sodium, and potassium. The quantity of liquor amnii increases during the period of utero-gestation, being most abundant in proportion to the size of the embryo, about the third month; the actual quantity at full term varies from a few ounces to several pounds. The amniotic fluid is supposed by some to be derived from the fœtus; according to Priestley it is secreted from the epi-

thelial cells lining the amnion; in all probability both sources contribute to its formation. The uses of the liquor amnii are to preserve the fœtus from external violence and from direct pressure of abnormal uterine contractions during utero-gestation; to allow some degree of movement to the fœtus; to preserve an equable temperature; and, during labour, to form in the membranes an elastic wedge for dilatation of the os uteri. The space between the amnion and chorion is at first occupied by a gelatinous substance, traversed by fine transparent filaments, called the *corps réticulé* of Velpeau: as the amnion enlarges this gelatinous substance is absorbed. Occasionally fluid is present between the amnion and chorion, which, by escaping during the early stage of labour, may give rise to an erroneous impression that the "waters have broken," whilst the amnion is still intact.

The *allantois* springs from the ventral aspect of the hinder part of the intestinal canal of the embryo and spreads out into the cavity left vacant by the formation of the amniotic folds. At first it consists of a membranous vesicle, derived from the hypoblast and the inner layer of the mesoblast, continuous with the cavity of the intestine, containing blood-vessels communicating with the intestinal circulation. It may be said, therefore, to consist of an intra-embryonic and an extra-embryonic portion, the point of division being placed at the site of the future umbilicus. The inner segment afterwards to be developed into the urinary bladder and the urachus we leave for the present; the outer segment, growing as stated into the space between the true and false amnion, comes into contact with this latter and spreads out by degrees until it entirely surrounds the embryo, its cavity having been obliterated by the walls of the

vesicle coming in contact and joining, forming a vascular membrane instead of, as at first, a membranous sac or vesicle. After the allantois with its vessels has united with the chorion a number of villi rapidly develop on the chorion, and penetrate into and intimately connect themselves with the decidua reflexa, forming the channel of nutrition to the embryo during its early stages of development. At first these villi are homogeneous in structure; afterwards they branch out and contain nuclei; later on vessels derived from the allantois penetrate them in loops and thus render them capable of absorbing nourishment for the embryo. About the end of the second month all the villi, except those in contact with the decidua serotina, disappear, being no longer required; those connected with the decidua serotina continue to develop and eventually form part of the placenta. The pedicle of the allantois at first contains two arteries and two veins, one of the veins afterwards becoming atrophied. The allantoic pedicle, with its vessels, two arteries and one vein, and the vitelline duct, also with its vessels, are included in the umbilical cord. These individual constituents of the cord are bound together in a mass of gelatinous material known as Wharton's jelly, the whole being covered by a layer of amnion. With the closure of the fœtal abdomen the site of the reflection of the amniotic folds, *i.e.* where amnion is continuous with fœtal epidermis, has become shifted from the sides of the umbilicus. When the abdominal walls of the fœtus close round the cord, that portion of the pedicle of the allantois within the fœtal abdomen develops into the urinary bladder and is in temporary communication with the umbilicus. Before birth the portion of the pedicle between bladder and umbilicus becomes impervious, and in that state persists to adult life, when it may

be recognised as the *urachus*, a fibrous cord which connects the bladder to the umbilicus.

The outer envelope of the ovum has been shown to consist at this stage of three distinct formations—first the vitelline membrane, then the outer amniotic fold, and lastly the allantois, the whole being called by some authors the *chorion*, although it will have been noticed that we applied the term to the double-layered membrane composed of the vitelline membrane and the false amnion.

At the time of formation of the decidua reflexa the chorion is in the stage of development previously described when non-vascular villi are distributed over the whole of its external surface. These villi insert themselves into the interglandular portion of the thickened and highly vascular uterine mucous membrane, and so intimately connect themselves with the decidua that the membrane cannot be separated from the ovum without tearing the villi more or less. With their vascularisation by means of the allantoid vessels, and their limitation to the region of the decidua serotina, where they greatly increase in size and complexity, we have formed the early *placenta*. Coincident with the hypertrophy of the placental villi, the uterine capillary network surrounding the villi also increases to a great extent, and furnishes a complicated interlacement of vessels closely applied to the vascular tuft in each villus. It must be borne in mind that between the fœtal vascular loops of the villi and the maternal vessels in the decidua there exists tissue derived on the one side from the villus itself, and on the other side from the decidua, and through this tissue all interchange between the fœtal and maternal vessels takes place.

The next step, the formation of the placental

sinuses, is still *sub judice;* some consider that it is effected by the coalescence of the network of vessels surrounding the fœtal villi and the absorption of

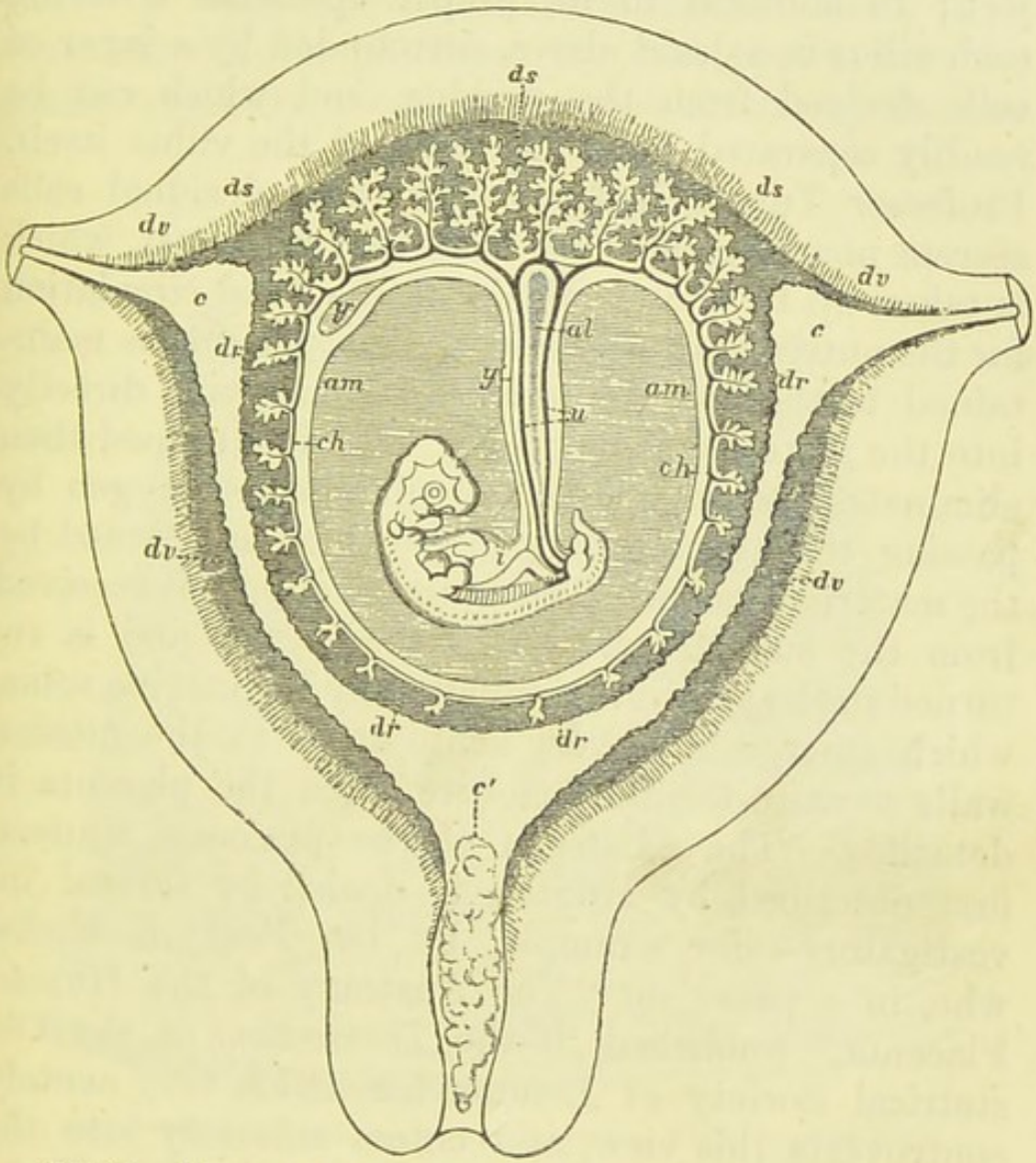


Fig. 67.—Diagrammatic Section of Pregnant Uterus at the Eighth Week. (Allen Thomson.)

dv, Decidua vera. *dr*, Decidua reflexa. *ds*, Decidua serotina. *ch*, Chorion, with villi growing into d. reflexa and d. serotina—in the former the villi are becoming atrophied. *u*, Umbilical cord. *al*, Allantois. *y*, Yolk-sac (umbilical vesicle) with its stalk *y'* within the cord passing to the intestine *i*. *am*, Amnion.

their walls at the point of junction, so as to leave, in place of a number of tortuous canals, single cavities occupying the entire thickness of the placenta. Ac-

cording to Professor Turner the placental sinuses are enormously dilated maternal capillaries, with walls of excessive tenuity, into which the fœtal villi project; in addition to its proper epithelial covering each villus is, as said above, surrounded by a layer of cells derived from the decidua, and which can be readily separated from the cells of the villus itself. Professor Turner believes that these decidual cells secrete nourishment from the maternal blood, which is taken up by the terminals of the fœtal circulation for the nutrition of the fœtus. This relation is maintained to the last, the fœtal never emptying directly into the maternal circulation. The fœtal blood then eliminates its impurities and obtains its oxygen by passing through capillary loops which are bathed by the maternal blood. The maternal supply is received from the curling arteries of the uterus, and is returned to the systemic circulation by the uterine veins, which emerge at a very acute angle to the uterine walls so as to facilitate closure when the placenta is detached. The existence of the placental sinuses, first described by Hunter, is denied by several investigators—for example, by Dr. Braxton Hicks, who, in a paper on "The Anatomy of the Human Placenta," published in the *Transactions* of the Obstetrical Society of London for 1872, very acutely controverts this view, and enters minutely into the arguments both for and against it. Dr. Hicks holds that only capillary spaces exist between the placental villi, and that, although the intervillar space is continuous throughout the placenta, it has no communication with the uterine arteries or veins, and therefore in its normal condition does not contain blood. Dr. Hicks objects to the ordinary methods used to demonstrate the existence of the sinuses, such as injections from the maternal side,

and the passing of probes or bristles, because the exquisitely delicate membranous walls are ruptured by such treatment. He states, however, that when water is injected into the intervillar space of a detached mature placenta, the fluid permeates the entire organ and escapes colourless from any fissures

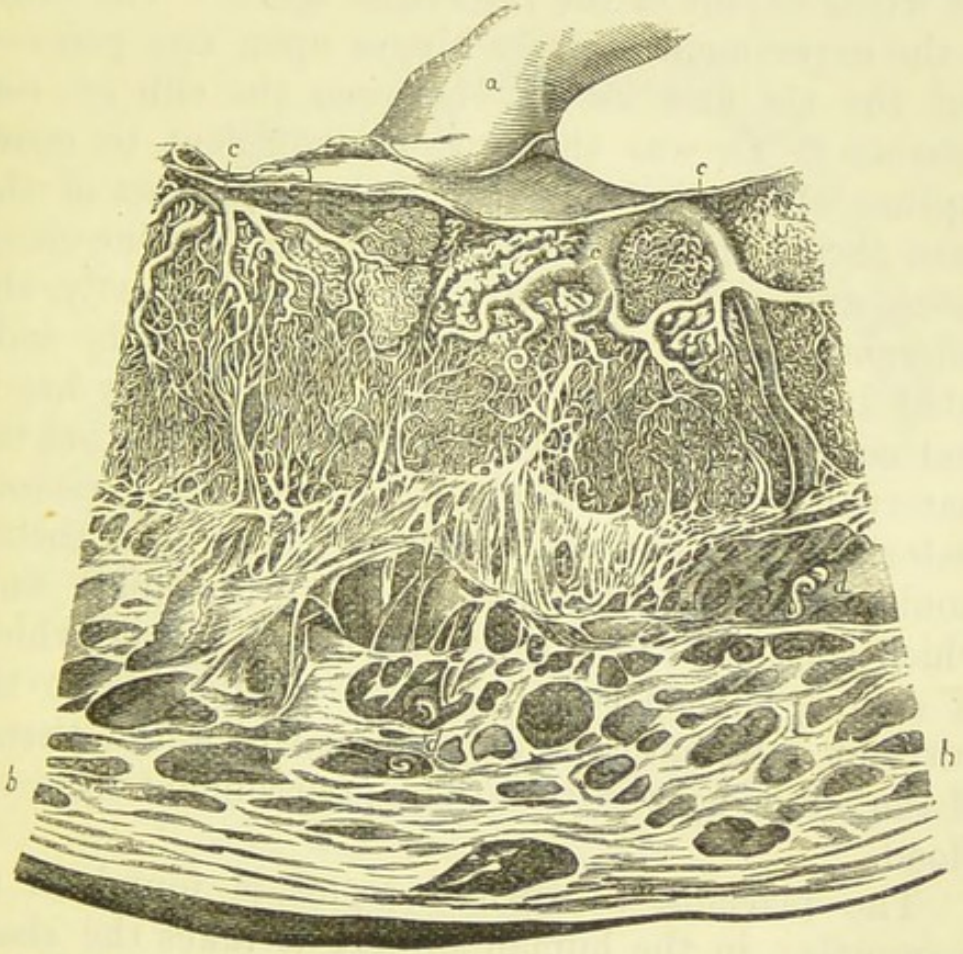


Fig. 68.—Section of fully-formed Placenta, with Part of Uterus.

a, Umbilical cord. *b*, *b*, Section of uterus. *c*, *c*, *c*, Branches of the umbilical vessels. *d*, *d*, Curling arteries of the uterus.

accidentally existing in the serotina, or other artificial openings, but does *not* return through either *artery* or *vein*; the colourless condition of the water after passing between the villi going to prove the absence of blood, and its refusal to return by artery or vein seeming to point to want of continuity between these vessels and the intervillar space. Dalton,

who adheres to the Hunterian view, states that on four different occasions he has taken an undelivered uterus, and after removing the child, has placed the womb under water with the placenta still adherent, and, by means of a blowpipe, has gently blown into a uterine vessel until air found its way throughout the whole extent of the intervillar space. The value of the experiment entirely hinges upon one point—Did the air find its way between the villi *per vias naturales?* Or was the pressure sufficient to cause rupture of the barriers, which the opponents of the sinus theory hold to exist between the uterine circulation and the intervillar space? Put shortly, the difference between the two theories might be indicated in the following manner:—One theory has it that certain cells transmit nutrient material from the maternal to the fœtal blood, and convey excretory material in the opposite direction. The other theory would argue the existence of an intermediate fluid which has been called the "uterine milk," and which, of course, is to a certain degree comparable to the nutrient lymphatic fluid through which the tissues of the adult body obtain their nourishment from the blood.

The placenta in various forms is found in all mammals; in the human subject it takes the shape of a more or less circular cake of meniscus form, the convex surface being applied to the uterus, leaving the fœtal surface slightly concave. An average placenta weighs twenty ounces, it measures about eight inches in diameter, and an inch or more in thickness at the centre, the peripheral portion being thinner. The smooth fœtal surface presents usually about its centre the insertion of the umbilical cord, from which point the umbilical vessels are seen to radiate over the placenta in all directions. The amnion covers loosely

this surface of the placenta, and can be readily stripped off it as far as the cord. When this is done, the vessels can be seen more plainly, and sometimes there is then exposed a remnant of yolk-sac, or umbilical vesicle, in the shape of a small body the size of a split pea or smaller, with a pedicle running

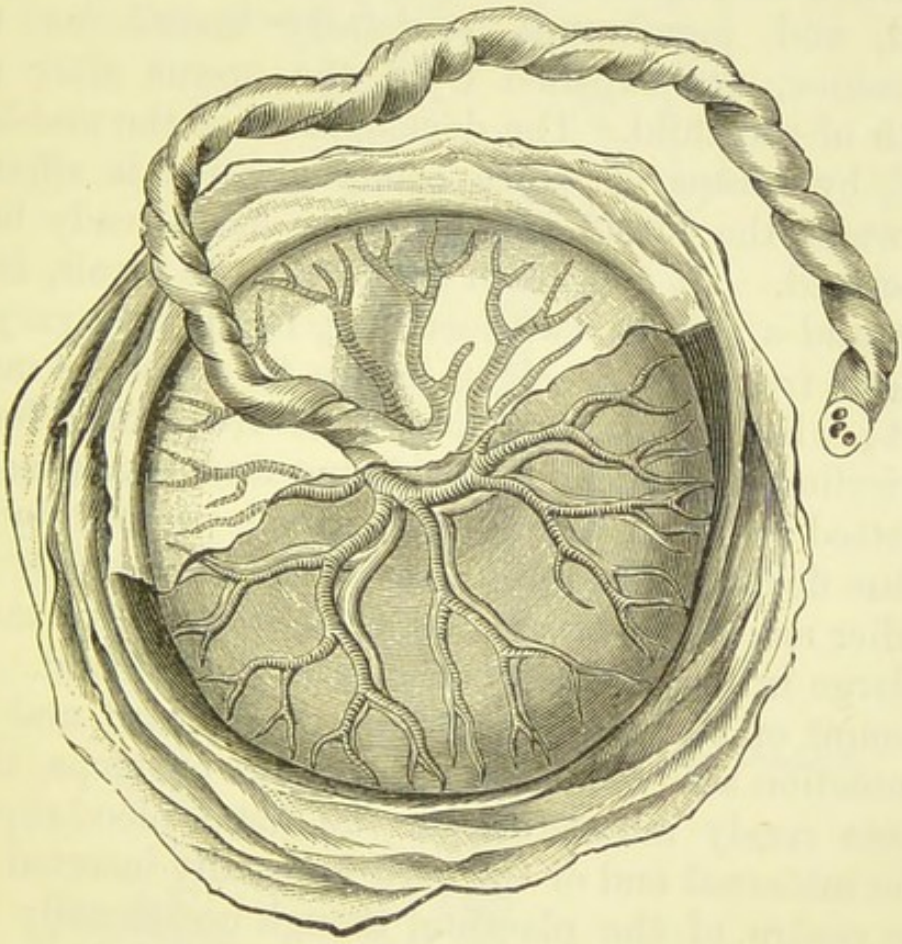


Fig. 69.—Fœtal Surface of Placenta. (Galabin.)
Amnion stripped from one-half and removed.

up to the cord. From the development of the placenta it will be readily understood that the chorion cannot, like the amnion, be stripped off from the surface of the placenta, but that at the circumference of the placenta the chorion and decidua merge into the tissue of the placenta itself. The external surface of a recently-detached placenta is composed of irregularly-shaped

masses of spongy structure, deep fissures separating them. This surface in the recent state is covered with more or less blood or blood-clot. On this aspect the placenta for about $\frac{1}{20}$ of an inch in depth has a layer derived from the innermost portion of the decidua serotina, the outer part of which remains attached to the walls of the uterus. The placenta, cord, and membranes, conjointly known as the *secundines*, are expelled from the uterus after the birth of the child. The development of the *umbilical cord*, by means of which communication is effected between the fœtus and placenta, has already been described. At childbirth the cord is, as a rule, from one and a half to two feet long, but it may vary in length from six or eight inches to almost as many feet; when unusually long it is frequently found encircling the neck of the fœtus, and sometimes is knotted on itself, a condition caused, perhaps, by the fœtus floating through a loop of the cord during the earlier months of pregnancy when the amniotic cavity is large in proportion to the size of the child. On account of the elastic structure of the cord and the protection afforded by the gelatinous envelope, these knots rarely interfere with the fœtal blood-supply. The maternal end of the cord is usually inserted into the centre of the placenta, though occasionally it is attached to the edge forming the *battledore placenta*. It may also divide into two parts, each with a separate insertion, and in some instances it may be attached to the membranes to one side of the placenta, when its constituents spread out as they approach that organ. This is termed the *insertio velamentosa*. The cord consists of one vein, without valves, and two arteries enclosed in a quantity of gelatinous substance—the gelatine of Wharton—and is covered over by a layer of amnion. Besides these

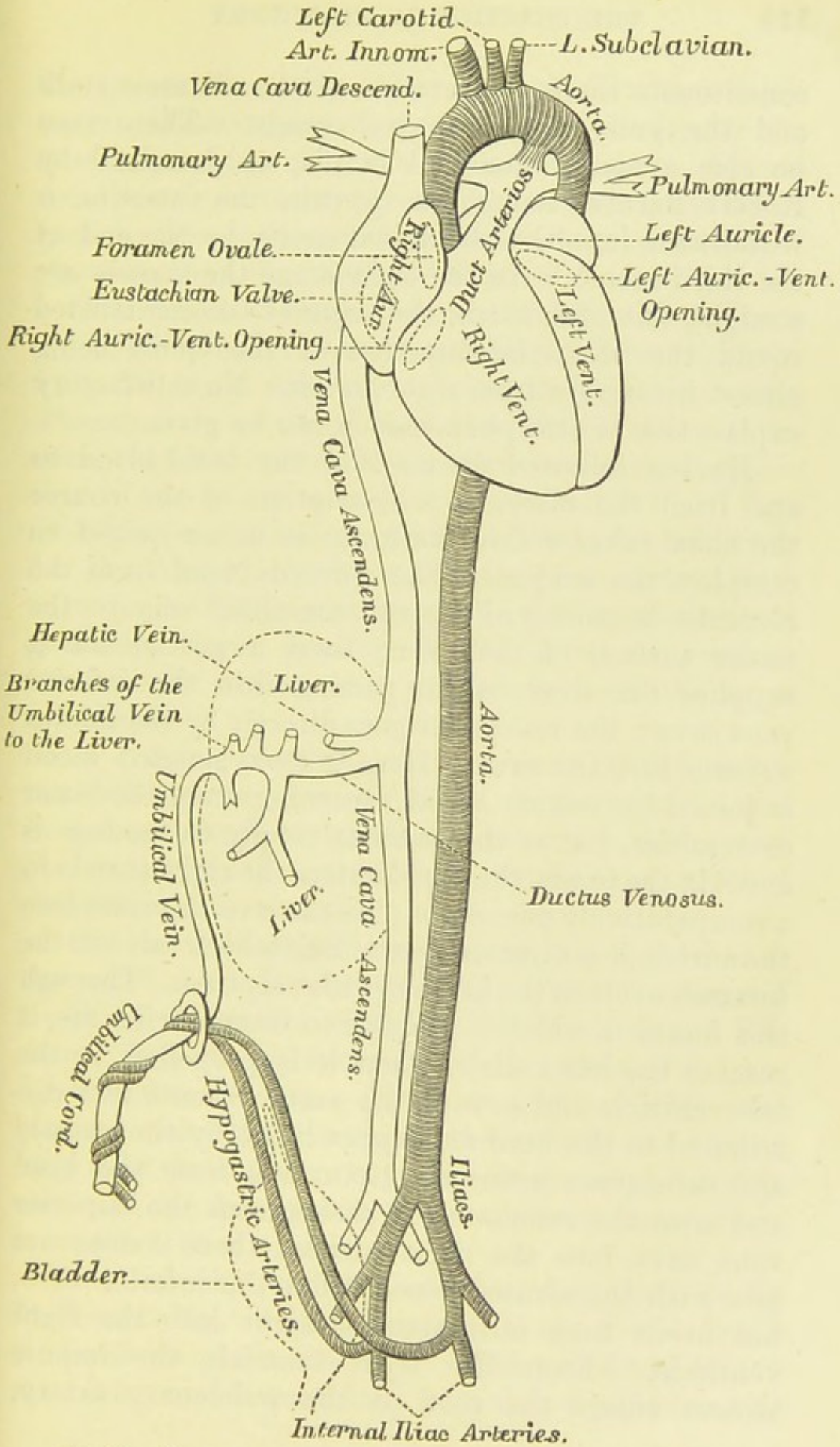


Fig. 70.—Diagram of the Fœtal Circulation. (After Flint.)

constituents there are remains of the allantoic stalk and the yolk-stalk with its vessels. There may be also a small intestinal hernia, as described by Robert Barnes, though, as a rule, the intestine is withdrawn into the abdominal cavity by the end of the third month. In the early stage the vessels are straight, but afterwards the arteries become twisted round the vein, the direction of the spiral being almost invariably from right to left. No satisfactory explanation of this phenomenon can be given.

Having followed the track of the fœtal blood to and from the placenta, a description of the course the blood takes within the fœtus is now required to complete the subject. The aërated blood from the placenta is conveyed by the umbilical vein to the under surface of the liver; there a portion of it supplies the liver before passing into the inferior vena cava; the remainder goes directly by the ductus venosus into the cava. Here this oxygenated blood is joined by venous blood returning from the lower extremities, but as the vascular supply to the legs is small in the fœtus, the blood enters the right auricle in a comparatively pure state. As the stream passes into the auricle it is directed by the Eustachian valve to the foramen ovale in the interauricular septum. Through this foramen, which is peculiar to intra-uterine life, it reaches the left auricle, when it is propelled to the left ventricle and so into the aorta, whence it is distributed to the head and upper limbs by the carotid and subclavian arteries. Returning from the head and arms the venous blood passes from the superior vena cava into the right auricle, where it does not mix with the aërated blood from the inferior cava, but in its turn is directed straight into the right ventricle. From the right ventricle the impure stream enters the root of the pulmonary artery,

though as the lungs are not yet in action little reaches these organs, the greater part passing by the ductus arteriosus into the descending aorta, whence some passes on to supply the lower limbs, but most goes by the hypogastric arteries to the cord and placenta, thus completing the circuit.

The first act of respiration, on the child's birth, opens up the pulmonary circulation, and thus allows the blood from the right ventricle to pass through the lungs, whence it is returned into the left auricle; at the same time the umbilical circulation ceases on separation of the placenta or ligature of the cord. These modifications of the circulation obviate the necessity for the ductus arteriosus and ductus venosus, which accordingly become obliterated; the foramen ovale gradually closes, because of the increased pressure in the left auricle, and independent circulation is established.

In order to meet the requirements of the obstetrical student, brief descriptions of the human fœtus in various stages of its development are here given. For further details special works on Embryology may conveniently be consulted.

One of the earliest developing ova described is the well-known Reichert's ovum, which is estimated to be of about the *twelfth or thirteenth day.* The ovum is a small, flattened, oval vesicle, 5·5 mm. by 3·3 mm. (1 mm. = $\frac{1}{25}$ of an inch). Villi were present round the margin of the vesicle, not universally over the surface; beyond a thickening about the centre of one flattened surface (embryonic area), there is no trace of the embryo.

One of the earliest embryos described is by Professor His, who estimated it as of about the *thirteenth to fourteenth day.* This embryo is 2·2 mm. long, and is contained in a thin vesicle covered

all over with villi. The whole ovum measures 8·5 mm. by 5·5 mm. The tail end of the embryo is attached by a short thick stalk to the vesicular wall. The head end is large, and the heart, in two halves, is beneath it. The reflexion of the amnion is nearly completed. The yolk-sac is comparatively

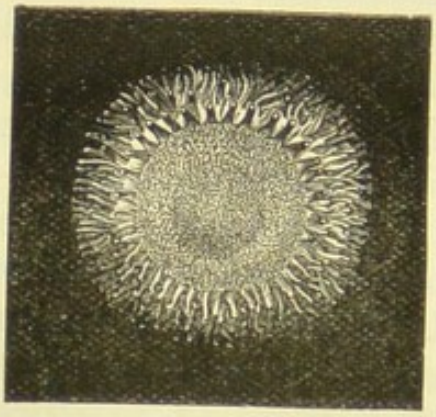


Fig. 71.—Front View of Reichert's Ovum. (Marshall, after Kölliker.)

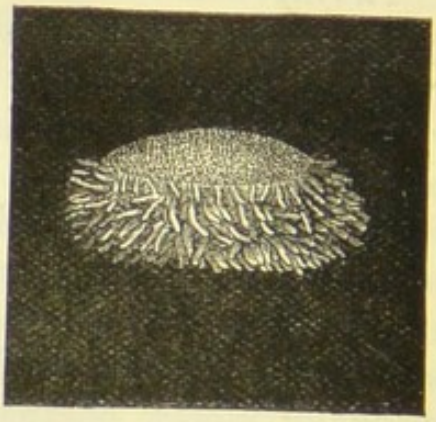


Fig. 72.—Side View of Same. (Marshall, after Kölliker.)

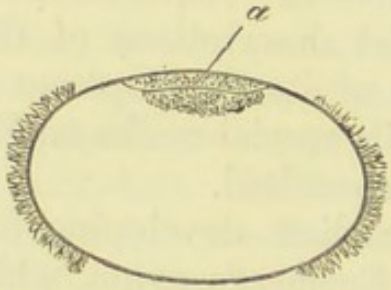


Fig. 73.—Diagrammatic Section of Reichert's Ovum. (Marshall, after His.)
a, Embryonal area.

large, and is separated from the embryo by a slight constriction.

Kollmann describes a later ovum, of about the *fourteenth* day, containing an embryo 2·5 mm. long. The yolk is more distinctly separated, the head is more prominent, the heart is a single tortuous tube, and on the dorsum of the embryo the neural tube is seen forming from behind forwards.

"During the *third week* the embryo assumes more definite form. The neural canal is closed along its whole length; the brain vesicles, optic vesicles, and auditory sacs are formed; the visceral arches and clefts develop; and the head and neck acquire their

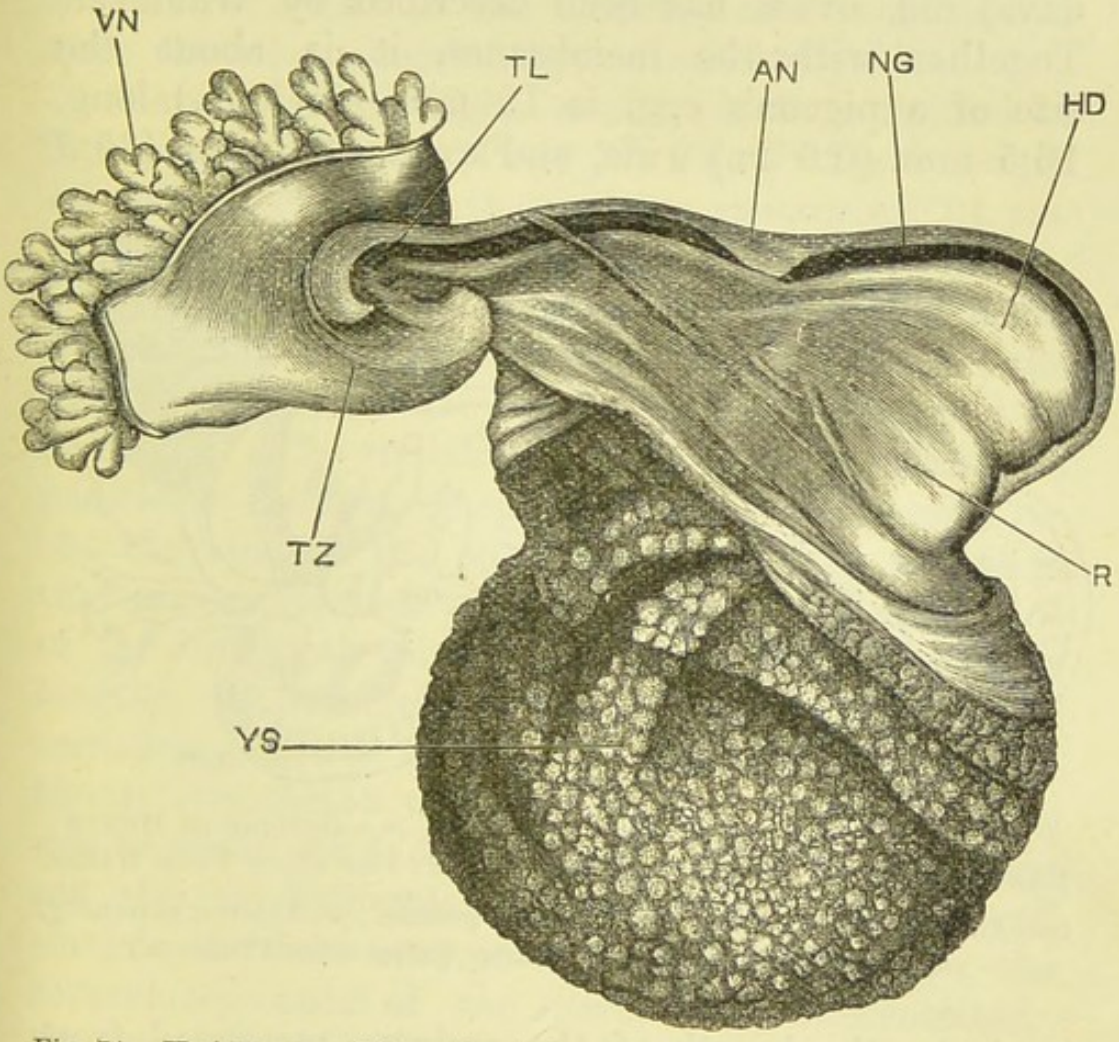


Fig. 74.—His' Embryo SR: estimated as of the thirteenth day. The wall of the blastodermic vesicle has been removed except the part to which the allantoic stalk is attached. (Marshall, after His.) × 25.

AN, True Amnion. HD, Head end of embryo. R, Heart. NG, Neural groove. TL, Tail. TZ, Allantoic stalk. VN, Villi. YS, Yolk-sac.

characteristic embryonic shape. The embryo increases considerably in size; the constriction between embryo and yolk-sac becomes much more marked; and towards the end of the week the first rudiments of the limbs appear. During this time development

proceeds rather slowly, the changes passed through in the course of the week corresponding roughly to those effected during the second and third days in a chick embryo."[1]

"A well-preserved, exactly *four weeks* (28 to 30 days) old, ovum has been described by Waldeyer. Together with the membranes, it is about the size of a pigeon's egg, is 19 mm. (0·75 in.) long, 16·5 mm. (0·6 in.) wide, and weighs 2·3 grm. (35·5

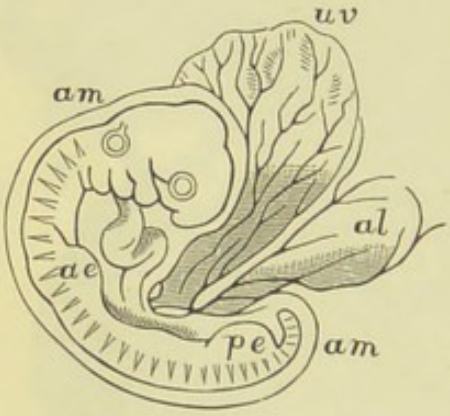


Fig. 75.—Outline of Human Embryo of about Three Weeks.

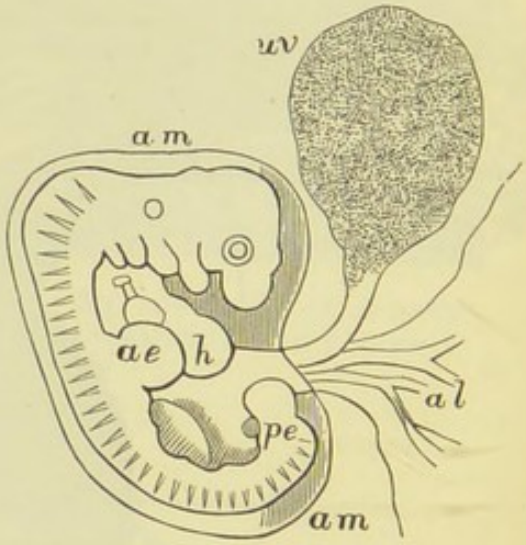


Fig. 76.—Outline of Human Embryo of about Four Weeks.

am, Amnion. *uv*, Yolk-sac. *al*, Allantoid pedicle. *ae*, Anterior extremity. *pe*, Posterior extremity. *h*, Heart. (After Allen Thomson.)

grains); the length of the embryo, measured from the summit of the posterior cephalic curve in a straight line to the caudal curve opposite the insertion of the head-limbs, amounts to 8 mm. (0·3 in.), while the actual length of the dorsal line from the summit of the anterior cephalic curve to the apex of the coccyx amounts to 20 mm. (0·75 in.) The embryo, both in form and the disposition of its organs, resembles other mammalian embryos, the

[1] Marshall, *Vertebrate Embryology*, 1893, p. 486.

head and trunk forming one mass, from which the narrower caudal extremity projects; visceral arches, distinct limbs scarcely indicated; umbilical cord very short and wide, with its arteries and single vein; yolk-sac and yolk-duct still large. The amnion lies moderately close to the embryo, and is separated from the villous chorion by a clear cavity." [1]

"An ovum of eight weeks which is figured in Ecker's *Icon. Physiol.* (Plate 27, Fig. 7) has a length of 3·6 cm. (1·5 in.), the embryo measuring 2·1 cm. (0·8 in.) By this time the amniotic cavity has increased; the fluid contained in it is more abundant; the amnion is in contact with the chorion, and the villi of the latter are especially well developed at one spot. The umbilical vesicle is very small; its pedicle is filiform; the umbilical vessels passing to the chorion are the only remains of the allantois that are visible, and they form the main constituent of the umbilical cord. The latter has increased in length; the umbilical ring is narrower, although still containing coils of intestine. The head is more distinctly constricted off from the trunk, and the eyes can be made out as little dots; the mouth and nose can also be distinguished, and in the lower jaw and clavicle the first centres of ossification appear; the several segments of the limbs are differentiated; the primitive kidneys have almost disappeared, and have divided into urinary and generative organs." [2]

At the end of the *third month* the embryo is from 3 to 4 inches long, and weighs from 1 to 2 ounces. Centres of ossification have appeared in most of the bones; the several parts of the limbs are distinct, and the nails are just to be seen. The external genital

[1] Spiegelberg, *Text-book of Midwifery*, vol. i. pp. 115-117. New Sydenham Society, 1887.

[2] *Ibid.* p. 117.

organs are visible, but the sex cannot yet be distinguished; the placenta is formed, and the chorionic villi, except those in connection with the decidua serotina, have disappeared. The umbilical cord, about $2\frac{3}{4}$ in. long, is twisted, and there is now no loop of intestine in its proximal part.

At the end of the *fourth month* the embryo is 5 to 7 inches long, and weighs 3 to 6 ounces. The head is a quarter of its whole size; the sutures and fontanelles are large. The several parts of the face are differentiated; sex is distinguishable; the skin is rosy, wrinkled, and covered with down (*lanugo*); meconium is found in the duodenum; muscular movements are sometimes noticed; and the umbilicus is near the pubes.

At the end of the *fifth month* the embryo is 8 to 10 inches long, and weighs from 10 to 16 ounces. The head is still large, and the eyelids begin to open; the skin is less wrinkled, there being more subcutaneous fat, and vernix caseosa is appearing in parts. Fœtal movements are perceived by the mother; there are points of ossification in the pubes and os calcis, and meconium is present throughout the small intestine.

At the end of the *sixth month* the length of the embryo is about 12 inches, and its weight about 2 pounds; the eyelids are open, eyelashes and eyebrows are appearing; the hairs on the scalp are longer and darker in colour; the skin is more firm and is covered with vernix caseosa; the umbilicus is situated about the middle of the abdominal wall. Meconium has reached the beginning of the large intestine; the testes are placed on the psoas muscles, and the centres of ossification appear in the sternum and in the bodies and laminæ of the sacral vertebræ. A child born at this period may make feeble attempts at respiration.

At the end of the *seventh month* the embryo is 14 to 15 inches long, and weighs about 3 pounds. The skin is almost free from wrinkles, because of the increase of fat. The surface of the body is covered with short hairs $\frac{1}{4}$ of an inch long. The membrana pupillaris is disappearing; meconium is present throughout the large intestine, and the testes have nearly reached the internal rings. A child born at this time is regarded as viable, and, provided it is strong and healthy and well cared for, it may survive.

At the end of the *eighth month* the fœtus is about 16 inches long, and weighs 4 to 5 pounds. The skin is filled out with fat, and covered thickly with vernix caseosa. The membrana pupillaris has disappeared; the nails reach the finger-tips, but not necessarily the ends of the toes, and the testes are lower, one of them, generally the left, being often present in the scrotum.

At the end of the *ninth month* the average length is from 18 to 19 inches, and the weight about $6\frac{3}{4}$ pounds. Both these figures have been much exceeded in some exceptional cases. I have myself delivered a woman with the forceps of a still-born child weighing 18 pounds. The hair on the scalp is long and dark; the down has disappeared from the body-surface. The umbilicus is slightly below the centre of the body. Both testes have descended into the scrotum, and the earliest epiphysial centres of ossification, viz. those in the lower end of the femora, have appeared.

A recently-delivered living child at full time has a whitish skin, free from lanugo except about the shoulders, and presents the vernix caseosa, especially on the flexor surfaces; the hair on the head is generally an inch to an inch and a half long, and is dark in colour; the nails project a little beyond the

finger-ends; the cranium is still large compared with the face, and its bones are hard. The sutures and fontanelles are comparatively small, owing to extent of ossification in the bones. As a rule, the child cries and moves its limbs immediately after birth, and often it passes urine and meconium, which is a thick, treacly substance, blackish or greenish-brown in colour, consisting of mucous bile and intestinal secretions with epidermic scales and lanugo derived from the liquor amnii swallowed during intra-uterine life.

As an aid to memory in everyday practice it is convenient to note the following numerical relations:—In the third and fourth months the number of inches measured by the fœtus is, roughly speaking, somewhat larger than the number of the months; in the fifth, sixth, seventh, and eighth months the number of inches is equal to double the number of the months.

CHAPTER VI

SIGNS OF PREGNANCY

THE early diagnosis of the gravid state is a matter of great importance, and, moreover, is a point upon which the practitioner is frequently called to pronounce judgment. In no case prior to the fourth month is any one sign to be relied upon as certain and conclusive, nor afterwards even is any single sign enough short of hearing the fœtal heart-sounds or definitely feeling and handling the child's head or limbs. Further, as inability to elicit these physical signs does not preclude the existence of pregnancy, it is obvious that the diagnosis in the majority of cases has to be inferred from the coexistence or otherwise of a number of symptoms and signs, each of which is no more than suggestive of the pregnant state. In making a diagnosis, attention should be directed to the following points :—

1. Cessation of the menses.
2. "Morning sickness" and other digestive disturbances.
3. Quickening.
4. Mammary signs.
5. Abdominal signs.
6. Vaginal signs.

7. Other minor signs and symptoms, including certain nervous, vascular, and urinary disturbances.

A very obvious symptom of pregnancy is *suppression of the catamenia.* Although this may take place independently of pregnancy, as in cases of anæmia or general debilitating diseases as phthisis, still it is one of the most regular and constant signs, and serves as an indicator to the mother to foretell the date of her delivery. The catamenia are usually absent during the whole period of utero-gestation, but exceptional cases occur where menstruation coexists with pregnancy. In some of these cases the menstrual flow continues for two or three months, the explanation offered being that the decidua vera and decidua reflexa have not as yet come together. In other cases undoubted menstruation continues regularly throughout the whole period of pregnancy, but in many instances so-called menstruation consists of irregular discharges proceeding from a torn or eroded cervix.

Morning Sickness, etc.—Inquiries will generally bring out the fact that the digestive system, sympathising with the new condition, has speedily undergone reflex disturbances. A most frequent and well-marked symptom is morning sickness. This consists of nausea or retching early in the day, generally soon after getting up; in some cases it sets in immediately after conception, in others not for two or three weeks. As a rule, it subsides about the fourth month, but in the later months the stomach may again be upset from direct pressure of the enlarged womb.

Other disturbances sometimes met with are perversion of appetite, salivation, and a persistent cough, which may result in vomiting.

Quickening.—About the fourth month the mother

usually first experiences a movement on the part of the child, which has been called quickening. If this, however, be taken to imply that now for the first time the fœtus is endowed with life, the term is fallacious; it may be regarded as the first perception by the mother of her infant's vitality, and, as a rule, is probably now felt because it is at this time that the uterus first comes into contact with the abdominal wall. This sign varies considerably in degree; with some women it is a constant and trustworthy guide in every pregnancy, the movements of the fœtus being accompanied by more or less constitutional disturbance, as sickness and a sensation of faintness; with others quickening is barely noticeable; whilst others again are not cognisant of it at all. Its value as a subjective sign of pregnancy is further discounted by the fact that patients about the climacteric are often deceived by other sensations, and confidently assert that they have "quickened" when not even pregnant. On the other hand, considered as an objective sign, death of the fœtus *in utero* will account for failure on the part of the accoucheur to perceive movements.

The fœtal movements may often be felt or seen after laying one hand flat on the maternal abdomen and gently percussing with the other, so as to disturb the fœtus and cause it to respond by movement; the fœtal impulses may also be detected by the stethoscope. Care must be taken to discriminate between the fœtal impulses and those produced by contractions of the uterine or abdominal muscles.

Mammary Signs.—A sensation of fulness with shooting pains shows that the breasts soon participate in the excitation of the uterine apparatus. About the second month these glands become nodulated to the touch, and display tortuous veins under the skin.

Soon after this period a small quantity of viscid fluid, with the microscopic characteristics of milk, may frequently be squeezed out of the nipples. The changes which take place in the nipples and areolæ are important indications. The nipples become turgid, and with the areolæ deepen in colour from deposition of pigmentary matter, whilst around the dark primary areola is a lighter-pigmented ring showing prominences due to the enlarged glandular follicles, which are ten to twenty in number and projecting about one-twelfth of an inch. This pigmented ring is the "secondary" areola. The change in colour or amount of pigmentation varies according to the woman's complexion, being darker in proportion as she approximates to the brunette. These mammary symptoms may be investigated as a prelude to abdominal or vaginal exploration. It must be remembered, however, that the conditions above described are not absolutely diagnostic of pregnancy, as they are sometimes produced by uterine tumours, etc.

Abdominal Signs.—Examination of the abdomen yields very valuable help in the diagnosis of pregnancy. On *inspection* there may be noticed, especially in those of dark complexion, a deposit of pigmentary matter in the skin, usually in the median line from the pubes upwards, which imparts a brownish hue to the integument. This is similar to the darkening of the mammary areola already described; a slight pigmentary coloration may manifest itself on the face, especially on the forehead and round the eyes. Such marks often persist for some time after parturition. In the later months of pregnancy inspection reveals the *striæ gravidarum*, which are sinuous streaks in the skin, pinkish when recent and silvery-white when old; they are due to stretch-

ing of the skin consequent on the abdominal enlargement, and along them all the layers of the integument are very much condensed. The condition of the umbilicus should also be examined. In early

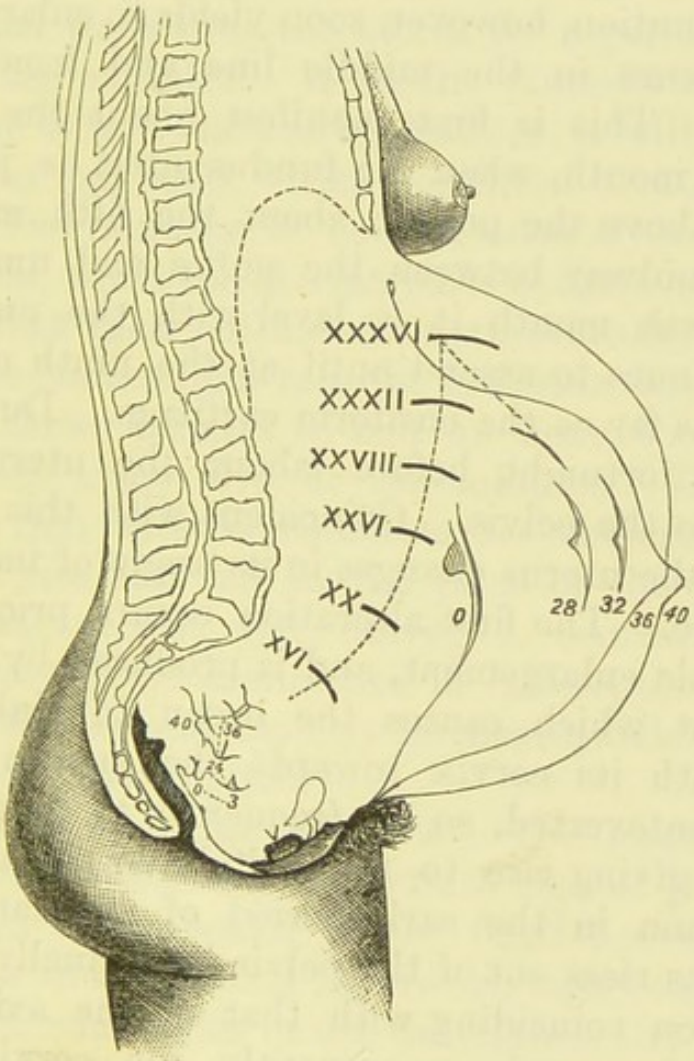


Fig. 77.—Diagrammatic Representation of the Changes in Position of the Uterus during Gestation.

The numerals indicate in weeks the height of the Fundus Uteri. The italic figures indicate respectively, also in weeks, the Abdominal Enlargement and Positions of Cervix Uteri. (After Schultze.)

pregnancy it has the usual depression, but about the fifth or sixth month this is obliterated, and afterwards a rounded prominence takes its place. The cardinal physical sign afforded by inspection, how-

ever, is the alteration in size and shape of the abdomen, corresponding with the developing uterus. In the beginning of utero-gestation, while the womb is yet in the pelvis, the sinking of this organ mentioned later produces some abdominal flattening. This diminution, however, soon yields to enlargement, which occurs in the middle line and from below upwards. This is first manifest about the end of the third month, when the fundus uteri is just perceptible above the pubes; about the fifth month it reaches midway between the pubes and umbilicus; at the sixth month it is level with the umbilicus, and continues to ascend until at the ninth month it extends as far as the ensiform cartilage. During the week or fortnight before labour the uterus sinks again into the pelvis. Coincident with this enlargement of the uterus changes in its angle of inclination take place. The first alteration occurs prior to any perceptible enlargement, and is produced by increase in weight, which causes the organ to sink in the pelvis with its cervix towards the sacrum and its fundus anteverted, so as frequently to press on the bladder, giving rise to the irritability of that viscus so common in the early period of pregnancy. As the uterus rises out of the pelvis it gradually assumes a direction coinciding with that of the axis of the pelvic inlet, and consequently the cervix points towards the hollow of the sacrum.

Palpation of the abdomen should now be practised, when, after the third month, a central swelling, springing from below and of somewhat doughy consistence, will be felt. This is of course the uterus, and its size should correspond with the history of amenorrhœa elicited from the patient. Later on the limbs or other parts of the fœtus may be distinguishable. Dr. Braxton Hicks in a paper in the *Obstetrical*

Transactions, vol. xiii., calls attention, as a means of diagnosis, to an alternate state of contraction and relaxation of the uterine walls after the end of the third month of pregnancy. This condition may be felt by placing the hand in firm contact with the abdominal walls over the uterus for a period of from five to ten minutes. If at the moment of contact the organ is in a state of contraction, it will be found to be firm and solid, which condition it retains from two to five minutes, to be succeeded by a period of relaxation, when the uterine walls become so soft and flaccid that their outline can with difficulty be made out. The contractions recur at intervals varying from two or three minutes to half an hour, occurring in most cases every five or ten minutes. Dr. Hicks explains that these contractions are the cause of the alternate rise and fall in the pitch of the placental bruit (*vide infra*); for, during a contraction, the uterine sinuses are diminished in calibre, the rapidity of blood-flow is consequently increased, and the sound thereby exalted in pitch.

Auscultation of the Abdomen.—The most definite and, indeed, often the only certain sign of pregnancy obtainable is the sound of the fœtal heart, usually not to be distinguished before the eighteenth week, but which, when once heard, determines the presence of a living fœtus beyond all doubt. The fœtal heart-sounds are very rapid, from 120 to 150 in a minute, and closely resemble the ticking of a watch placed at a short distance from the ear;—of course with each heart-beat there is a double sound. Nothing but non-rhythmical intestinal noises can interfere with the diagnostic value of this sign, except the sounds of the maternal circulation, and these may be readily discriminated by placing the finger on the radial artery of the mother whilst listening to the beat of the

fœtal heart, when the absence of synchronism at once identifies the origin of the auscultatory sound. The area of the fœtal heart-sounds over the maternal abdomen is limited in extent, and obviously varies with the position of the fœtus. The sounds are most distinctly heard when the dorsum of the child is towards the mother's abdomen; when the child faces the mother's abdomen, the child's limbs and the thicker layer of liquor amnii interfere with the conduction. In the majority of cases the fœtus lies with its back towards the mother's left side, therefore the heart-sounds are most plainly heard at a point midway between the umbilicus and the left anterior superior spine of the ilium; next in frequency is the corresponding spot on the right side. In breech cases the sound is higher up above the umbilicus.

Auscultation of the fœtal heart-sounds, then, as a positive sign is perfect and conclusive, but as a negative sign it is not of corresponding value. For if, after the lapse of the normal interval after conception, the fœtal heart-sounds are not heard, it does not follow that no fœtus is present, as the fœtus may be dead, or its heart-beats may be so feeble as to be indistinguishable through the abdominal walls. Excess of liquor amnii, of fat on or of flatus within the maternal abdomen may render inaudible the heart-sound even of an ordinary vigorous fœtus; in such cases repeated examinations may be necessary before the sign is made out with certainty. Another auscultatory sign which may be heard before the fœtal heart is the *uterine souffle* caused by the passage of the maternal blood through the enlarged uterine vessels, and usually more distinctly heard over that part of the uterus giving attachment to the placenta, although the sound is not restricted to the placental site, as was formerly taught. It consists of a long

harsh blowing murmur synchronous with the maternal pulse. In diagnostic value it is much inferior to the sound of the fœtal heart, giving no indication as to whether the fœtus is living or not; neither is it a sure sign of pregnancy, since a very similar sound may be caused by an aneurism and in some cases by a uterine tumour. Still it has a certain value, and is probably more often to be heard than the fœtal heart-sounds.

Vaginal Signs.—The labia are swollen, and in many cases show varicose veins. The vagina has a purplish hue, and more than the usual amount of mucoid secretion is present. When digital examination is made, pulsation is felt in the vaginal walls, which are very lax. The cervix is found to have undergone the changes described in the chapter on the gravid uterus—softening and so-called shortening. In pregnancy of six to ten weeks' duration a careful bimanual examination will show that the uterus has acquired a globular rather than an ovoid shape—its lower segment is very much bellied out—and those parts of the anterior and posterior walls just about the vaginal roof are peculiarly soft and yielding, less firm to the touch than either the cervix or the fundus uteri. These phenomena constitute "Hegar's sign." In advanced pregnancy the enlarged lower uterine segment is very manifest through the anterior vaginal wall, and very often the presenting part of the fœtus can be definitely recognised.

We must mention at somewhat greater length the phenomenon known as *Ballottement*, which when successfully elicited demonstrates the presence of a foreign body in the uterus. Whilst the patient is in the erect position, or recumbent with her shoulders raised, one or two fingers of the right hand are introduced into the vagina; the point of one finger is

passed to the cervix uteri, and a sudden impulse made in an upward direction, when the fœtus, after being driven towards the fundus, drops again on the

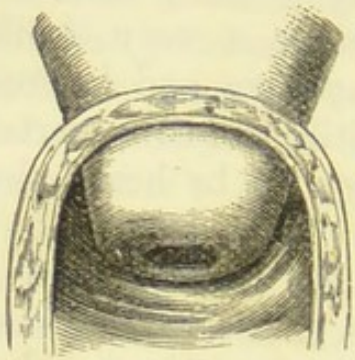


Fig. 78. — Os and Cervix Uteri at the Third Month of Gestation.

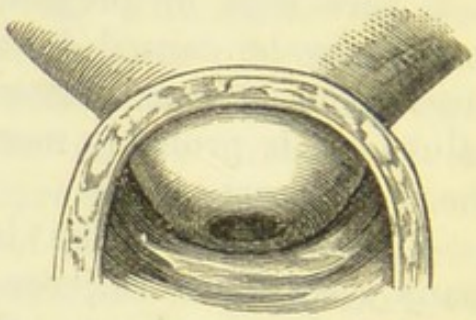


Fig. 79.—At the Sixth Month.

Fig. 80.—At the Eighth Month.

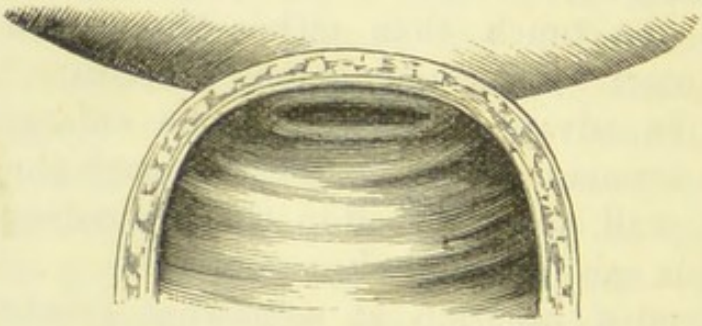


Fig. 81.—At the Full Time.

tip of the finger, to which it communicates the sensation of a free-falling body. Ballottement is most successful from the fourth to seventh month, as the cavity of the uterus is then large in proportion to the

size of the fœtus. It is not an infallible sign of pregnancy, as a similar sensation may be produced by a stone in the bladder, or by the fundus of an anteverted uterus. It is likewise of little avail if the placenta covers the os uteri, or in footling cases.

If attention has been directed to the points enumerated above, pregnancy should not be difficult of diagnosis. Other minor signs and symptoms may just be named, such as headaches, neuralgias, and the longings of pregnant women; also piles and varicose veins of the legs due to pressure; and, finally, it is possible to elicit ballottement on external examination, the patient being supported in a semi-prone position with the abdomen hanging over the edge of the couch. Formerly the presence of *kiestein* in the urine in the form of a pellicle on its surface after standing a day or two was considered a valuable sign. Unfortunately, however, kiestein occurs sometimes in the urine of non-pregnant patients and even of men, and is therefore of little practical value.

Duration of Pregnancy.—This subject has received much attention from obstetricians, not only in a physiological point of view, but in respect to its important legal bearings.

Numberless difficulties encounter the attempt to predict the exact period of the occurrence of parturition; the data employed to determine this question are derived from—(1) Cases of impregnation resulting from a single coitus; (2) Cessation of the menses; and (3) Date of quickening. The result deducible from a single coitus is liable to a certain degree of error arising from the uncertainty as to the duration of the period which intervenes between insemination and impregnation. Under favourable circumstances the spermatic filaments may retain their fecundating power for some days

after emission, when, if the ovule be delayed in its escape from the ovary for an equal period, actual contact, and consequently fertilisation, is postponed for a more or less extended interval; on the other hand, if the ovule has reached the uterus at the time of coitus, it may be fertilised forthwith. The stoppage of menstruation is by no means a certain indicator whence to deduce the exact period of impregnation, which may take place immediately after the last discharge, or at some period nearer the time when the next nisus is due. We have no evidence as to how long the spermatozoa and ovule (after its escape from the Graafian follicle) retain their vitality within the female generative organs. The examination of the uteri and ovaria of animals several days after coitus shows the spermatozoa in their usual active condition. With regard to the ovule we are still far from any precise knowledge of its viability. Quickening is still more misleading, as it is a symptom dependent for recognition upon the perception of the mother, which varies to such an extent as to deprive her evidence in this question of any scientific value.

The only way to solve the difficulty is to take the evidence of carefully collated statistics; these give the period of 40 weeks or 280 days as the duration of normal gestation; it will be observed that we have here a multiple of the menstrual interval, which has led some writers to credit the ovaries with the power of initiating parturition.

Two important questions now arise. The first is—To what extent, compatible with bringing forth a living child, may these 280 days be augmented? Cases are recorded where the term of gestation exceeded 313 days; others in which even this liberal allowance has been exceeded to such an extent as to

pass the limits of credulity. That the normal period may be exceeded by one or two weeks is undoubtedly a fact, but it is impossible to fix the precise maximum time the living fœtus may remain in utero.

The converse question is of equal and more practical interest—How short a time after conception may a viable child be brought forth? This problem, for obvious reasons, is not liable to such exaggerated

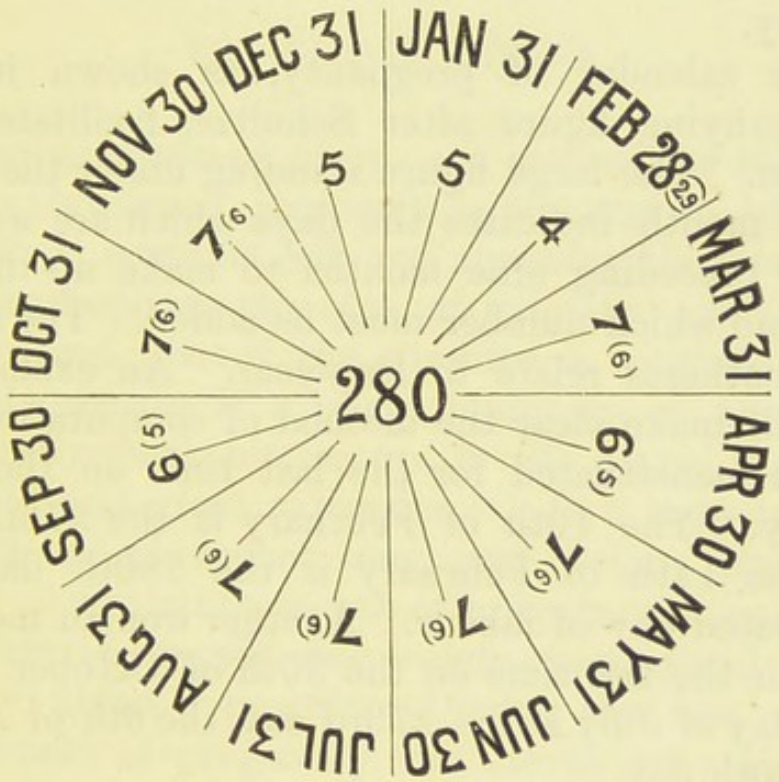


Fig. 82.

statements as the last; still no definite answer can be given. An instance of early viability is given by Murphy, the length of gestation being 175 days, and the same author gives 171 days as the shortest period.

In calculating the probable date of delivery in ordinary practice, we reckon 280 days from the beginning of the last catamenial period. The German method of calculation is convenient: given the

date of the last menstrual period, go back three months, and then add seven days, or six days in leap year if the gestation period includes the end of February. If the end of February be included in the three months counted back, then add five days only. For example, let March 1st represent the commencement of the last menstrual period, three months back equals December 1st; add five days and you get December 6th, the approximate time of delivery.

The calendar of pregnancy, as shown in the accompanying figure after Schultze, facilitates calculation. The large figure standing under the name of the month indicates the days which are wanting in the preceding nine months to make up the 280 days, and which number must be added. The figures in parentheses relate to leap-year. An example or two will make clear the method of computation. A woman menstruated for the last time on the 10th of May. The 10th of February is the 276th day, and the 14th of February is the 280th day, the anticipated day of labour. Another woman menstruated for the last time on the 30th of October. The 30th day of July is the 273rd day, the 6th of August the 280th day.

In using the calendar, nine months forwards may be counted, or three months backwards, the latter perhaps being the more expeditious.

CHAPTER VII

THE GRAVID UTERUS

THE unimpregnated uterus can scarcely be regarded as fully developed, inasmuch as amongst its ultimate elements it contains cells and muscular fibres capable, under appropriate stimulus, of extended growth and development; but if the stimulus is withheld, these elements remain in a latent, undeveloped condition. The most remarkable feature in the gravid uterus is its rapid and great expansion; before impregnation it is about $2\frac{1}{2}$ inches long, and weighs about $1\frac{1}{2}$ ounce; at the ninth month of pregnancy it measures 12 inches in length, and weighs, immediately after delivery, about 2 pounds. During the first two or three weeks of pregnancy the uterus maintains the shape of its unimpregnated state, but it gradually becomes more spherical; after the third month and later on, the longitudinal diameter increases in greater proportion than the transverse, causing the organ to assume the characteristic ovoid form of the later months of pregnancy. At first the walls increase a little in thickness, but afterwards they become thinner, when on section the outline of the cavity corresponds with the external contour of the organ.

As the uterus increases in size the cervix appears

to project less into the vagina. The usual explanation of this change is that the cervix becomes drawn up and absorbed, so to speak, into the uterine body. So long ago as 1826, Holtz, and more recently Farre and Duncan, have shown that the cervix maintains its normal length until the last two weeks of pregnancy, when it does undergo shortening—the result of incipient, painless uterine contractions. There is therefore no real shortening or obliteration of the cervix until the period immediately preceding labour. In the unimpregnated uterus the cervix is firm and hard; in the pregnant state the cervix is relaxed, infiltrated, and softened, so that by the seventh or eighth month it is scarcely distinguishable from the vaginal walls.

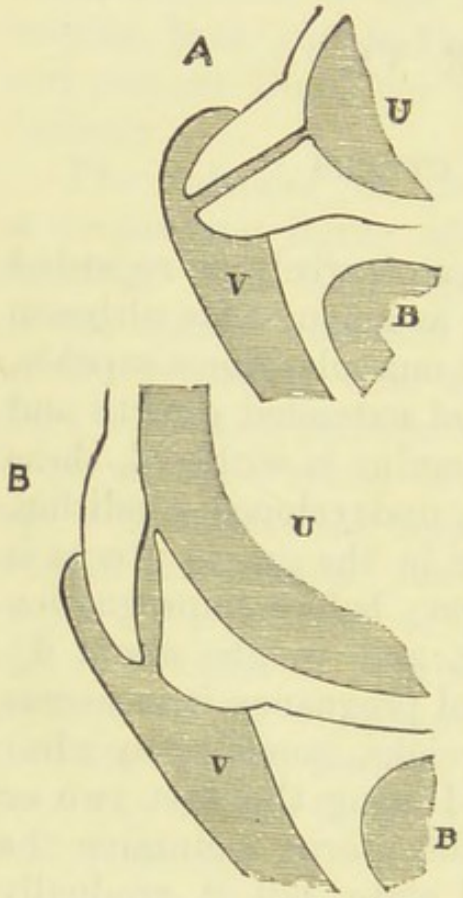


Fig. 83.—Diagram to illustrate how there may be apparent shortening of the cervix, as seen and felt from the vagina, without any shortening of the cervical canal. The upper figure, A, shows the cervix at about the third month, the lower, B, at about the eighth month of pregnancy. U, Cavity of uterus. V, Vagina. B, Bladder. (Galabin.)

The apparent shortening of the anterior lip of the cervix at full time is due to the partial or complete obliteration of the angle which exists between the anterior vaginal wall and the cervix. This is accounted for by the greater thickness of the vaginal wall itself, and by the fact that very often the lower part of

the anterior uterine wall is considerably bellied out just in front of the internal os by the presenting part of the fœtus. In these cases it has been noticed clinically that the apparent effacement of the anterior lip disappeared when the woman was examined in the genu-pectoral position. Again, in these cases the axis of the cervical canal may form a considerable angle with the longitudinal axis of the uterine cavity, in which event the cervix may, without very careful examination, appear to be shortened, the explanation being that a straight line drawn from the external os direct to the child's head would be much shorter than the actual length of the obliquely-directed cervical canal.

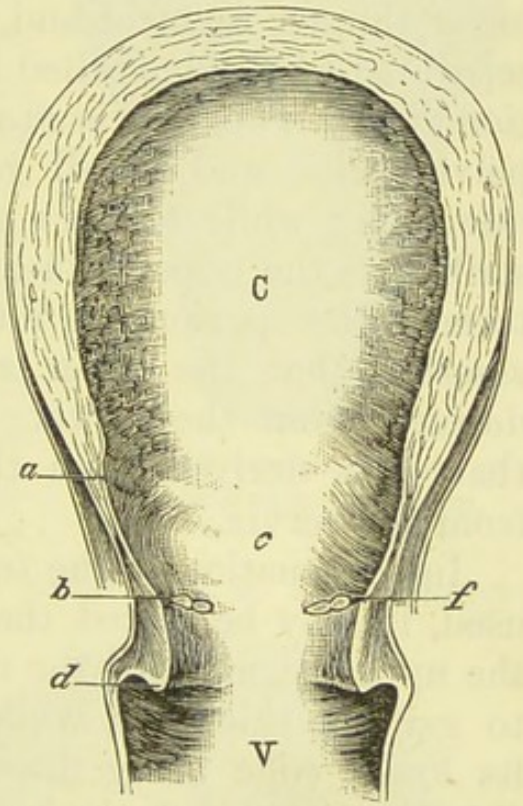


Fig. 84. — Longitudinal Section through Walls of Uterus in Eighth Month of Pregnancy. (Bandl.)

a, Contraction ring, or ring of Bandl. *b*, Os internum. *d*, Os externum.

The older view that the upper part of the cervical cavity expands so as to enlarge the available space for the child is, as we have said, not now generally accepted; and Duncan points out, that if this view were correct there should invariably be hæmorrhage before labour in cases of placenta prævia, but cases of placenta prævia are frequently seen in which no hæmorrhage occurs before the onset of labour. Bandl has, however, to a certain extent

revived the question. After a close examination of Braun's section of the body of a parturient woman, he found—and this can be demonstrated during life —that the full-time-pregnant uterus presents three portions: first, a cervix with its upper and lower orifices, the intermediate cavity plugged with mucus, and a fœtus-containing cavity above, which has a lower thinner segment and an upper thicker portion separated by a ridge called Bandl's ring, or the retraction ring. This ring is situate about the level of the pelvic brim, and Bandl regards it as the true os internum; while Müller's ring, or what we have described as the upper orifice of the cervical cavity, he termed the spurious os internum. Bandl therefore asserted that the lower segment of the uterus is derived from the cervix; but most authors agree that it is derived from the uterine body and not from the cervix.

In explanation of the term "retraction ring" just used, it may be stated that the general view is that the upper segment of the uterus tends during labour to gain in thickness, while its capacity is lessened, its lower edge being drawn upwards or retracted. On the other hand, the lower segment is believed to lessen in thickness while it gains in area, so as to admit of the passage of the child. It is in this lower segment that rupture of the uterus almost invariably commences.

At the early period of pregnancy, owing to its increased weight, the uterus sinks somewhat into the pelvis, and cannot be felt through the abdominal walls; but about the third or fourth month its fundus emerges from the pelvis, and about the sixth month it reaches the umbilicus; it continues to rise, until at last it attains the level of the ensiform cartilage.

In its ascent the uterus is directed at first by the axis of the pelvic brim upwards and forwards; afterwards this position is maintained by the sacral promontory and the symphysis pubis, so that the womb lies immediately behind the abdominal walls, and is thus placed in the best position for the avoidance of pressure, either on the bowels, inferior cava, or aorta.

Fig. 85.—Internal Layer of Uterine Muscular Fibres.

The actual increase in bulk of the uterine walls is due mainly to hypertrophy of the muscular coat, the peritoneal envelope simply enlarging so as to keep pace with it; the mucous lining, however, by developing into the decidua, adds somewhat to the entire thickness of the walls. The muscular coat of the uterus consists of three layers, described when treating of the unimpregnated organ, but these are more strongly defined in the gravid state. The internal layer, arranged concentrically around the opening of

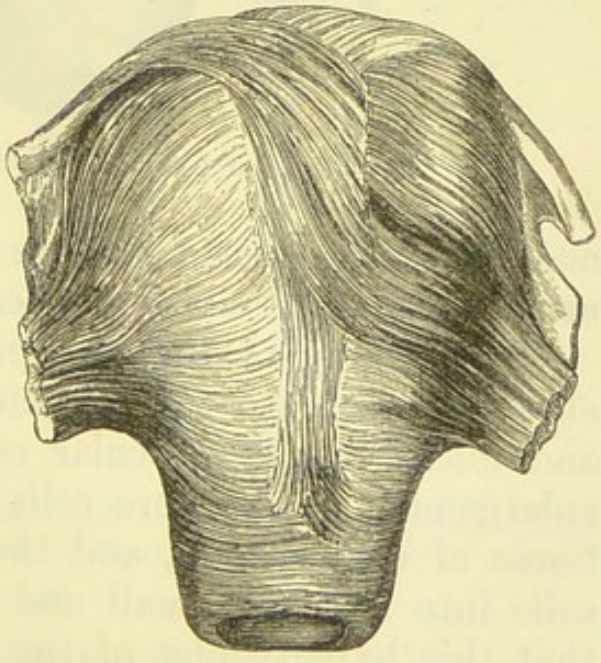


Fig. 86.—Middle Layer of Uterine Muscular Fibres.

each Fallopian tube, and in a circular direction round the body, is thin; the middle layer is thicker, and interlaces in all directions; the external consists of transverse and longitudinal fibres; the transverse fibres, found principally on the anterior and posterior surfaces, surround the entire organ, and merge into the round, broad, and ovarian ligaments. The direction of these various fibres, however, is not so

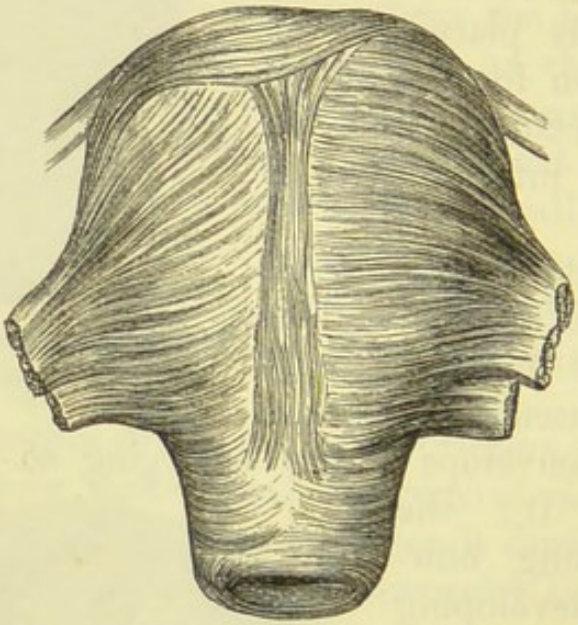


Fig. 87.—External Layer of Uterine Muscular Fibres.

manifest in the recent state as many of the diagrammatic representations would lead us to believe.

In speaking of the unimpregnated uterus, reference was made to the existence of small fibre cells and nuclei in the muscular coat; now it is to the enlargement of the fibre cells into smooth muscular fibres of colossal size, and the development of new cells into first the small and then the large fibres, that this hypertrophy of the muscular coat is due. According to Kölliker, this transformation takes place up to the sixth month, after which period none but the colossal fibres are to be found. The

blood-vessels of the gravid uterus are considerably enlarged, the veins obtaining a muscular coat developed from embryonic cells pre-existing in their middle

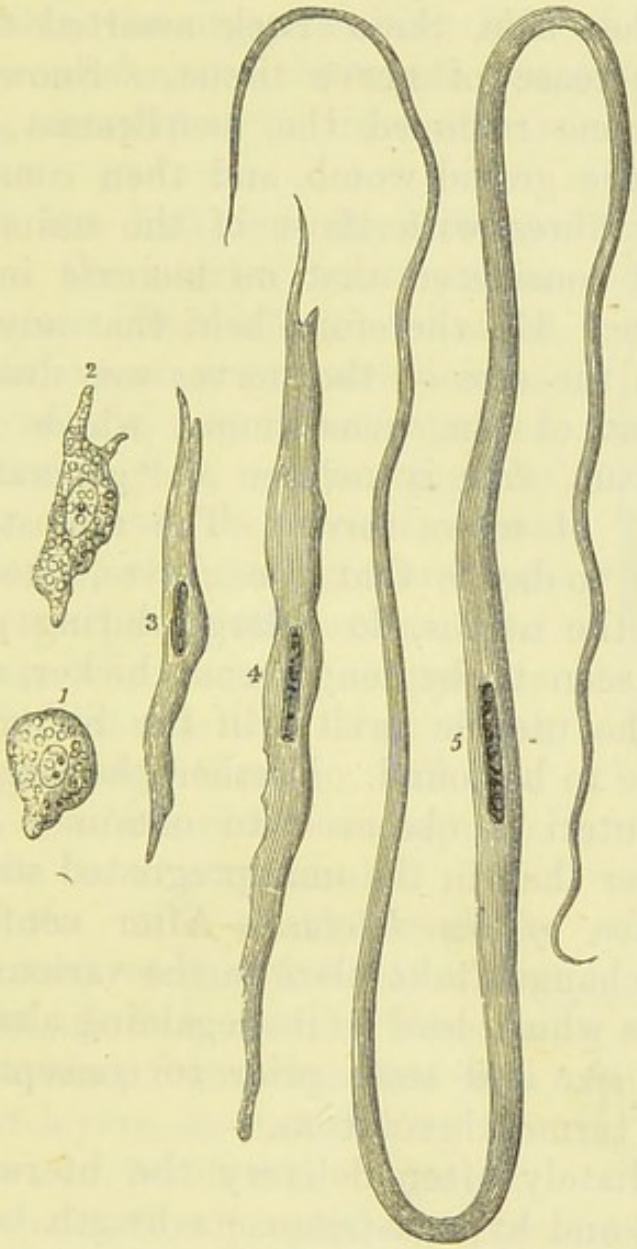


Fig. 88.—1 and 2, Embryonic nucleated fibre cells of the unimpregnated uterus. 3, 4, 5, Muscular fibre cells of the gravid uterus in different stages of development.

tunic. The veins supplying the placenta are, however, less amply furnished than the rest of the uterine veins.

The question whether, in the gravid uterus, an

actual augmentation of nerve-supply takes place was a much-contested point. Robert Lee, amongst a number of other disputants, held that the uterine nerves increased in bulk during the gravid state; on the other side, Snow Beck asserted that there was no increase of nerve tissue. Snow Beck in his dissections removed the neurilemma from the nerves of the gravid womb, and then compared the fine nerve fibres with those of the unimpregnated organ, and considered that no increase in size had taken place. He therefore held that any apparent increase in the size of the nerves was due solely to enlargement of the neurilemma, which is merely fibrous tissue, and is neither a "generator nor a conductor" of nerve force. The almost universal opinion of to-day is that the nerves, like the other tissues of the uterus, do enlarge during pregnancy. They are seen to be longer and thicker, and course towards the uterine cavity, in the lining of which ganglia are to be found. Further, the large ganglion cervicale uteri is observed to obtain a size many times larger than in the unimpregnated state.

Involution of the Uterus.—After confinement a series of changes take place in the various tissues of the uterus which lead to its regaining almost, if not quite, the size and state prior to conception. This process is termed involution.

Immediately after delivery the uterus occupies the pelvis and hypogastrium, its length being about 8 inches and its weight about 2 pounds, the walls being an inch or more in thickness. The peritoneal covering is loose and wrinkled, the muscular coats are contracted, and the interior of the uterus is irregular and nodulated at the placental side. Elsewhere it is smooth and soft, the muscle being only covered by the outer portion of the decidua which is

not cast off during labour; the mucous membrane of the cervix is retained. At the end of a week the weight is about one pound, and its length 5 to 6 inches. The diminution in size continues gradually for some time, the organ sinking into the pelvis in about three weeks, and the whole process of involution being completed in from six to ten weeks.

During the first few days of the puerperium the uterine contractions, which continue after labour and assist to a certain extent to promote involution of the muscle, may be accompanied by considerable pain, constituting the *after-pains*. Partly on account of the tissue waste in the muscle fibres resulting from these contractions, and also because the vascular supply is now largely cut off, the large fibres undergo fatty degeneration, followed by partial or complete absorption, which leads to a considerable diminution in the bulk of the muscle. About the end of the first month a development of new muscle fibres is described, arising from nucleated cells in the outer layers, so that during the latter period of involution degeneration and regeneration proceed simultaneously.

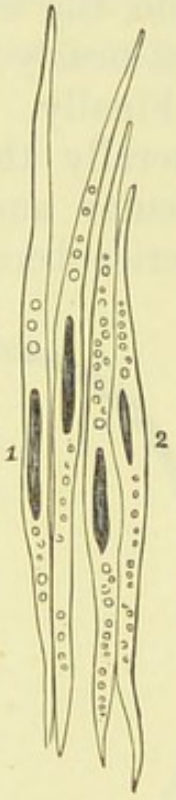


Fig. 89.

Muscular fibre cells a fortnight after delivery, in a state of fatty degeneration.

Involution of the decidua is accomplished by means of a degenerative change in its superficial portion, which is cast off in the lochia, and as in the case of the muscles, a regeneration of mucous membrane begins about the end of the fourth week. First of all, a thin layer of mucous membrane is formed from the deepest portion of the decidua

which has not been cast off. The epithelium of this new mucous membrane becomes in a little time columnar, and later ciliated. The membrane becomes thicker, and at the same time utricular glands are formed. The region of the placental site is the last to be supplied with new mucous membrane, the explanation being that here the muscle is most nearly laid bare during labour.

Finally, during the involution of the uterus generally there is a coincident diminution in the vascular and nervous supply. The lumen of the arteries becomes smaller and the vascular walls less thick—some fatty degeneration occurring in the middle tunics especially, being followed later by absorption. The vessel walls remain, however, thick relatively to their condition before pregnancy. The large venous sinuses become obliterated by organisation of the thrombi formed immediately after labour.

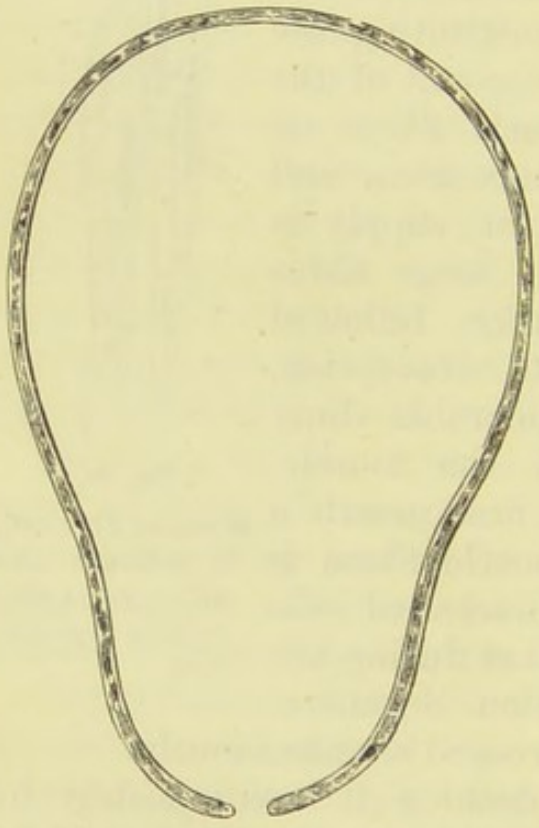


Fig. 90.—Outline of the Ovoid Uterus.

Fœtus in Utero.—The entire fœtal *attitude* is that of flexion. At the end of pregnancy the spine is curved forwards, the chin resting on the sternum, the thighs are flexed on the trunk, the knees bent, and the arms crossed over the front of the chest. This arrangement of

the trunk and limbs gives to the fœtus an ovoid outline which is well adapted to the uterine cavity, and presents the child in the most favourable position for passing through the maternal pelvis.

It used to be held that when once the fœtus had taken up its position, this was maintained until delivery; but repeated examinations have revealed that in the majority of cases changes of position take

Fig. 91.—Ovoid Form of Fœtus at Full Term.

place from time to time, that they occur more readily during the earlier months, are most frequent in multiparæ, and are often caused by contracted pelves.

In by far the majority of cases the fœtal ovoid *presents* by one or other pole; usually the head end is the presenting or lower part. The reason for this has been variously accounted for by different writers, the most practical explanation being that it is deter-

mined by *gravitation*, aided by the *form* and *inclination* of the uterine cavity. A series of experiments were made by Veit, who placed a fœtus in a spheroidal vessel of salt water of specific gravity identical with that of the fœtus, when it was found that its head gravitated lower than its breech, there being also a downward inclination of the right shoulder, which was accounted for by the position of the liver.

Fig. 92.—Adaptation of Fœtus to Uterus.

Matthews Duncan found that the specific gravity of the detached head exceeded that of the trunk, and by a number of other experiments and logical deductions therefrom has considerably developed the gravitation theory. The shape and inclination of the uterine cavity, as was previously remarked, exert considerable influence. In the earlier months of pregnancy the shape of the uterus is spheroidal, and its cavity

is large as compared with the size of the fœtus, which lies free in a large quantity of liquor amnii. As might be expected, therefore, there is not at this time the same uniformity in attitude and presentation of the fœtus as in the later months, when the uterus has become pyriform; the fœtus then naturally tends to adapt itself to the ovoid cavity in which it is contained, and as there is not now the same relatively large space between the fœtus and the uterine walls, changes in position do not so readily occur, unless the liquor amnii is very excessive. That the inclination of the uterus affects the presentation of the fœtus is shown by the following arguments:— When a woman is in an upright position, the anterior wall of the uterus forms an angle of 35° with the horizon; down the incline thus formed the fœtus has a tendency to slide, checked, however, by the cervix and closed os. If the woman is placed on her back, still the uterus is in an inclined position, its angle with the horizon being now 55°, so that whether the woman is standing or lying on her back (the superior gravity of the head being allowed) the fœtus will naturally present with its cephalic extremity towards the os, impelled thereto partly by gravitation, partly by the inclination of the uterine walls. When the mother lies on either side the uterus is horizontal, which would leave the position of the fœtus unaltered in its relation to the womb; but, as Schroeder observed, if the fundus is tilted over toward the side on which the woman lies, the fœtus, obeying the laws of gravity, would reverse its position, and a breech presentation would result. This, however, could take place only during the earlier months when the cavity of the uterus is large in proportion to the size of the fœtus. Sir James Simpson endeavoured to account for the

position of the fœtus by reflex action, asserting that if a living child were in a position not adapted to the shape of the uterine cavity, the normal uterine contractions of pregnancy would lead to excessive movements on the part of the fœtus tending towards an alteration of the malposition.

The various processes of development of the uterus and fœtus being at length completed, the time comes for the final act of the generative function—

Fig. 93.—Fœtus and Uterus at Fifth Month.

the expulsion of the fœtus. The uterus, it will be remembered, receives its nervous supply from the sympathetic and spinal systems, more largely from the former. Labour, from its initiatory phase to its full development, is mainly the result of reflex action. For some time previous to the completion of pregnancy the superficial part of the decidua becomes separated from the uterine walls, with the exception of that portion of it to which the placenta is attached, the *decidua serotina.* This detachment is

brought about by fatty degeneration, followed by absorption, thus producing solution of continuity, and placing the fœtus and its membranes in the position of a foreign body in the uterus. Irritation of the uterine nerves is then set up, to be by them transferred to the sympathetic ganglia, and thence reflected in the form of motor activity to the muscular coat of the uterus.

When once the requisite amount of nervous tension is established, a discharge follows in the shape of uterine contraction, succeeded by a period of repose; after a time renewed irritation reproduces nervous excitation, which again culminates in a fresh discharge of nerve force, to be followed, as before, by a period of rest. These alternations of energy and quiescence succeed each other with increasing rapidity, and by degrees assume an inverse ratio towards each other, the contractions becoming longer and the intervals shorter. The diaphragm and abdominal muscles are now brought into play, at first in obedience to the will, but in the later stage their movements become reflex, until at last the combined action of these co-ordinated forces effects the expulsion of the fœtus. The relation of the force brought to bear by the uterus itself to that exerted by the abdominal muscles in the act of expulsion has been variously estimated. Many indications, however, such as the futility of simple abdominal contractions to effect expulsion of the fœtus in cases of uterine inertia, prove that the uterus is by far the more powerful.

Although, usually, uterine contraction is induced by nervous irritation, originating in the organ itself, it is not altogether independent of mental impressions. It is well known that the advent of the medical attendant, especially if a stranger to the

patient, will occasionally induce temporary cessation of the pains; other mental stimuli, on the contrary, will induce action previously in abeyance. These impressions are conveyed from the cerebrum through a uterine centre in the fourth ventricle near the vaso-motor centre, and by this transferred to a lower spinal centre in the lumbar cord. The medullary centre is affected by emotions, sensory impressions, such as irritation of the nipple, etc., as well as by states of the blood; the amount of control possessed by the medullary centre itself over uterine action is relatively small, but still through it there may be excitory or inhibitory impressions transmitted to the lower nervous apparatus,—probably the rhythmical contractions of pregnancy have their origin in the tonic action of the medullary centre.

The mechanism which effects the dilatation of the os uteri during labour is subject to some doubt, some considering the cervix to be entirely passive, others partly passive and partly active. When the paucity of circular muscular fibres in the cervix is taken into consideration, with the fact that individually none of these fibres entirely surround it, but merely embrace segmental portions, it is not difficult to conceive how the excess of power from the body of the uterus forces the coniform bag of membranes in the shape of a hydraulic wedge between the lips of the os, and gradually distends it until the longitudinal fibres are brought into play, which then render great assistance by contracting in the direction of the fundus, and thus drawing up the os over the presenting part of the fœtus. This explanation shows how the passive ring of the cervix may be dilated by extrinsic means. The intrinsic factor in the opening of the os consists in an active relaxation, so to speak, of the circular

muscle fibres. This is comparable to what happens in the case of the urinary bladder when physiological relaxation of the sphincter and contraction of the body of the organ occur concurrently. During the first stage of labour this physiologically active dilatation of the os uteri during a pain necessarily increases the efficacy of the wedge-like action of the bag of membranes, and also facilitates the drawing up of the cervical ring by the longitudinal muscle of the uterus.

CHAPTER VIII

MECHANISM OF LABOUR

UNDER the designation *Mechanism of Labour* are comprehended the various movements and changes in position assumed by the fœtus in its relation to the maternal pelvis during labour. It is the basis of a scientific knowledge of the act of parturition, and it is of high importance to the student thoroughly to comprehend this mechanism, for a mastery of it will lift him above the level of a mere midwife.

Presentation.—By this term we simply mean that portion of the fœtus which comes foremost in the preliminary stage of labour. Presentations are divided into *Natural* and *Faulty*. Natural presentations comprehend cranial, breech, knee, and footling cases. Faulty presentations include all other varieties. Either end of the fœtus may present, and delivery ensue; but when the transverse diameter presents, delivery is impracticable until the faulty presentation is rectified.

The cranial is by far the most frequent presentation, so that by patients and nurses it is usually spoken of as *the* natural presentation; in a breech presentation, on the contrary, the same authorities are wont to say that the child "comes the wrong way."

Before describing the various cranial presentations, we will give a short description of the anatomy of the fœtal head. The fœtal skull (Figs. 94 and 96) is oval in shape; the cranial bones are soft, and separated from each other by membranous divisions called sutures, which serve as important guides in determining the position of the head during labour. This absence of rigid bony union admits of considerable compression and modification of the shape of the head during parturition. The principal sutures are the sagittal, coronal, and lambdoidal. The *sagittal* suture extends from the superior angle of the occipital bone to the root of the nose. It separates the two parietal bones, and in the fœtus marks the division of the frontal bone into two equal parts.

The *coronal* suture separates the frontal from the parietal bones, and extends between the temporal sutures of the two sides, stretching from the upper part of the squamous portion of one temporal bone to a corresponding point on the other.

The *lambdoidal* suture separates the superior edge of the occipital bone from the posterior borders of the two parietal bones.

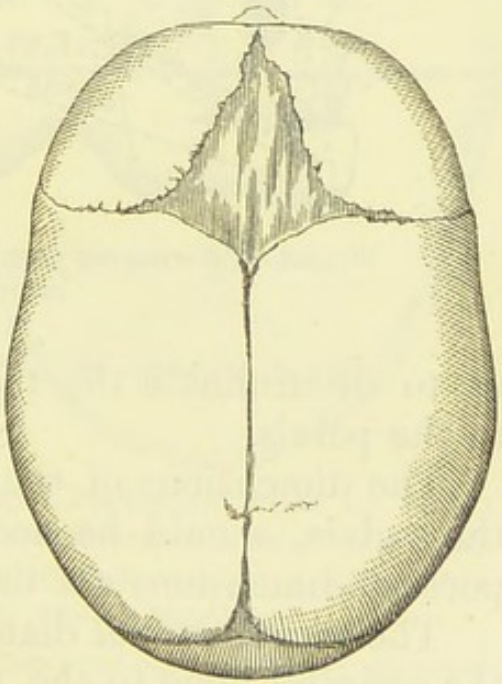


Fig. 94.—Anterior and Posterior Fontanelles.

There are two *fontanelles*—the *anterior*, quadrangular in shape, situated at the point of intersection of the sagittal and the coronal sutures, is recognised by the examining finger as having four angles with a suture running

into each, and, as will be seen from the figure, its greater diameter is longitudinal; the *posterior* is situated at the point of junction of the posterior end of the sagittal with the lambdoidal suture; it is triangular, and is felt by the finger to be the meeting-place of three sutures. It may be mentioned that as an evident space it is often wanting in a full-grown, well-ossified fœtus. A knowledge of the shape and topography of these fontanelles is essential to enable

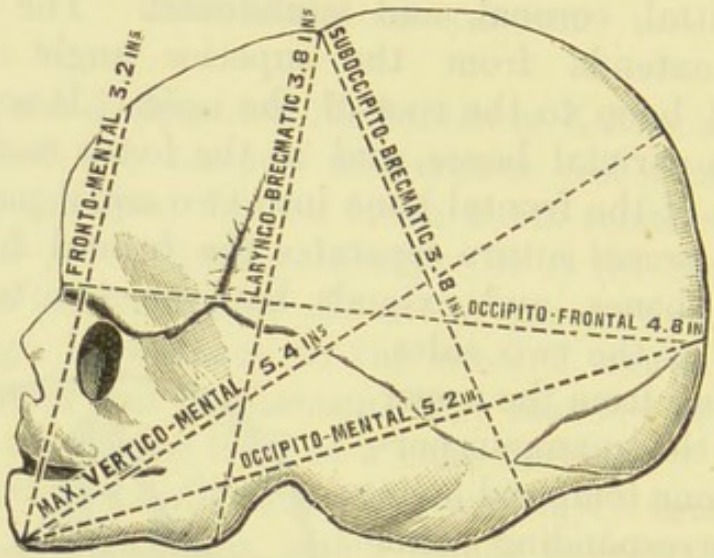


Fig. 95.—Profile of Fœtal Skull, with Diameters indicated.

us to discriminate the relative position of the head to the pelvis.

The dimensions of the child's head, like those of the pelvis, should be accurately known. The important dimensions are the following:—

The *occipito-mental* diameter, taken from the tip of the occipital bone to the point of the chin, measures 5·2 inches. This diameter was formerly considered to be the largest presented by the fœtal head, but Budin points out that the greatest diagonal measurement obtainable extends between the chin and a point

on the sagittal suture, at a distance in front of the posterior fontanelle varying considerably under different conditions. This is the general rule, and this *maximum* diameter averages 5·4 inches. In some instances, *e.g.* brow presentations, it may coincide with the occipito-mental diameter, or indeed have to be taken to a point behind the posterior fontanelle.

The *occipito-frontal* diameter, extending between the tip of the occipital bone and the glabella, or the root of the nose, measures 4·8 inches.

The *sub-occipito-bregmatic* diameter, taken between the junction of the occiput with the neck and the anterior fontanelle at a point where the lines of the coronal and sagittal sutures would intersect, measures 3·8 inches.

The *fronto-mental* diameter, taken between the top of the forehead and the chin, averages 3·2 inches.

The *laryngo-bregmatic* diameter, measured between the centre of the hyoid bone and the middle of the anterior fontanelle, is about 3·8 inches.

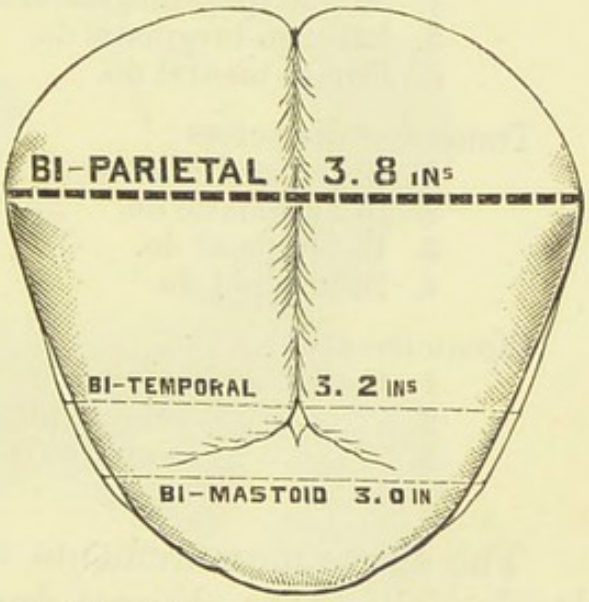


Fig. 96. — Posterior View of Fœtal Skull, showing Sagittal and Lambdoidal Sutures, and Bi-parietal Diameter drawn boldly.

The bi-temporal and bi-mastoid diameters are indicated by faint lines.

Of the transverse diameters of the fœtal skull the following are of importance :—

The *bi-parietal* diameter, extending between the two parietal eminences, is 3·8 inches ; the *bi-temporal* diameter, between the extremities of the coronal suture, is 3·2 inches ; the

bi-zygomatic about 3·25 inches; and the *bi-mastoid* is about 3 inches.

Of the circumferential measurements, the following are of interest :—(1) Corresponding to the maximum diameter is the greatest circumference of about 14·6 inches; (2) in relation with the sub-occipito-bregmatic diameter is the smallest circumference of about 13 inches; while (3) corresponding with the occipito-frontal diameter is a circumference of about 13½ in. The following table shows these measurements in a form easy for reference :—

	in.
Sagittal and vertical diameters :	
1. Maximum diameter . .	5·4
2. Occipito-mental do. . .	5·2
3. Occipito-frontal do. . .	4·8
4. Sub-occipito-bregmatic do. .	3·8
5. Laryngo-bregmatic do. . .	3·8
6. Fronto-mental do. . .	3·2
Transverse diameters :	
1. Bi-parietal diameter . .	3·8
2. Bi-zygomatic do. . .	3·25
3. Bi-temporal do. . .	3·2
4. Bi-mastoid do. . .	3·0
Circumferences :	
1. Corres. with maximum diam. .	14·6
2. ,, ,, sub-occipito-bregmatic do.	13·0
3. ,, ,, occipito-frontal do. .	13·5

The above measurements are those of the child's head, without the changes due to parturition. During even the most favourable labour some moulding of the head will take place special to each presentation. The following alterations in measurement may be briefly stated (Budin) :—For vertex presentations, increase of the maximum diameter, diminution of all the rest with the exception of the transverse diameters of the base; in face presentations, increase of the occipito-mental and occipito-frontal

diameters, diminution of the fronto-mental and laryngo-bregmatic diameters.

We shall now pass on to consider the various presentations, beginning with those of the head. The head may present by the *vertex* or the *face* or *brow*. The vertex is by far the most common of all, and is

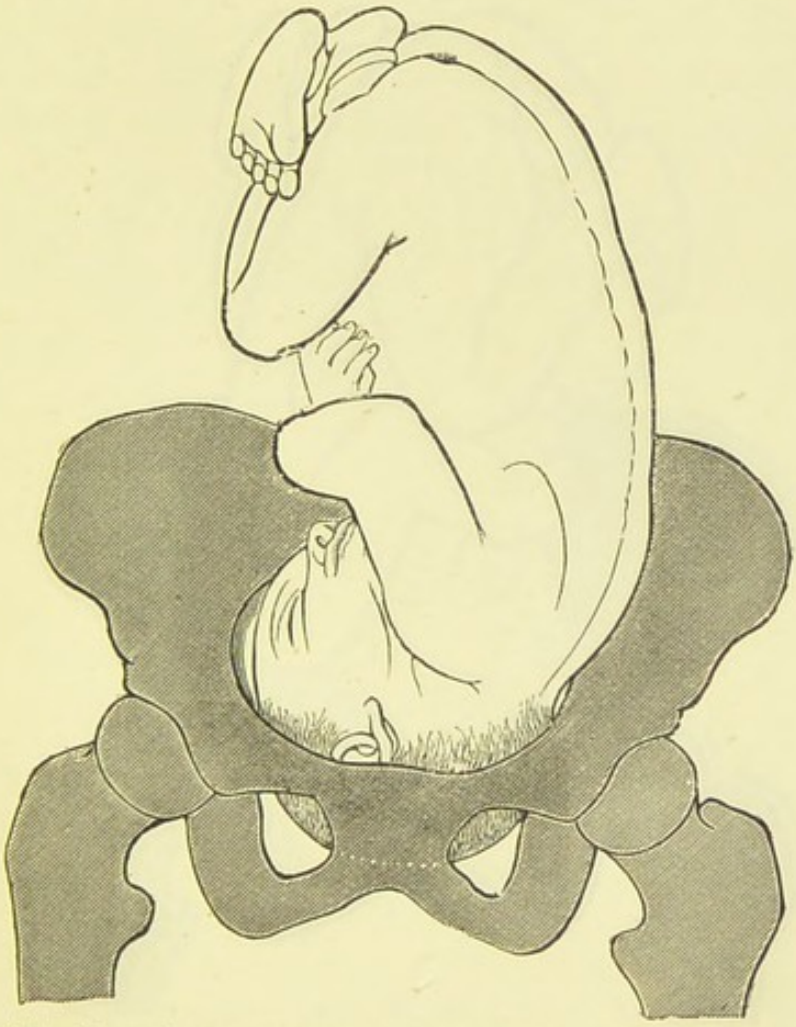


Fig. 97.—Left Occipito-Anterior, or *First* Position of the Vertex. (Farabeuf and Varnier.)

to be met with in four different *positions*. In the *first* position the long diameter of the head corresponds with the right oblique diameter of the pelvis, the occiput pointing forwards and to the left acetabulum, and the forehead to the right sacro-iliac synchondrosis. This first position of the vertex

is known as the left occipito-anterior, or briefly L.O.A. In the *second* position the vertex is in the left oblique diameter, with the occiput pointing to the right acetabulum, and the forehead to the left sacro-iliac synchondrosis. This is the right occipito-anterior, or R.O.A. position. In these two forms it

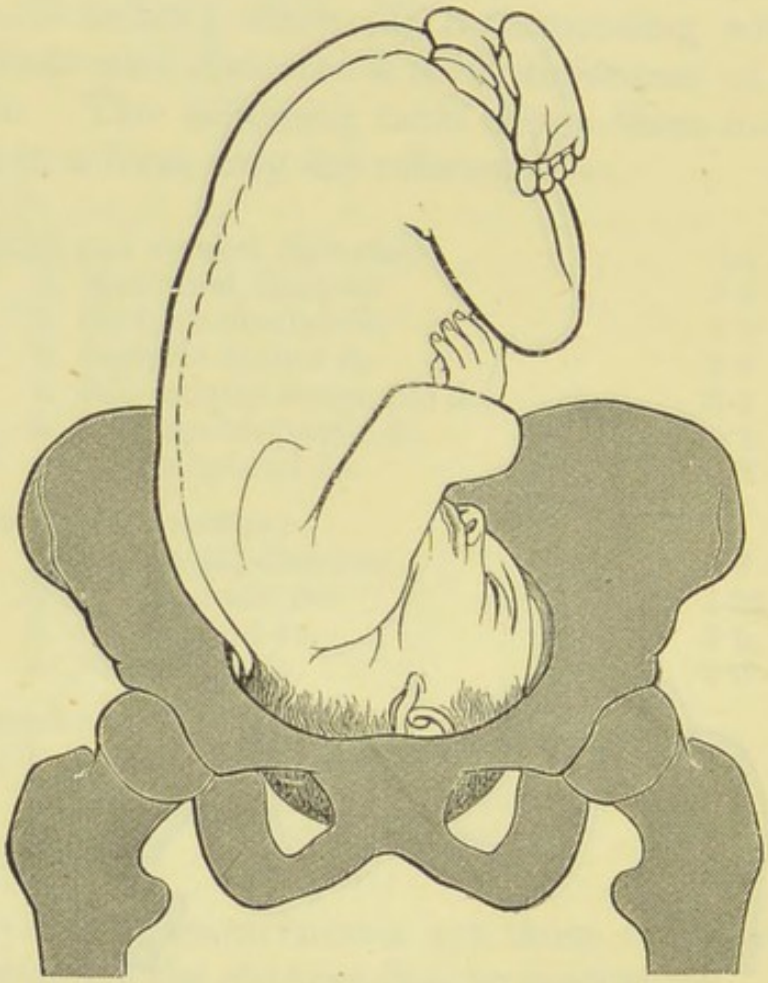


Fig. 98.—Right Occipito-Anterior, or *Second* Position of the Vertex. (Farabeuf and Varnier.)

will be observed that the occiput is directed towards the pubes of the mother; in the next two the forehead takes this direction, the former being classed as occipito-anterior positions, the latter as occipito-posterior. Thus in the *third* cranial position the head is in the right oblique diameter of the pelvis,

but the occiput points where the forehead points in the first, to the right sacro-iliac synchondrosis, and the forehead to the left acetabulum. This is known as the right occipito-posterior position, or R.O.P. It is, as will be seen, the opposite of the first. In the same manner the *fourth* or left occipito-posterior,

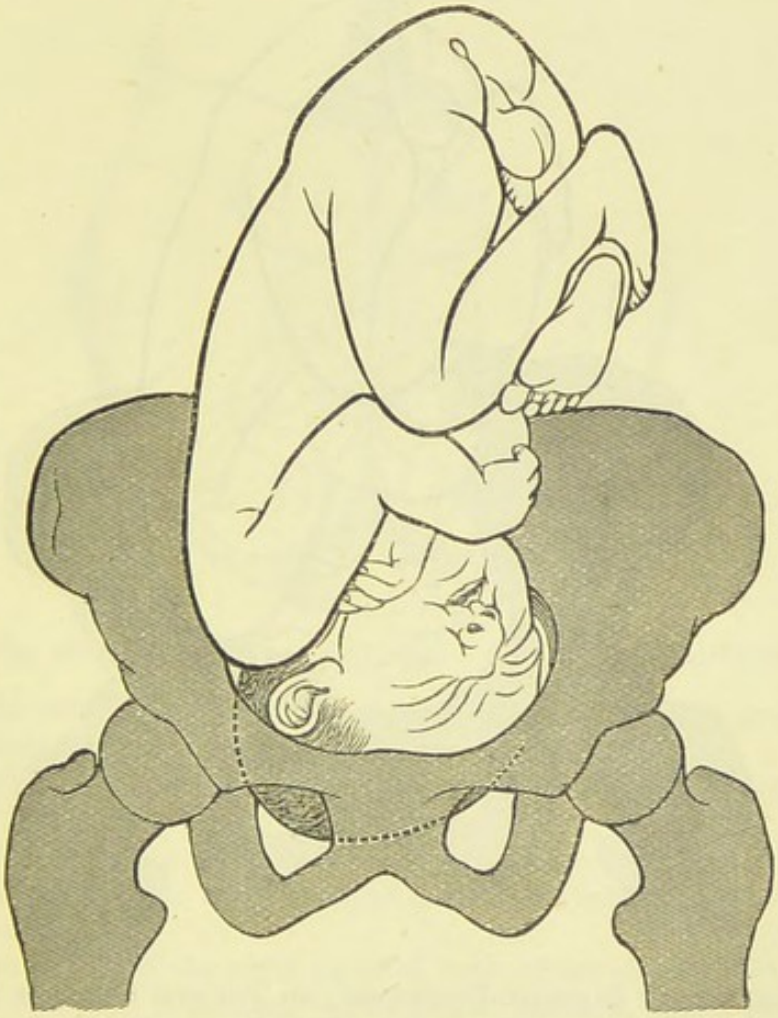


Fig. 99.—Right Occipito-Posterior, or *Third* Position of the Vertex. (Farabeuf and Varnier.)

L.O.P., is the converse of the second, the occiput pointing to the left sacro-iliac synchondrosis, and the forehead to the right acetabulum.

First position.—Before the head reaches the pelvis its long diameter is parallel to the brim; on entering the pelvis, however, *flexion* occurs, and it assumes

what is called the occipito-frontal obliquity, with the occiput directed downwards, and the chin bent on the sternum. This position naturally results from the junction of the vertebral column and head being much nearer the occiput than the chin. On the application of the expulsive force from above, the

Fig. 100.—Left Occipito-Posterior, or *Fourth* Position of the Vertex. (Farabeuf and Varnier.)

greater part of which is transmitted through the condyles, the resistance being below, flexion occurs, because the posterior end of what may be considered as the cranial lever, the fulcrum being at the condyles, is much shorter than the anterior. Resistance, therefore, acts with greater effect on this longer anterior arm, retarding it whilst flexion goes on,

until the chin rests on the sternum, thus steadying the head and affording another point for the transmission of force to the presenting part.

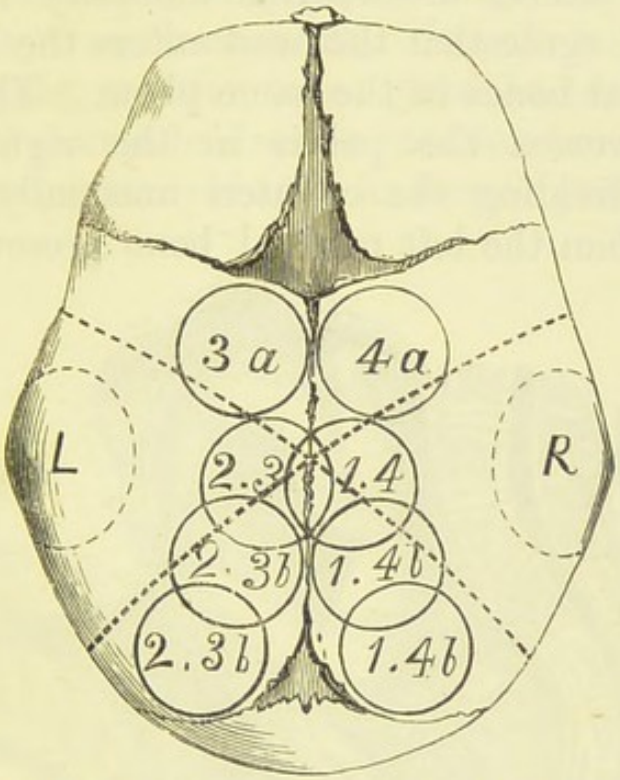


Fig. 101.—R, Right parietal bone. L, Left parietal bone.

1, 1, 1. The different points of the right parietal bone which present successively in the first position.

4. The part of the parietal bone which presents at the os uteri, in the fourth position, at the commencement of labour.

4*a*. The part of the parietal bone which presents at the ostium vaginæ, in the fourth position, when the head is delivered in the occipito-posterior position.

4*b*, 4*b*. The points of the right parietal bone which present successively when the head, presenting in the fourth position, makes the quarter turn, and is delivered in the occipito-anterior position.

The figures 2, 3, 3*a*, and 3*b*, 3*b*, mark, in the same way, the presenting points in the second and third positions of the head on the left parietal bone.

The two diagonal lines across the head mark the intersection of the head by the vulva and perineum, as the head passes out, so that only one tuber parietale occupies the ostium vaginæ at the same time.

(Tyler Smith.)

Whilst the head is in this position, an examination reveals that the right *tuber parietale* is the most pro-

minent part. According to Naegelé, the head enters the brim obliquely, the right parietal bone being much lower than the left; more recent authorities deny this lateral or Naegelé obliquity in normal labour, and agree that the head enters the brim with both parietal bones in the same plane. The sagittal suture traverses the pelvis in the right oblique diameter, dividing the os uteri unequally, more of the right than the left parietal bone presenting, and

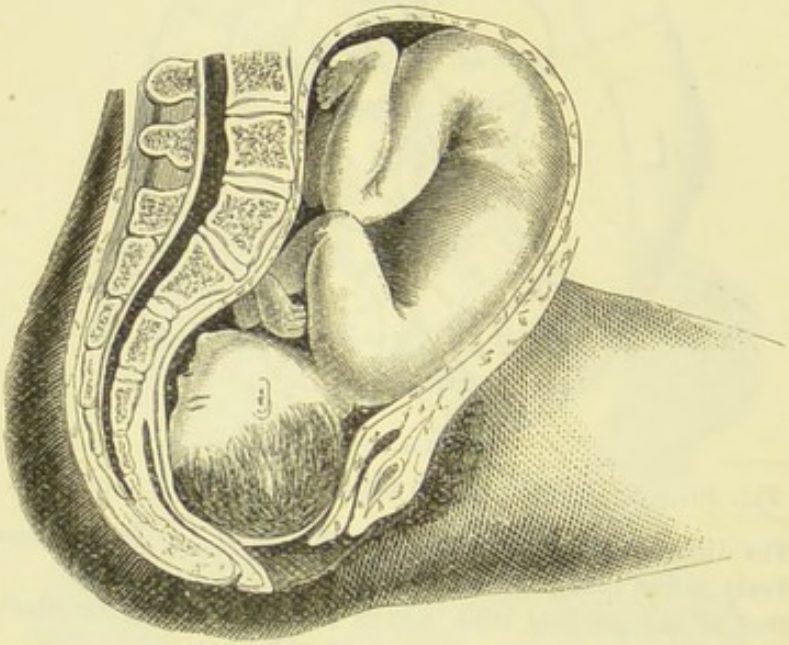


Fig. 102.—Head within the Pelvic Cavity—First Position.

on this spot is formed the primary caput succedaneum, or scalp tumour, from absence of pressure on as much of the scalp as corresponds with the dilating os uteri. When the os is well dilated, the sagittal suture may be traced forwards and downwards (the mother being on her left side) to the posterior fontanelle and lambdoidal suture, and backwards and upwards to the anterior fontanelle.

As the head advances its position changes, its long diameter gradually assuming a parallelism with the conjugate (or antero-posterior) diameter of the

pelvis, the forehead lodging in the hollow of the sacrum, and the occiput being turned towards the pubes. This *internal rotation* of the head may be readily observed by keeping the finger in contact with it during two or three pains. It will be found that during a pain rotation takes place in one direction, and as the pain subsides the rotation is reversed, the head returning somewhat to its former position ; these

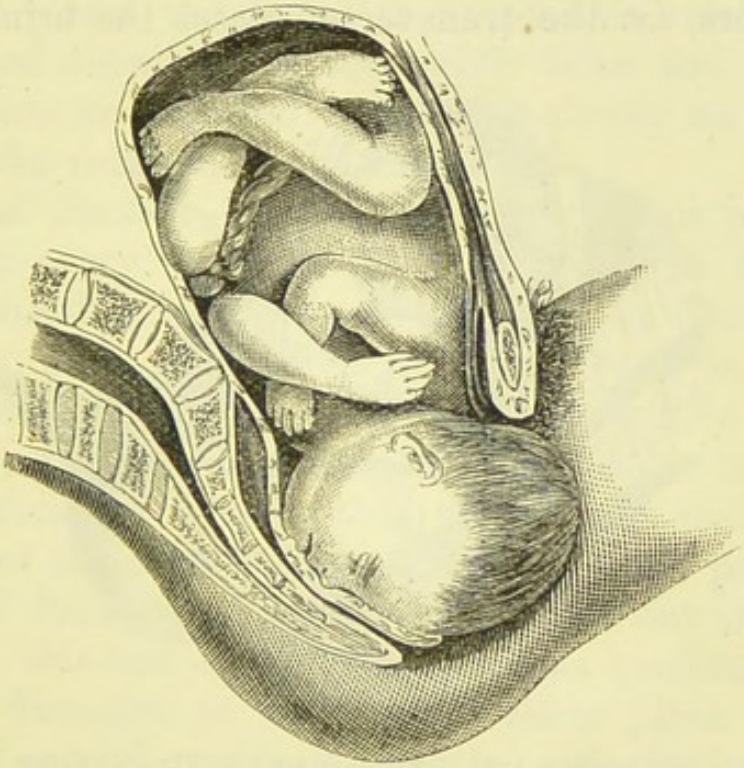


Fig. 103.—Head passing under Pubic Arch—First Position.

alterations going on until at last the head glides into its new position. Before rotation is quite effected the chin leaves the sternum, and the frontal portion of the head advances beyond the occiput, thus reversing the previous position. The presenting part is now the posterior and superior quarter of the right parietal bone, and here the secondary caput succedaneum is formed. The occiput is now slightly under the pubic arch, and as the pains continue, the fore-

head and face coming against the pelvic floor are directed forwards, constituting a movement of *extension*, and by this movement, combined with descent, the child's head is born. To the last the head maintains a certain amount of obliquity, the first part to escape being the upper and posterior part of the right parietal bone.

The shoulders have now to undergo a similar rotation. As a rule, the greatest diameter of the shoulders, *i.e.* the transverse, passes the brim in the

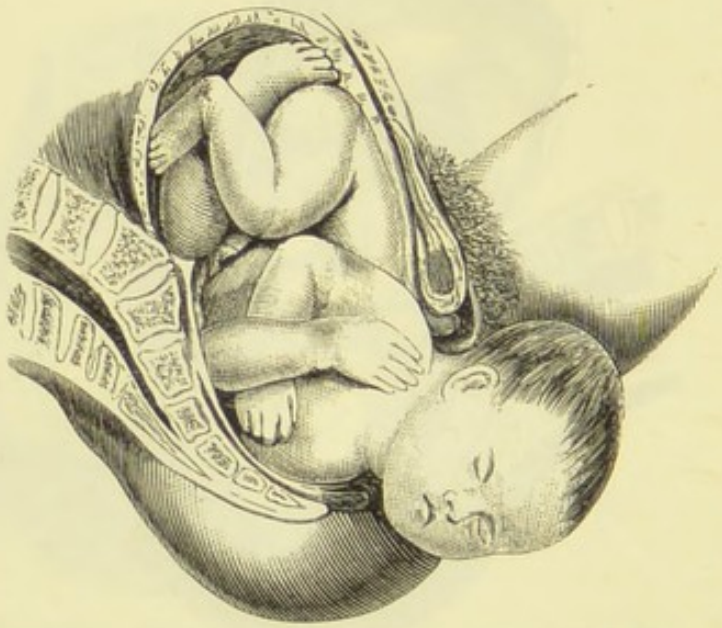


Fig. 104.—Emergence and Extension of the Head—First Position.

left oblique diameter, when the long diameter of the head occupies the right. Their rotation is effected by a like mechanism as applies to the head, but the inclined planes that come into action are those at the ends of the oblique diameter of the pelvis. Thus the right shoulder glides along the anterior surface of the right ischial plane, and passes forward under the arch of the pubes, and rests there whilst the left shoulder sweeps along the perineum, as did the face when the head was under-

going expulsion; this causes the delivered head to revert to the first position, *i.e.* to look to the mother's right, constituting the movement of *restitution* or *external rotation.* The objects fulfilled by these various movements of the fœtal head may be thus summed up :—Flexion (occipito-frontal obliquity) is the means of always presenting the shortest diameter of the head to the pelvic canal; extension causes the head to advance along the curved passage of the pelvis; rotation places the fœtus in favourable relation to the varied diameters of the pelvic brim and outlet. Restitution or external rotation is simply an indication of the rotation of the shoulders.

Second Position.—The mechanism in this position being in every way parallel to that of the first, it will be needless again to go through the details, all that has been said about the first position being applicable equally to the second, bearing in mind, however, that the direction of the head's occipito-frontal diameter when within the brim is in the left instead of the right oblique diameter of the pelvis.

Third Position.—It has been pointed out that the head in this and the fourth positions presents in a reverse direction to that which takes place in the first and second positions, that is, with the forehead forwards, the consequence being that the mechanism of this class of labours presents more difficulties than are met with in those described before.

When the head enters the brim it is found that the sagittal suture traversing the pelvis in the right oblique diameter may be traced, with the patient on her left side, downwards and forwards to the anterior fontanelle, and upwards and backwards to the posterior fontanelle; the difference in the situation of the fontanelles (the posterior being generally the lower) is a means of diagnosing this position.

Labour may here terminate in two ways—either by the forehead remaining towards the pubes, expulsion taking place in this position, or by the occurrence of rotation into the second position, with the forehead towards the left sacro-iliac synchondrosis, and the occiput towards the right acetabulum.

As a rule, and this is the more favourable, the occiput is directed forwards, and the position of the head is changed within the pelvis to the second (occipito-anterior) position. This is effected by the occiput being lowest owing to the flexion, and consequently first to meet the pelvic floor, by which it is directed forwards towards the free space under the pubic arch. On the other hand, if, because of imperfect flexion, the occiput does not reach the pelvic floor before the forehead is engaged in the pelvis, the inclined planes of the pelvis effect their ordinary rotation of the head, *i.e.* the anterior cephalic pole, the forehead, goes forwards — the posterior, the occiput, being turned backwards into the hollow of the sacrum.

In the first event, the case becomes what is known as a reduced occipito-posterior position, and the delivery of the head is effected by extension, as in primary occipito-anterior positions. In the second class of cases, or unreduced occipito-posterior positions, unassisted delivery can only take place with the head in a state of considerable *flexion*—the forehead, eyes, nose, mouth, and chin successively emerge from under the pubes, while the occiput sweeps over the perineum. Operative interference is often indicated in these persistent occipito-posterior cases, because the difficulty in delivery is much increased as the outlet of the pelvis has to be traversed by the child's head presenting the occipito-frontal instead of the smaller sub-occipito-bregmatic diameter.

Bearing these facts in mind, it is well to attempt to assist rotation forwards by helping the preliminary flexion of the head. This is best done by pressing up the brow towards the ilio-pectineal line.

Fourth Position.—This position bears a like relation to the third that the second does to the first, the occipito-frontal diameter of the head presenting in the left oblique diameter with the anterior fon-

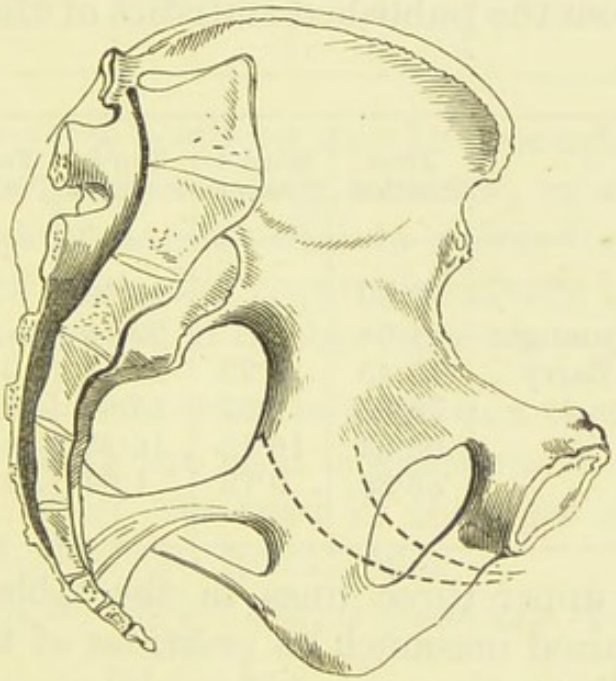


Fig. 105.—Outline of the Internal Surface of the left half of the Pelvis.

The two curved lines mark the path of the head in the first and in the occipito-anterior termination of the fourth positions.

tanelle towards the right acetabulum. Its mechanism is just like that described for the third position. It may terminate, as may the third, in a persistent occipito-posterior presentation or become reduced. In the latter case, when the occiput has gone forwards the further mechanism is the same as in the case of a primary first position.

With regard to the relative frequency of the

various cranial presentations, it appears from statistical observations that those positions, the first and the third, in which the longitudinal diameter of the vertex corresponds with the right oblique diameter of the pelvis, are far the most frequent; the second and fourth positions, in which the left oblique diameter is occupied by the sagittal suture, having a very much lower percentage-rate.

Leishman gives the following table of percentages, deduced from the published statistics of the observers quoted :—

	First Position.	Second Position.	Third Position.	Fourth Position.	Not Classified.
Naegelé . . .	70·00	...	29·00	...	1·00
Naegelé, the younger	64·64	...	32·88	...	2·47
Simpson and Barry .	76·45	0·29	22·68	0·58	...
Dubois . . .	70·83	2·87	25·66	0·62	...
Murphy . . .	63·23	16·18	16·18	4·42	...
Swayne . . .	86·36	9·79	1·04	2·8	...

To the upper three lines in the table objection has been raised inasmuch as positions of the head in the left oblique diameter of the pelvis are practically not acknowledged; on the other hand, it may be alleged that many of the numerous second positions given by Murphy and Swayne were originally R.O.P., or third positions at the pelvic brim, which were noted as R.O.A. when the occiput was undergoing forward rotation.

After discussing the varied results Leishman strikes an average between the figures of Dubois and Murphy, and gives the result as being in all probability very near the truth :—

First Position.	Second Position.	Third Position.	Fourth Position.
67	10	20	3

From careful observation of 248 cases in the maternity department of the St. Mary's Hospital, Manchester, Dr. Walls gives the following percentages :—

L.O.A. or First Position.	R.O.A. or Second Position.	R.O.P. or Third Position.	L.O.P. or Fourth Position.	Head *Transverse.* Occiput to *Right.*	Head *Transverse.* Occiput to *Left.*
64·51	1·2	27·43	4	2	·8

The transverse positions may be accounted as occipito-posterior cases rotating forwards, or as original transverse presentations due to pelvic flattening—of seven such cases, five required delivery by forceps. A rough interpretation of this report is :—

Of 100 cases of vertex presentation there will be

(1) 3 in which the head is *transverse.*

(2) Over 90 of the head in the *right oblique diameter.* 60 L.O.A., 30 R.O.P., and

(3) 5 only in the *left oblique diameter.* 1-2 R.O.A., 4 L.O.P.

CHAPTER IX

MECHANISM OF LABOUR—*continued*

Face Presentations.—These presentations differ from vertex presentations in extension of the head having taken the place of flexion; this extension brings the face into the presenting position instead of the vertex. If the formation of the face is considered in relation to the pelvis, it is obvious that in face presentations the chin will, as regards mechanism, naturally occupy the rôle which the occiput plays in the delivery of vertex presentations; it therefore follows that in facial presentations the natural way of delivery is for the chin to emerge under the pubic arch, and the forehead to pass along the perineum.

Face presentations, like those of the vertex, may occur in four positions, numbered so that each represents the correspondingly numbered vertex presentation, changed to a face presentation by extension of the head:—

First, Right mento-posterior, or R.M.P.
Second, Left mento-posterior, or L.M.P.
Third, Left mento-anterior, or L.M.A.
Fourth, Right mento-anterior, or R.M.A.

First Facial Position.—When the face is in this position the nose is in the right oblique diameter,

the forehead looking towards the left acetabulum. Tracing the nose in the opposite direction, that is, backwards and upwards, when the woman is on her left side, the mouth and chin are felt towards the right sacro-iliac synchondrosis. The nose, like the sagittal suture in the first cranial presentation, divides the os uteri unequally, the right side of the face taking the anterior and larger portion.

The presenting part is the upper portion of the right malar bone, and on it, implicating the eye, will

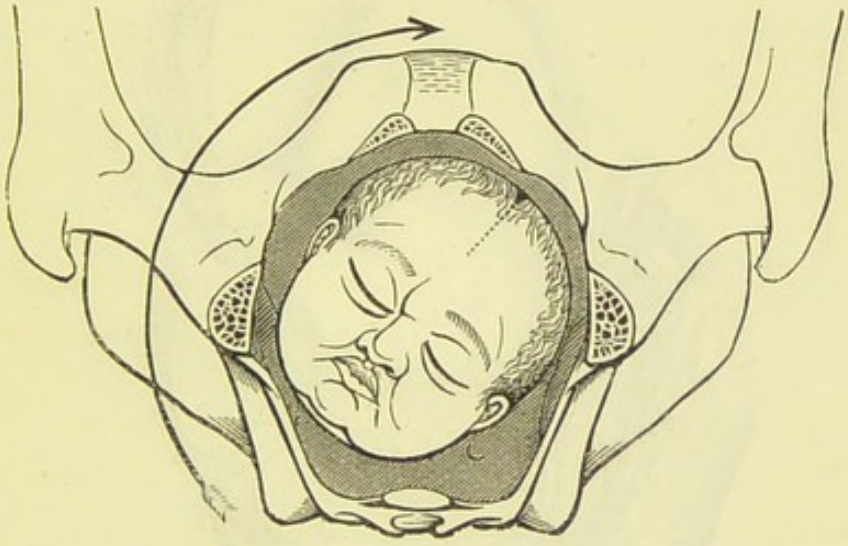


Fig. 106.—Right Mento-Posterior, or *First* Position of the Face within the Pelvis. (Farabeuf and Varnier.)

The arrow indicates the $\frac{3}{8}$ of a circle through which the chin should travel forwards.

be found the primary caput succedaneum. When the face engages in the pelvis, *extension* of the head becomes more marked, corresponding to the flexion in vertex presentations, and as labour goes on the secondary caput succedaneum is formed lower down the cheek near the angle of the mouth. Following the extension comes *internal rotation*, in which movement the chin, taking the part of the occiput in occipito-posterior positions, may rotate either forwards or backwards. The former is the general rule when

extension is complete, and is the more favourable, for persistent mento-posterior, like unreduced occipito-posterior cases, lead to extreme difficulty and generally necessitate operative interference. If, however, the chin has rotated well forwards, it becomes fixed under the pubic arch, whilst the head is born by the movement of *flexion*, the forehead,

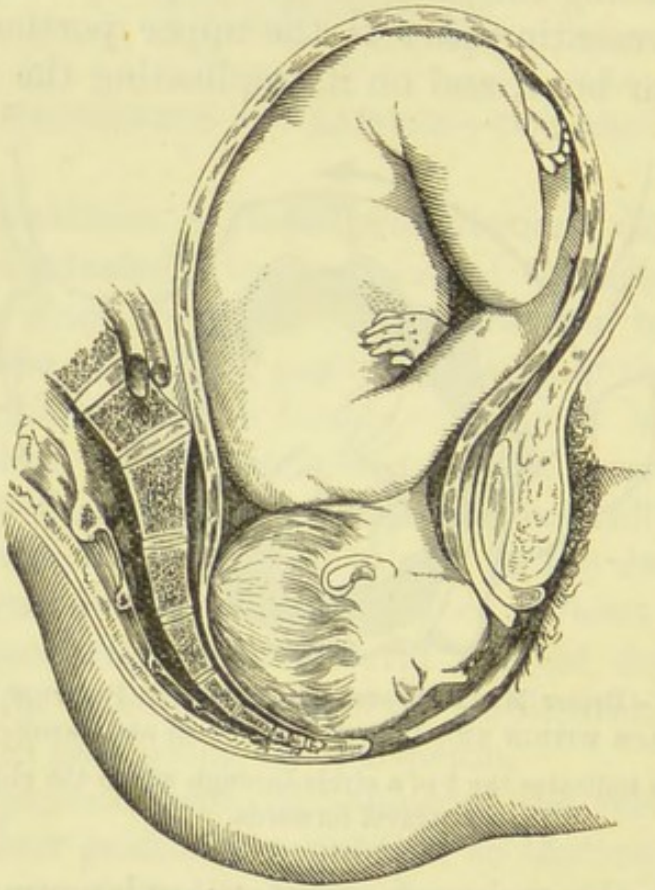


Fig. 107.—Emergence of the Head from the Pelvis in Face Presentation.

vertex, and occiput gliding successively over the perineum. It may be observed that the chin, like the occiput in vertex presentations, does not emerge exactly in the antero-posterior line, but slightly to one side. After delivery, the head undergoes the usual *external rotation* or *restitution*, the face turning up, *i.e.* to the mother's right side, accounted for by

the rotation of the shoulders in their passage through the pelvis. The body of the child is delivered, as in the first vertex presentation, with the right shoulder forwards.

Second Facial Presentation.—The forehead here presents towards the right acetabulum, and the chin towards the left sacro-iliac synchondrosis, the long diameter of the face being in the left oblique diameter of the pelvis. The mechanism of delivery is in every way comparable to that described above, where

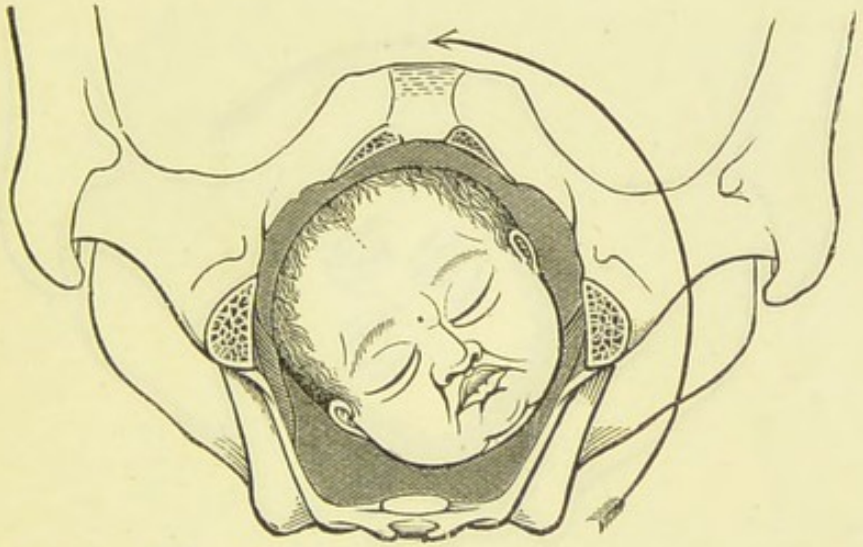


Fig. 108.—Left Mento-Posterior, or *Second* Position of the Face within the Pelvis. (Farabeuf and Varnier.)

The arrow indicates the $\frac{3}{8}$ of a circle through which the chin should travel forwards.

the face is in the corresponding position in the right oblique diameter.

Third Facial Presentation.—The nose will be found to be in the right oblique diameter, with the forehead towards the right sacro-iliac synchondrosis, and the left malar bone is the presenting part. The mechanism here, remembering that the chin corresponds with the occiput in vertex presentations, is comparable to that of occipito-anterior cases; the chin being forwards and to the left glides along the anterior part of the

left ischium until it has rotated under the pubic arch, and the head is born by flexion, as described before.

The *fourth facial presentation*, right mento-anterior, compares with the third as does the second with the first. The mechanism of delivery is precisely similar to that of the third.

According to Churchill, face presentations occur once in every 223½ cases. As regards relative frequency of the four positions, the figures given

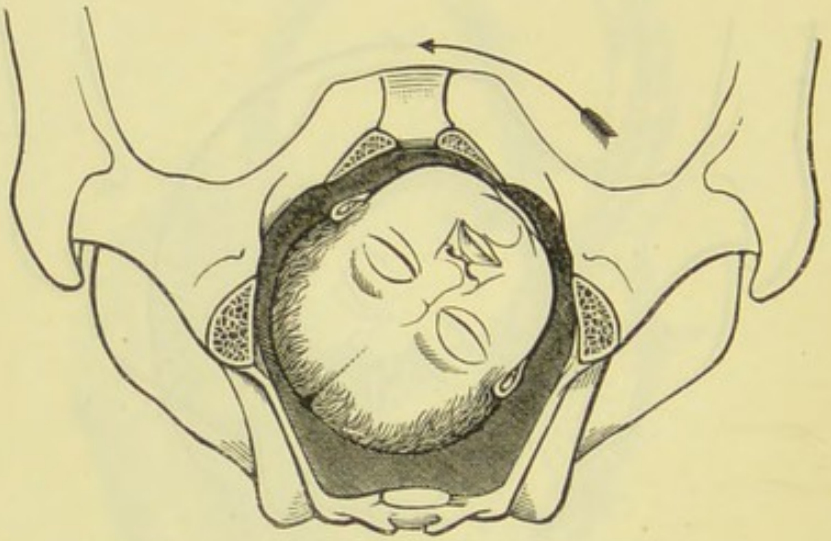


Fig. 109.—Left Mento-Anterior, or *Third* Position of the Face within the Pelvis. (Farabeuf and Varnier.)

The arrow indicates the ⅛ of a circle through which the chin should travel forwards.

for the various vertex presentations do not quite apply, because the fundus uteri being generally inclined to the right, vertex presentations with the occiput to the right are more likely to be transformed into face cases than left occipital cases. Naegelé gives the proportion of cases in which the chin is to the right compared with those in which it is directed to the left as 22 to 17. Most right chin cases will, of course, be R.M.P., or first positions, and most left chin cases L.M.A., or third

positions, as the face, like the vertex, generally presents in the right oblique diameter. Naegelé disregarded positions of the presenting part not in the right oblique diameter, but most observers would agree that some of his 22 were right mento-anterior, that is, in the fourth position, and some of his 17 were left mento-posterior, or second position.

Ordinarily face presentations do not call for much in the way of active treatment, but if aid seems to be needed extension may be promoted by digital

Fig. 110.—Right Mento-Anterior, or *Fourth* Position of the Face within the Pelvis. (Farabeuf and Varnier.)

The arrow indicates the $\frac{1}{8}$ of a circle through which the chin should travel forwards.

pressure on the forehead or by hooking down the chin with the finger. Should the chin be behind, rotation may be assisted by drawing it downwards and forwards, so as to bring it under the pubic arch. Mento-posterior cases are dangerous, because of the stretching and pressure on the blood-vessels of the extended neck. It is advisable to relieve this as soon as possible, and forceps are to be used early if rectification does not occur naturally or by means of the method indicated above.

Brow presentation is intermediate between vertex and face, and the mechanism of delivery presents difficulties greater than either, as the pelvis has to be traversed by the occipito-mental diameter of the fœtal skull. One frontal eminence is the presenting part, and in one direction the finger can reach the anterior fontanelle, in the other the eyes and nose. The treatment consists in a manual attempt to transform the presentation into one of the vertex or

Fig. 111.—Head after Brow-Face Presentation. (Lusk.)

face, the latter being generally the more practicable. Should these manœuvres fail, the early application of the forceps will generally be required.

Pelvic Presentations.—Pelvic presentations are now usually included amongst the natural presentations. A contrary opinion was long held, and the earlier obstetricians used to attempt to rectify presentations of this class. Now, however, it is acknowledged that although fœtal life is placed in greater jeopardy,

pelvic presentations are not more riskful to the mother than cranial presentations.

The factors leading to presentation of the breech are to be sought in either maternal or fœtal conditions which in any way hinder the usual presentation and engagement of the head. Amongst the maternal causes are deformed pelves, malpositions of the uterus, and deficiencies in muscular power. On the part of

Fig. 112.—Adaptation of Fœtus and Uterus in Breech Presentation.

the uterine contents we must mention such predisposing conditions as placenta prævia, hydramnios, too small or too large a fœtus, fœtal deformity or hydrocephalus, and multiple pregnancies.

The head of the fœtus in utero is obviously the most bulky and unyielding part; when, therefore, in cranial or face presentations, the head is born, the most difficult part of the task is accomplished, for

now the pelvic passage of the mother is so dilated that the rest of the fœtal body slides out with comparative ease. In pelvic presentations, on the contrary, the last is the most difficult stage of delivery, for although in breech presentations, with the legs flexed on the trunk, the bulk is considerable, yet these soft and compressible parts fail to dilate the canal so effectually as the passage of the comparatively hard head, so that when the cranium arrives at the pelvis it has further to dilate the parts. Another difficulty, too, in the final stage of pelvic presentation arises from the uterus having only the head to contract on, which places it at a great mechanical disadvantage, as it can exert but feeble expulsive force. If at this stage the head does not speedily follow, the cord is compressed, and the child is suffocated. These are some of the reasons why the life of the fœtus is so much more frequently sacrificed in pelvic than in cranial presentations.

The mechanism of pelvic presentations bears a considerable resemblance to that of cranial presentations, modified by the difference existing between the presenting parts.

Pelvic presentations may be divided into four classes, two with the fœtal abdomen towards the maternal spine, and two with the fœtal abdomen towards the front.

The four positions are numbered as follows :—

1st, Left sacro-anterior. L.S.A.
2nd, Right sacro-anterior. R.S.A.
3rd, Right sacro-posterior. R.S.P.
4th, Left sacro-posterior. L.S.P.

In the *first pelvic presentation* (L.S.A.) the breech is in the left oblique diameter, with the left trochanter forwards, and directed towards the right acetabulum.

When the os uteri is fairly dilated, the sulcus between the nates is found to be in the right oblique diameter, with the genital organs towards the right sacro-iliac synchondrosis, and the anus and sacrum to the front. It is a matter of the greatest importance to be able to detect pelvic presentations with certainty, and although to the eye there is considerable difference

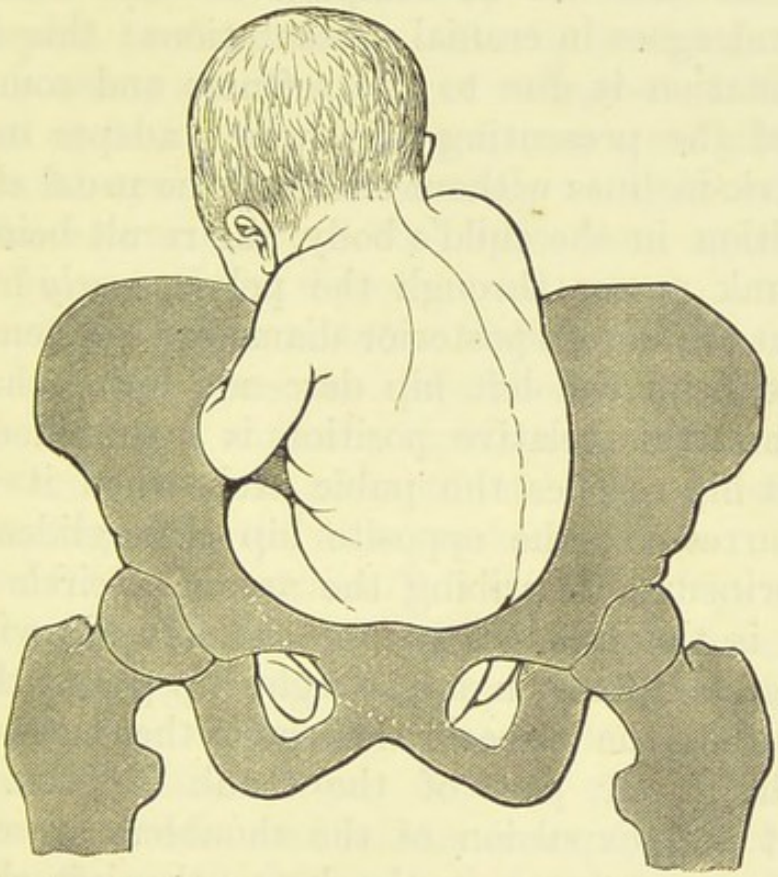


Fig. 113.—Left Sacro-Anterior Position. *First* Position of the Breech. (Farabeuf and Varnier.)

between one of the nates and shoulder, still when only the tips of one or two fingers can be brought to bear on the exploration, the discrimination of the parts is not a little difficult: for example, in a hasty and imperfect examination, the female genital organs may be easily confounded with the margin of the axilla; again, in another case, the breech may be mistaken for a swollen face,

but if, however, the examination is conducted with adequate care, and the various parts are thoroughly explored, all difficulties may be overcome. The anus and the asperities on the back of the sacrum are specially trustworthy in the diagnosis of breech presentations. The breech in passing through the pelvis performs a rotation somewhat similar to but not so complete as that which the head undergoes in cranial presentations: this incomplete rotation is due to the softness and compressibility of the presenting part, which adapts itself to the pelvic inclines without effecting the usual changes in position in the child's body, the result being that the trunk passes through the pelvis *nearly* but not quite in the antero-posterior diameter. When entering the brim the left hip descends lower than the right, and this relative position is maintained until the left hip reaches the pubic arch, when it is partially arrested; the opposite hip then glides along the perineum, describing the arc of a circle whose centre is the *point-d'appui* of the left hip with the pubic arch. As soon as the right hip passes through the outlet the breech descends, the legs escape, and the lower part of the trunk is born. The descent and expulsion of the shoulders are effected in the same way as in the hips—the left shoulder rotates forwards and descends under the pubic arch and there forms the centre on which the right shoulder revolves along the perineum until both emerge, leaving the head only in the pelvis. Whilst all this has been taking place, the head has become flexed on the sternum, a position it is important not to disturb by making undue traction on the trunk, lest the neck may become extended and the arms slip up alongside the head, and thus prove a serious bar to delivery. As the shoulders emerge, the head

enters the right oblique diameter of the pelvis with the occiput towards the left acetabulum; the face then rotates into the hollow of the sacrum, the occiput presses on the pubic arch, and the chin, nose, and forehead sweep along the perineum until the head is born. Now it is evident how important it is that the chin should keep well to the sternum; indeed, sometimes it becomes necessary to assist nature in this respect, to depress the chin by pushing on the malar bones with the first two fingers of the left hand on each side of the nose (or, as some prefer, in the mouth), and at the same time to make pressure with the two fingers of the right hand against the occiput in an upward direction.

Second Pelvic Presentation (R.S.A.)—This corresponds to the last, the hips being in the right oblique diameter, with the right trochanter forwards and towards the left acetabulum. The movements are the same as in the first presentation.

Third Pelvic Presentation (R.S.P.)—The hips occupy the left oblique diameter, with the right trochanter towards the right acetabulum; the right hip presents; the head enters the brim in the right oblique diameter, with the occiput towards the right sacro-iliac synchondrosis, and rotates from right to left till the occiput reaches the pubic arch, when expulsion is effected as in the first pelvic presentation.

Fourth Pelvic Presentation (L.S.P.)—The hips occupy the right oblique diameter, with the left trochanter forwards and towards the left acetabulum; the left hip is the presenting part. The head enters the pelvis in the left oblique diameter, with the occiput towards the left sacro-iliac synchondrosis; rotation occurs from left to right, until the face passes into the hollow of the sacrum. Expulsion is effected as in the first pelvic presentation.

Pelvic presentations, which are considered as embracing those of the breech, feet, or knees, occur in rather more than 2 per cent of all deliveries at full time, the proportion being increased in the case of premature births. The breech itself presents in more than two-thirds of these pelvic cases, the foot or feet in nearly one-third, while knee (or knees) presentations are but rarely met with.

With regard to the relative frequency of the various positions of the breech, the first and second are most common, the third and fourth being comparatively of rare occurrence.

Foot and Knee Presentations.—So far as mechanism is concerned, these cases do not differ from breech presentations. It is therefore unnecessary to go again over the same ground.

Diagnosis.—In footling cases the membranes usually descend through the os uteri in an elongated form like the finger of a glove, the foot sometimes being recognisable through them. When the membranes are ruptured the presenting limb should be carefully examined to determine *whether it is a foot or a hand.* Notice that the foot is long, narrow, and yet thick compared with the hand; that the toes form only a small part of the foot, and their ends form an even line, whilst the fingers are long and their extremities are not on a level; that the great toe is in close proximity to the rest, whilst the thumb is separate and more mobile; but the special diagnostic test is the fact that the foot is set at an angle with the leg, and there is the posterior projection of the heel. The diagnosis may have to be made *between the knee and elbow*, but the bony points about the knee—the patellar tubercle of the tibia and the femoral condyles—are not difficult to distinguish from the more pointed olecranum and condyles of the humerus;

and any uncertainty would be dispelled if the examining fingers were passed along the limb to the foot or hand.

In pelvic and footling cases, when the trunk emerges, the cord must be gently pulled down as the fœtus descends, so as to avoid undue tension, and then guided into the hollow of one of the sacro-iliac synchondroses, in order to protect it from pressure. The pulsation of the cord must be observed with the finger, and if any flagging of the circulation is detected, aid must be given at once, or the life of the child will be sacrificed. The plan already described for extracting the head may be tried; for other methods see the chapter on Version.

Transverse Presentations.—The fœtus is here presented broadside to the os uteri instead of endwise as in the presentations previously considered. In this position, under ordinary circumstances, it is impossible for delivery to take place without the assistance of art. These presentations are therefore classified as unnatural; shoulder, elbow, and hand presentations are included under the generic title of cross births. They are divided into four varieties—two with the child's back towards the abdomen of the mother, and two with the child's back towards the spine of the mother. In either of these cases the child's head may lie to the right or to the left; hence the four positions. There is no necessity to speak of the mechanism of this form of presentation, as delivery is usually effected by artificially converting it into a footling case. The early diagnosis of transverse presentations is very important, and palpation of the abdomen is of especial value, for the presenting part is generally out of finger-reach until labour is somewhat advanced. The shoulder is usually the first

part to appear at the os, the arm coming down later. It may be distinguished from the breech by being less fleshy, and by having but one projecting part, whereas the breech has two, with the genital organs between. If, however, there is any doubt, the best authorities deem it advisable to gently disengage the limb, when the foot or hand will at once decide the question. If the arm is down, it should be ascertained whether the head or

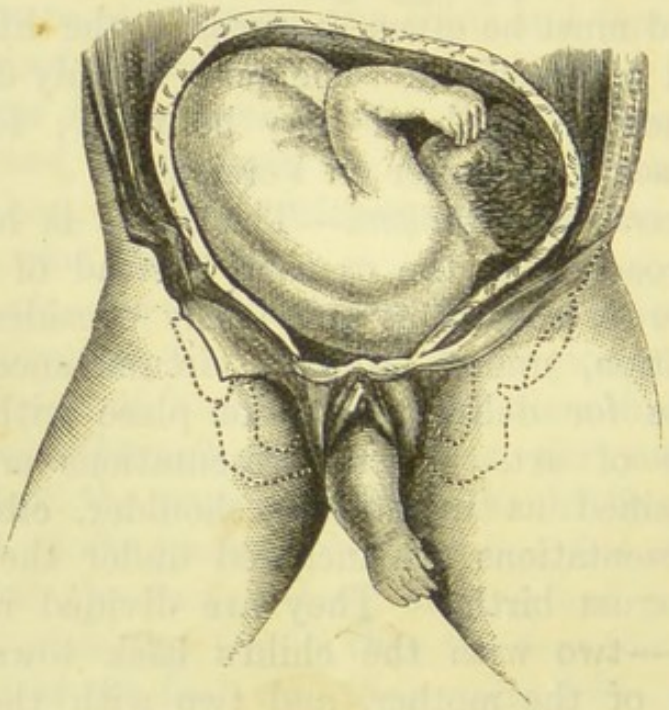


Fig. 114.—Arm Presentation.

shoulder accompanies it; if the head, it is better not to interfere until it enters the brim, lest bad be made worse by the conversion of a head and arm into a shoulder presentation, pure and simple. After the head has entered the brim, the arm may be pressed up alongside it during the interval between two pains, and kept up during a pain or two, when it will probably be carried up over the brim, allowing the head to present alone. If the shoulder accompanies the arm, the operation of turning should at

once be resorted to; for if the fœtus and maternal pelvis are both of normal size, unaided delivery is impossible. The shoulder becomes jammed tighter and tighter against the soft parts of the mother, the child dies through the undue pressure, and the mother perishes either from exhaustion consequent on extensive sloughing, or from rupture of the uterus, brought about by violent but futile attempts to expel its contents.

Fig. 115.—Commencement of Spontaneous Evolution.

Spontaneous Evolution and Expulsion.—Under certain circumstances, however, cases of arm presentation have been delivered by the unaided natural efforts. This may be effected in three ways. First, by the shoulder receding and the head becoming engaged, or what is known as *spontaneous rectification;* second, by the uterus relaxing so far as to allow the head and shoulder to ascend, while the breech becomes the presenting part, constituting what is termed *spon-*

taneous version, a phenomenon of extremely rare occurrence; and third, by the arm remaining down and the neck and shoulders impinging on the pubic arch, forming the centre of motion for the trunk to revolve on. Expulsion takes place by the trunk becoming gradually doubled on itself, and moving down the hollow of the sacrum to the perineum, delivery being accomplished as in pelvic presenta-

Fig. 116.—Further Progress of Spontaneous Evolution.

tions. This form is of relatively more frequent occurrence than the last, and is called *spontaneous evolution*. It was held to be the true explanation of what has been described as spontaneous version, but it is now admitted that delivery may take place in both ways. It is, however, necessary, for spontaneous evolution to occur, that either the fœtus be considerably under, or the maternal pelvis over, the normal size. It is most often seen in premature deliveries.

Transverse presentations occur about once in every

250 labours. The dorso-anterior positions, as might be expected, are the commoner, and more frequently the head is to the left.

The causes of these presentations are to be sought among the conditions which lead to disproportion or want of adaptability between the pelvis and the uterine contents; such, for instance, as irregular

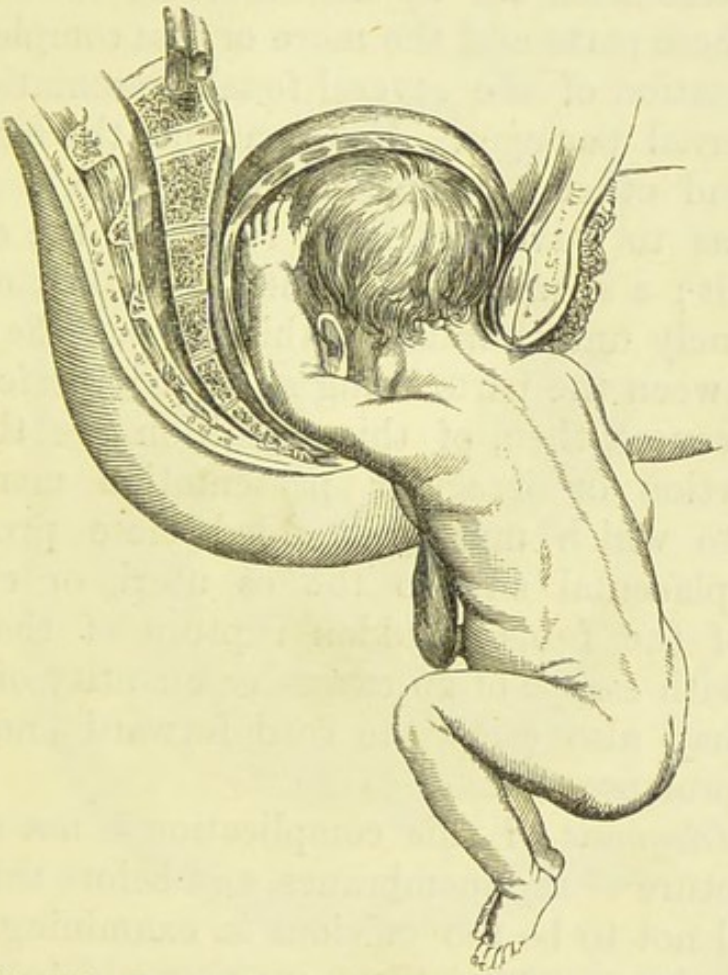


Fig. 117.—Termination of Spontaneous Evolution.

contraction or displacement of the uterus, deformity of the passages, deformity or death of the fœtus, placenta prævia, hydramnios, premature birth or multiple pregnancy.

Funis Presentation is a term used to indicate the presence of a loop of the funis along with or below the presenting part of the fœtus in the first stage of

labour. After the membranes have ruptured, the cord is said to be *prolapsed*, and this is a complication of the gravest kind with regard to the life of the child. It may accompany any of the numerous forms of fœtal presentation, occurring less frequently with cranial, oftener with breech, and most of all with transverse presentations. This disproportion may be accounted for by the difference in the contour of these parts and the more or less completeness and adaptation of the several fœtal presentations to the maternal passages. For example, the head fits the os and other portions of the passage in such a manner as to leave but little room for the cord to get past it; a shoulder presentation, on the contrary, is extremely unfavourable in this respect, the adaptation between the parts being so very imperfect.

The causes, then, of this condition are those of disproportion or irregular presentation mentioned before, to which must be added close proximity of the placental site to the os uteri, or extreme length of the funis; sudden rupture of the membranes, with escape of an excessive quantity of liquor amnii, may also carry the cord forward and cause sudden prolapse.

The *Diagnosis* of this complication is not difficult after rupture of the membranes, and before this event it is well not to be too officious in examining, as, by prematurely rupturing them, we may add to the mischief; for so long as the membranes are intact we may safely conclude that the cord is in a position much more favourable than we could possibly give it by manipulation. Moreover, by allowing the membranes to fulfil to the uttermost their office of dilating the passage, we secure the principal conditions of a speedy delivery, so greatly to be desired in funis presentations. When the cord hangs down in the

vagina it may easily be recognised by taking it between the fingers, when, if pressure has not done its fatal work, the fœtal pulse will be felt. Even if pulsation has ceased, it is not difficult to identify the cord by touch alone. It is on record, however, that a coil of the small intestine, passing through a rupture in the uterus, has been mistaken for the

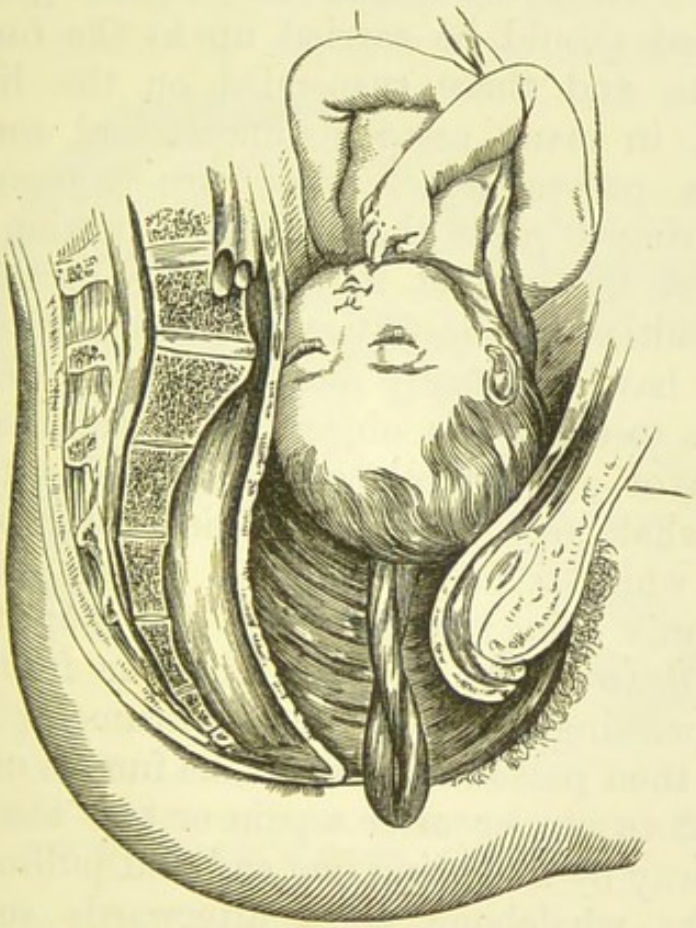


Fig. 118.—Presentation of the Funis with the Head in the First Position.

umbilical cord; but this blunder could scarcely occur without gross negligence or ignorance, or a perilous union of both. In prolapse of the funis the dangerous effect on the fœtus is the main thing to be taken into consideration, for the progress of delivery is in no way interfered with, nor does the mother encounter any additional peril in direct con-

sequence of the cord being down. The cause of danger to the child is pressure on the cord, and consequent stoppage of the fœtal circulation. To obviate this is no easy matter; for although the funis may possibly be readily replaced, yet it often still more readily comes down again. Various have been the plans for rectifying this aberration. Sir Richard Croft advised that the offending portion of the cord should be carried up to the fundus of the uterus, and there suspended on the limbs of the child, in many cases a difficult and somewhat dangerous proceeding. Some are content with endeavouring to place the prolapsed portion of the cord above the occiput in the hollow of the neck. The difficulties in the way of successfully replacing the cord have led many obstetricians to devise instruments to effect this object. The simplest form, and type of all the others, consists of a thin flat slip of whalebone with an opening near one end, through which a loop of tape is passed; the prolapsed funis being placed within the loop, the tape ends are drawn down so as to bring the funis (without compressing it) close to the instrument, and the whole is then passed up towards the fundus uteri, and either left *in situ*, or after a pain or two the tape is drawn away by liberating one end and pulling at the other, the whalebone being afterwards separately withdrawn. My late friend John Roberton used a large soft and flexible vulcanised rubber catheter with a stilet. A loop of worsted is passed round the cord and through the eye of the instrument, which is introduced with the stilet *in situ*; the stilet is then withdrawn, and the catheter allowed to remain until it is expelled with the placenta. Dr. Barnes suggests that, whilst the cord is being replaced, the patient should assume the *knee-elbow* position.

When, in spite of all efforts, we are unable to return the cord, it should be placed so as to undergo as little pressure as possible; in cranial presentations towards the sacro-iliac synchondrosis unoccupied by the head; in other presentations where the fœtus presses least on the pelvis. This condition must be carefully and constantly observed. If pulsation is seriously interfered with, it becomes a question whether delivery should be expedited by artificial means,

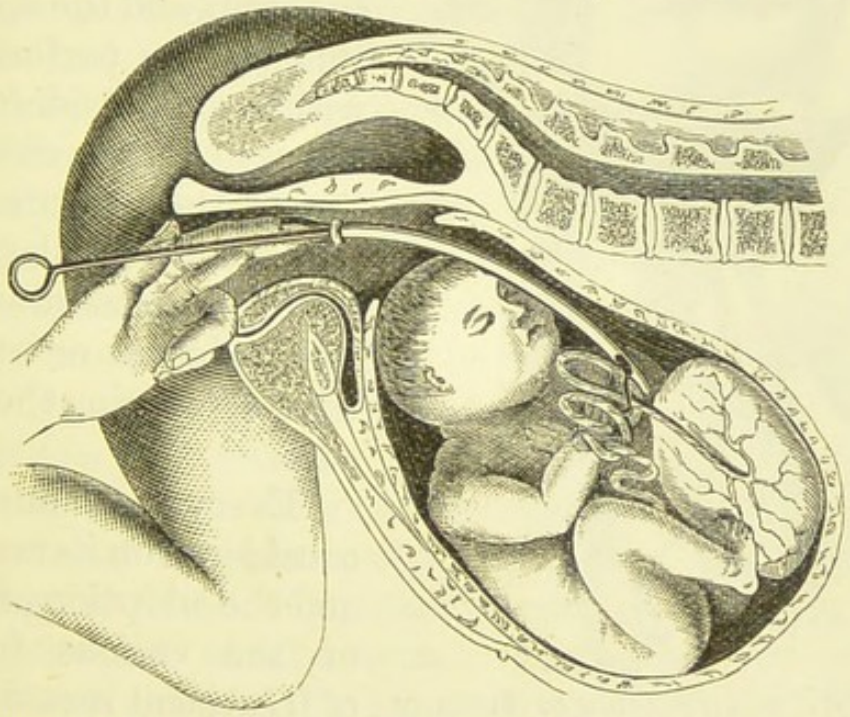


Fig. 119.—Mode of replacing the Funis by Roberton's Instrument in Knee-Elbow Position. (After Barnes.)

version, or the forceps, bearing in mind that in endeavouring to preserve the child's life that of the mother ought not to be endangered. If the child is evidently dead, no steps need be taken unless other circumstances than prolapse of the funis call for interference. We must not conclude, however, that the child is dead because pulsation in the cord has for a time apparently stopped, since life may persist for some time notwithstanding very untoward appearances so far as placental circu-

lation is concerned. If, however, the cord continues flaccid and pulseless, we may safely conclude that the child is dead.

The question of turning is a disputed point, the majority of authorities holding that this operation is rarely called for in funis presentations pure and simple; but if the child is evidently about to succumb, and the operation can be performed without considerably increasing the risk to the mother, turning is allowable. Similar reasons must determine the advisableness or otherwise of applying the forceps.

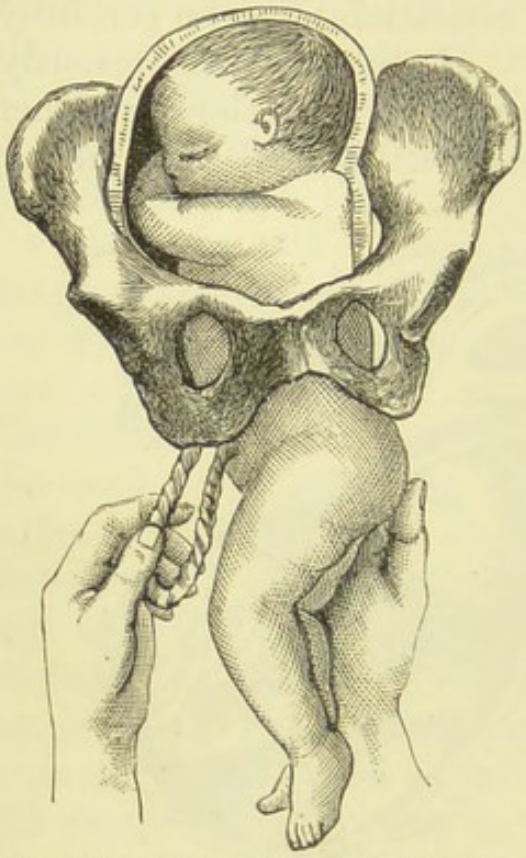


Fig. 120.—Manipulation of Funis in Pelvic Presentation.

Every case must be considered on its merits, and the adoption of any of the various forms of treatment mentioned will be determined in a great measure by the extent to which the os uteri is dilated:—with a small os uteri try reposition of the cord by hand, instrument, or some form of cervical plug, *e.g.* a Barnes' bag; on the other hand, if the os be well dilated, and the cervix soft, replace the cord and expedite the delivery by the method most suited to the presentation.

Besides the presentations mentioned above, various *compound presentations* are occasionally seen. They consist of combinations of those already discussed, and their causes are comprised in the list given with

regard to funis presentations. We have considered compound presentations, including prolapse of the funis, and must briefly enumerate certain others, with their appropriate treatment.

Head with Arm or Hand.—Occasionally the hand or arm is felt alongside or below the presenting part of the head. If the pelvis be large and the head small, delivery may take place without assistance, but it is best to replace the offending limb and to complete the child-birth by forceps or by version. It must be remembered that the limb should be pushed up by the side of the head in the direction of the child's belly, otherwise the arm may become fixed behind the neck and form a still greater obstruction to delivery by forceps. This position of the arm behind the neck may occur spontaneously, constituting Sir James Simpson's dorsal displacement of the arm. The treatment advised by him was to bring down the arm completely, and deal with the case as above. Probably the better proceeding would be version in the first instance, without troubling about the arm.

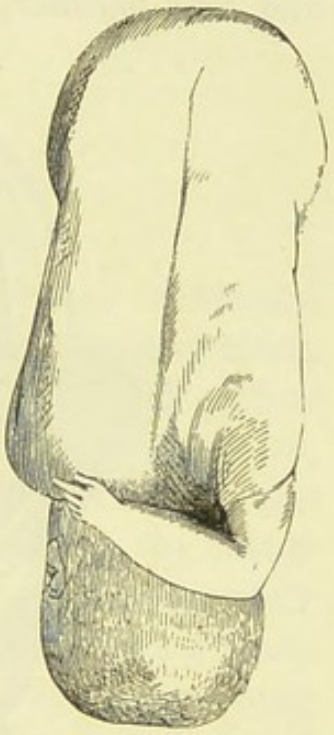


Fig. 121.—Dorsal Displacement of the Arm. (After Simpson.)

Head with Foot or Feet.—This presentation is more rarely seen. It is advisable to replace the limb or limbs, and if the head does not engage, to assist by forceps. Dr. Galabin points out that if the alternative treatment of bringing down the leg be adopted, it is well to make very sure by abdominal examination that we have not a case of twins to deal with, in which case the leg or legs might

belong to the second child, when the proceeding would be attended by the risk of producing the greater difficulty of locked twins.

The Head with a Hand and a Foot forms another compound presentation rarely seen; Leishman describes a case in which he found the *head, hand, foot, and cord together*, completely blocking up the pelvis.

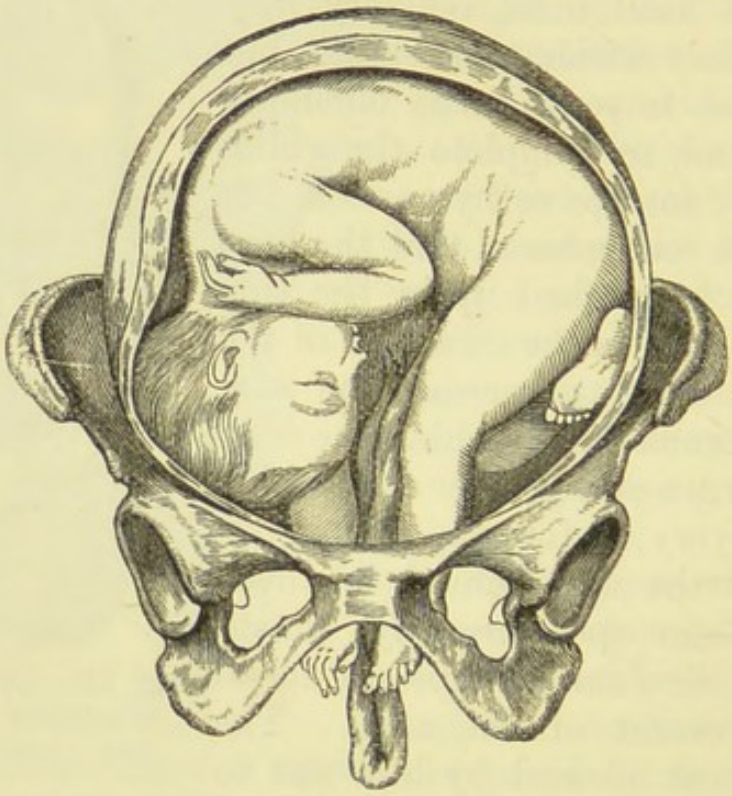


Fig. 122.—Presentation of the Funis Hand and Foot.

The appropriate treatment in such cases is version under the influence of an anæsthetic.

Lastly, in transverse positions of the child there may present *hands and feet together*, with or without the cord. If possible, the presentation should be transformed into a breech presentation, or the arms should be pushed aside and one leg brought down.

Presentation of the placenta must be mentioned here, but its consideration will be deferred to a later chapter.

CHAPTER X

DISEASES OF PREGNANCY

WOMEN are liable to a variety of diseases incidental to the gravid state, some affecting the whole system, others attacking only the generative organs. Thus the diseases of pregnancy may be divided into—1st, general; and 2nd, localised affections. One of the most common of the general complaints in the latter months of pregnancy is evidenced by anasarca, few women escaping without experiencing at least a trace of it in the shape of swollen feet. The symptoms may range from simple puffiness of the ankles to œdema of the whole body, with the legs enormously increased in bulk, and the labia distended to the size of a child's head, causing, in this exaggerated form, much pain and distress. This condition, formerly attributed solely to pressure of the enlarged uterus on the pelvic vessels, is now known to be connected with anæmia or hydræmia, and usually, in the severe forms, with the presence of a certain amount of albumen in the urine, indicating congestion of the kidneys, or actual nephritis. The presence of albumen may be due to pressure delaying the return of the blood from the kidneys, it having been proved experimentally on animals that ligature of the renal veins will induce albuminuria. Albumen in the urine of pregnant

women is a matter of much importance, since its presence indicates great liability to convulsions during parturition; it is therefore well to examine the urine in all suspected cases, especially when headache or other possibly uræmic symptoms exist (see below). In anasarca resulting from pressure on the veins which return the blood from the lower extremities, the œdema is confined principally to the legs, and in anæmia it is also most commonly met with about the ankles; but when the whole body is swollen, it is probable that the kidneys are affected. It is obvious that the anasarca cannot be cured until the exciting cause is removed, but much relief may be obtained by warm or vapour baths, dry-cupping the loins, diuretics, as acetate of potash, decoction of broom, or a combination of digitalis and acetate of iron. If the legs chiefly suffer, it is well to maintain, as far as practicable, the recumbent or right-angled position; the use of elastic stockings or of bandages to the legs is often of much value. A fairly frequent form of localised anasarca is œdema of the vulva, due to obstruction of the pelvic veins by the enlarged uterus. The labia minora become much swollen, and are translucent. Postural treatment, which is all that can be recommended, is of less value in this class of cases. Puncture has been employed, but it has often resulted in abortion or premature labour.

Diabetes may occur during pregnancy, may come on after labour, or conception may take place during an attack of diabetes. Pregnancy may go on favourably to the full term in a diabetic patient, but as a rule both mother and child incur a much increased risk. Pruritis of the vulva due to eczema must be remembered as a frequent symptom of diabetes. Abortion, miscarriage, or premature labour often occurs. Matthews Duncan found that in 22 confinements of 15

women at term or premature, 4 of the patients died after delivery. Hydramnios was frequent. Of 19 children born of 14 mothers, 7 were still-born, though viable, and 2 died soon after birth. During lactation a certain amount of sugar may be present in the urine, and is then regarded as a physiological condition.

Headache of a severe and intractable type, somnolence, dizziness, singing in the ears, or some abnormality of the organs of vision, are frequently symptomatic of uræmia consequent on renal mischief; various forms of paralysis are also liable to be produced by uræmic poisoning. In such cases the treatment should be directed to the kidneys. Symptoms in many respects analogous to the above may result from simple hyperæmia, unattended with renal mischief, a condition demanding the use of saline aperients and a free vegetable diet, especially fruits, with a proportional diminution of animal food.

The persistent symptomatic *sickness* of early pregnancy may become a very severe and troublesome complication, reducing the patient to a state not far short of starvation. In the worst cases, all food, solid or liquid, is immediately rejected, the epigastrium becomes tender, and the violent retching and vomiting may rupture a blood-vessel in the stomach. Should the condition last some time, the patient becomes extremely wasted, and a kind of "typhoid state" supervenes, with delirium and high temperature, the tongue being dry, cracked, or ulcerated, and the lips and gums covered with sordes. Copeman related in the *British Medical Journal*, May 15, 1875, three cases of obstinate vomiting during pregnancy, which were relieved by artificially dilating the os uteri with the finger. Graily Hewitt suggested that the vomiting of pregnancy was frequently caused by flexion of the uterus, the nerve

filaments being compressed at the seat of flexion, and further suggested that in Copeman's cases vomiting proceeded from this cause, and that the relief afforded was due to removal of the pressure by the process of dilatation employed.

The treatment of continued and excessive vomiting consists in abstinence from solid food, and in endeavouring to allay the irritability of the stomach by means of iced drinks, soda-water, lime-water and milk, or champagne, and the administration of hydrocyanic acid, bismuth, oxalate of cerium, kreasote, pepsine, hyposulphite or sulphite of soda, and especially in cases of acid vomiting the bicarbonate of soda, and the external application of sinapisms or belladonna plasters to the epigastrium, or of ice-bags to the spine. Vaginal pessaries of morphia, cocaine, or atropine are often useful; and in very obstinate cases I have seen much benefit result from the free application of nitrate of silver to the os and cervix. I have also witnessed the singularly beneficial effect of single-drop doses of ipecacuanha wine (the first drop to be taken in the morning before raising the head from the pillow), given four or five times a day as recommended by Dr. Ringer. A foul tongue and loaded bowels call for mild purgatives as Pil. Rhei Co. Peptonised food, being easy of assimilation, is sometimes retained when ordinary food is not. In extreme cases when the stomach rejects everything, nutrient enemas, with or without pepsine, may be tried; but if the patient seems likely to sink, abortion, after consultation with another medical man, should be effected without delay. The foul condition of the tongue and mouth seen in bad cases occasions very great discomfort to the patient, and this may continue even after abortion has been successfully accomplished. Mouth-washes of borax,

chlorate of potass, or hyposulphite of soda should be tried, or recourse had to a gargle made of a teaspoonful of Tr. Benzoin Co. in a cupful of warm water. This latter has acted very satisfactorily in several most obstinate cases.

A pregnant woman is sometimes troubled with dyspepsia, loss or vitiation of the appetite, and heartburn. In the matter of diet, the whims of the patient may, within reasonable limits, be indulged. The dyspeptic symptoms may be treated in the ordinary way.

Ptyalism, caused by an altered state of the nervous supply to the salivary glands, though a somewhat unfrequent trouble during pregnancy, occasionally occurs in a distressing degree. It often commences at the earliest stage of pregnancy, and some women become cognisant of their condition through the occurrence of this symptom. As a rule, there is no constitutional disturbance, no ulceration of the gums or mucous membrane of the mouth, nor any fœtid odour of the breath. The fluid, which is thin and tenacious, may vary from a slight increase of the normal quantity to two or three quarts in the twenty-four hours. Treatment is of little avail; gargles of alum, chlorate of potash, sulphite of soda, or borax sometimes restrain the flow; and quinine, nitro-hydrochloric acid with chlorate of potash will improve the general health. Ptyalism ceases with the birth of the child.

Constipation is a common, almost constant, condition during pregnancy. The enlarged womb pressing on the bowel greatly interferes with its peristaltic action, and induces a condition of alvine atony even in women who, at other times, have regular and healthy evacuations. Dietetic treatment should first be tried, as ripe fruit, oatmeal porridge, and bran

bread, although it is not at all easy to induce a pregnant woman to adhere to a systematic course of diet. Amongst the medicinal remedies may be enumerated the time-honoured castor-oil, which, however, should not be insisted upon, as it is extremely repulsive to many patients. The mineral waters of Carlsbad and Friedrichshall, when taken first thing in the morning, are very efficacious. The liquid extract of *Rhamnus Frangula* is a very agreeable aperient, and the similar preparation of *cascara sagrada* (*Rhamnus Purshianus*) is beneficial, care being taken to administer it in an agreeable form. Sulphate of magnesia given as in the prescription on page 278 will generally be found both useful and acceptable to the patient. Should the rectum, through neglect, become blocked with hardened fæces, enemata are necessary.

Diarrhœa and *dysentery* are troublesome and debilitating incidents during pregnancy. Before giving astringents it is well to ascertain that the bowels are not loaded with hard fæcal matter, a condition by no means unfrequent during diarrhœa, and which requires enemata and castor-oil.

Neuralgia of the face and mammæ may be generally relieved by quinine, butyl chloral hydrate, antipyrin or phenacetin, and by the application of anodyne liniments. In some cases the uterus is the seat of severe neurosis. I have seen cases of this kind which resisted all treatment, and were so distressing as to require the induction of premature labour.

Anæmia.—The blood of healthy pregnant women, especially towards the end of gestation, is deficient in discs and albumen, whilst the fibrin factors are present in increased quantity; should actual anæmia occur, it may be treated pretty much as in the non-gravid state. Some cases develop pernicious anæmia. The disease

sets in towards the mid-period of pregnancy, and is more apt to attack women pregnant late in life. It is marked by extreme debility, feverishness, anorexia, vomiting, dyspnœa, and a runaway heart. A drop of blood examined microscopically is characterised by ill-shapen red corpuscles and granular matter. Treatment seems of little avail, the tendency being to slow and progressive dissolution. It may be necessary to induce premature labour. Transfusion has been fruitlessly tried.

Another troublesome disorder during pregnancy is the cough due to reflex causes. It often lasts during the whole term of utero-gestation, and little can be done beyond relieving the urgent distress. Labour is the only cure.

Pregnancy exercises an injurious effect in certain chronic ailments, such as cardiac and renal disease, and also, contrary to popular supposition, in phthisis. Acute diseases, as the exanthemata and continued fevers, if in a mild form, run the usual course; if severe, they usually lead to abortion. Acute pulmonary complaints, especially pneumonia, are more fatal than in the unimpregnated condition. Acute yellow atrophy of the liver is peculiarly associated with pregnancy, and runs a very fatal course both as to mother and child.

During the later months of pregnancy varicose veins in the legs are very common; the sufferer should maintain the recumbent posture, and make use of elastic stockings or bandages. Hæmorrhoids draw attention to the condition of the bowels; as external applications, hot fomentations and Ung. Gallæ Co. are useful. Sometimes we find a varicose condition of the vaginal and labial veins; if the pressure be very great, the veins may burst subcutaneously and form a thrombus, which may attain

considerable dimensions. In some cases the effused blood is removed by absorption, in others an opening has to be made to evacuate the blood and clot.

In affections of the bladder, as irritability, inducing a constant desire to pass water, and incontinence or retention of urine, the position of the womb should be ascertained; displacement of that organ not unfrequently being the cause of such ailments. In some instances the origin is purely sympathetic, as in the vesical irritation so frequently met with in the earlier months of pregnancy. When the position of the womb is in fault, attempts must be made to rectify the displacement by manipulation and the application of bandages, and by rest in the recumbent position. If the cause is sympathetic, small doses of morphia or belladonna, or the introduction into the vagina of medicated pessaries containing morphia, will afford relief.

Pressure of the gravid uterus on the liver, diaphragm, and sacral nerves induces a variety of painful symptoms, which can be palliated by narcotics, friction, and rest. Jaundice is rare; it is to be remembered that in many cases it is symptomatic of acute yellow atrophy.

Direct pressure of the uterus on the lower spinal nerves not unfrequently produces paresis of one leg, generally the left; as in all the less severe forms of peripheral paralyses, the tendency is to recovery after the pressure is removed. Paralysis of the lower extremities sometimes follows severe and prolonged instrumental labours, from injury to one of the cords of the lumbar or sacral plexus; the duration of the paralysis obviously depends upon the amount of bruising sustained by the nerves.

Copious *leucorrhœa* is of common occurrence in pregnancy, resulting from a hyperæmic condition of

the vaginal mucous membrane and glands; the discharge is usually of a purulent character, and often produces severe excoriation of the vulva and neighbouring parts. Cleanliness is the great preventive of evils resulting from this cause. Vaginal injections, if deemed necessary, should be of a mild nature, and should be cautiously used, a few drops of a solution of permanganate of potash in a pint of water being generally all that is needed. It should be remembered that the use of vaginal injections during utero-gestation is not unattended with the risk of inducing premature labour. If more powerful remedies are necessary, we may advantageously resort to medicated vaginal pessaries containing tannin or alum.

Troublesome and irritating pruritus of the vulva sometimes, as we have seen, occurs in the early months of pregnancy; in such cases the possible existence of sugar in the urine must be borne in mind. In very severe cases the pruritus spreads to various parts of the body, and the irritation now and then becomes so wearing as to cause abortion. Small vesicles are found on the inner surface of the labia, which are due to acridity of the vaginal discharges and want of cleanliness. The leucorrhœa should be dealt with by the vaginal douche (*vide supra*); the external treatment consists in frequent ablution with bran water, and the use of borax lotion with opium, an ointment of equal parts of red oxide of mercury ointment and cod-liver oil, or chlorate of potash with glycerine and hydrocyanic acid. A powder of calomel and oxide of zinc (1 to 4) dusted on to the part affected, bismuth oxide and vaseline in equal parts, calomel and zinc ointments, solutions of cocaine (5 per cent), carbolic acid (1 in 150), and yellow wash are also local applications of the greatest value.

During gestation the central nervous system is,

in many cases, more or less disturbed. Motor and sensory affections of various parts of the organism are not unfrequently met with: as hemiplegia, paraplegia, or more limited paralyses; partial or complete paralysis of the nerves of special sense; formication, local (vulvar) or general; trophic derangements, giving rise to vesicular and other affections of the skin. Many of these disorders are associated with albuminuria, and disappear after delivery; if in such cases the symptoms are severe it may be necessary to induce premature labour. In other instances the condition of the blood in pregnancy conduces to the formation of fibrinous vegetations on the cardiac valves, which may give rise to embolism in some parts of the nervous centres.

Chorea in pregnancy is a rare but very serious complication. It is apt to run a much more severe course than the ordinary chorea of childhood; women who in early years have been sufferers from it, are predisposed to an attack during pregnancy. It may cause considerable mental disturbance, even to insanity, or it may lead to abortion; in one-third of the severe cases death has resulted. Fresh air, nourishing food, iron, arsenic, and other tonics are to be insisted upon; the bromides of sodium, potassium, and ammonium give much relief. If in spite of hypnotics the attack is so severe as to exhaust the patient through loss of sleep, the induction of premature labour is the only resource.

Amaurosis may occur during pregnancy without albuminuria and without ophthalmoscopic evidence of extravasation of blood into the retina. Eastlake has recorded a remarkable case in which amaurosis occurred after parturition in eight successive pregnancies. He saw the case after the eighth labour. In this case there was no albumen in the

urine, and an ophthalmoscopic examination made by Zachariah Laurence revealed only slight contraction of the retinal arteries. Vision invariably returns after labour. Treatment during pregnancy is of no avail. If the symptoms are very grave, it may be necessary to induce premature labour. This must be differentiated from the amaurosis of albuminuria, which will be treated of later.

Displacements of the Uterus.—The various forms of uterine displacement met with in the non-gravid state are liable to assume aggravated proportions in the pregnant organ; in some cases a normally-placed uterus becomes displaced for the first time after the commencement of pregnancy.

Prolapse of the Uterus.—Pregnancy predisposes to *prolapsus* by increasing the weight of the uterus; and when pregnancy occurs in a woman the subject of prolapse, the condition is aggravated during the first few months of utero-gestation, while the womb is yet within the pelvis. Later the effect of pregnancy is usually to ameliorate the symptoms, for the uterus attains a size too large to allow of its remaining in the pelvic cavity. Prolapsus, with its attendant bearing-down sensation and interference with micturition and defæcation, is met with in varying degrees —from slight prolapse of the vaginal walls to complete procidentia of the whole retroverted uterus. The treatment consists in the observance of the recumbent position for a time, in regular attention to bowels and bladder, and in supporting the uterus by pad, pessary, or plug, till it develops further and rises out of the pelvis.

Anteversion of the Uterus is a displacement which frequently takes place during the early stage of pregnancy, causing vesical irritability which soon subsides with rest; in some cases, however, *e.g.* in pelvic

deformity, lumbar lordosis, or in extreme laxity of the abdominal walls (pendulous belly), the malposition persists and requires special means to be taken for its reduction. On vaginal examination, the os uteri will be found high up in the direction of the sacrum, and the fundus, pressing on the bladder, will be felt through the anterior vaginal wall. Reduction should be attempted by pressing with the fingers on the anterior wall of the vagina, and so pushing the fundus upwards; repeated replacement, opiates, and rest in the dorsal position should be resorted to, together with the application of a bandage to assist in keeping the uterus in position.

Anteflexion of the Gravid Uterus may or may not be combined with anteversion; in some instances pregnancy commences in an already anteflexed uterus. The symptoms are much like those mentioned above, but vomiting and pain are somewhat more marked, and in some cases abortion may occur. The treatment consists of rest in the dorsal position, and an abdominal binder or belt. Pessaries are rarely of service.

Retroversion of the Uterus. — This malposition usually occurs previous to the fourth month of pregnancy. In retroversion the os uteri is tilted up towards the umbilicus, the base of the bladder and the urethra being dragged up with it, displacing the meatus urinarius to such an extent as to render the passage of the catheter very difficult. The uterine body causes a considerable projection of the posterior vaginal wall into the vagina, and the finger passed into the vagina takes a forward direction immediately behind the symphysis pubis, instead of towards the sacral concavity, it being difficult or impossible to reach the os. If the bladder is distended the abdominal walls are unusually tense and painful

to the touch; on percussion the bladder may be detected as a fluctuating tumour, occupying the normal position of the gravid uterus at the sixth or seventh month, or even extending as high as the ensiform cartilage. The depression of the fundus uteri may be so marked as to produce a very characteristic bulging of the anus and perineum.

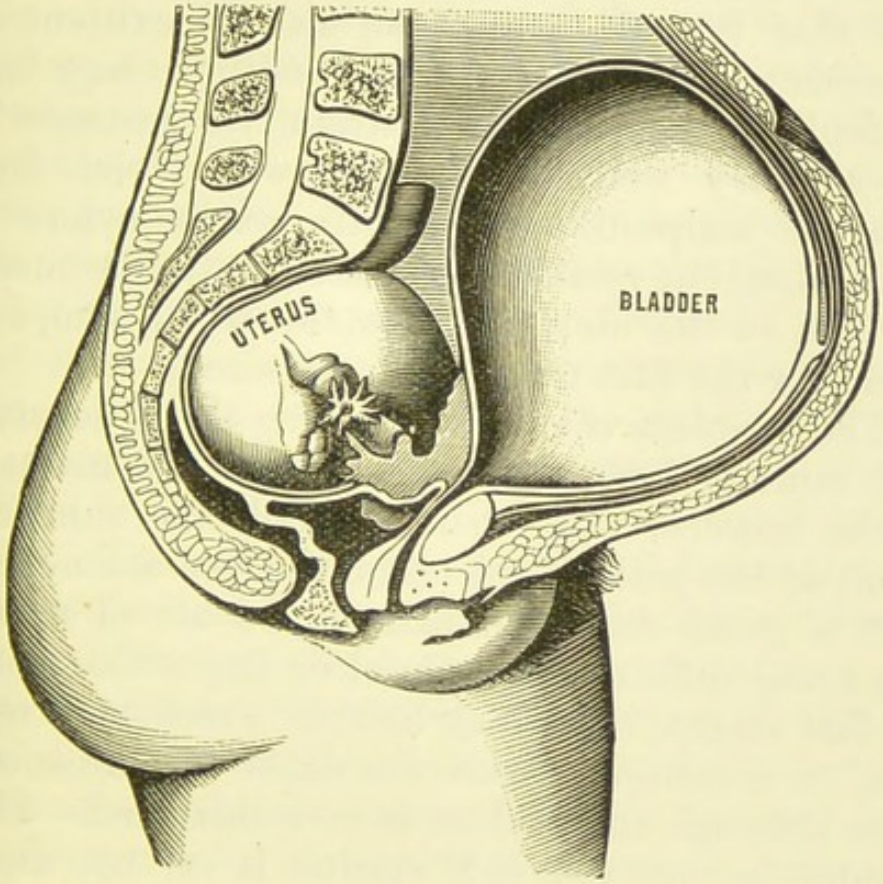


Fig. 123.—Retroflexion of the Gravid Uterus. (Schultze.)

In *retroflexion* the cervix uteri, though forced against the symphysis pubis, retains its downward direction; the urethra is not elongated, and consequently urinary retention is less frequent than in retroversion; the perineal bulging is also less marked. The fundus uteri may be felt by the finger in the vagina, but, as previously stated, the os, being situated high up behind the pubes, is difficult to reach; an examina-

tion per rectum reveals the fundus pressing on the bowel.

The cause of this displacement used to be attributed solely to the distended bladder pushing the uterus backwards; but, as a rule, the retention of urine is the consequence of the enlarged uterus blocking the urinary outflow; the distended bladder, therefore, is the result rather than the cause, except that it may increase an already existent displacement. Sometimes the condition may arise suddenly, as a result of a strain, for instance lifting a heavy weight. I agree with Tyler Smith that the malposition frequently exists before impregnation, but remains unnoticed until the increasing size of the uterus evokes the usual symptoms, when, for the first time, it is recognised.

The *symptoms* comprise a bearing-down sensation, with more or less pelvic pain; obstinate constipation of the bowels; and, what is usually the chief complaint of the patient, retention of urine accompanied with a great desire to pass it, the act of micturition being difficult and painful or impossible; or, in the late stages, there may be the "overflow of retention," a condition which simulates incontinence of urine although the bladder is over-distended. If the bladder be not relieved, cystitis is set up, and in severe long-continued cases it may result in complete sloughing of the whole mucous membrane, with possible death from exhaustion or pyæmia. In other unfavourable cases, although the bladder inflammation is not so extreme, the kidneys may become implicated and uræmic symptoms supervene. The likelihood of abortion must always be borne in mind.

The *treatment* consists in first emptying the bladder with a male elastic catheter, which must

be directed upwards as far as it will go close behind the symphysis pubis; and in evacuating the rectum by the use of enemata. The patient should then be placed on her left side, chloroform being administered, and the fundus replaced by passing the finger, or, if necessary, the hand, into the vagina and applying the requisite force. Should the womb ascend it will take a direction coincident with one or other of the oblique diameters of the pelvis, thereby avoiding the promontory of the sacrum; when the direction has been ascertained, the pressure should be continued in accordance with the line of ascent. If this method fail, the patient may be placed in the genu-pectoral position, and pressure made on the fundus by introducing one or two fingers of the left hand into the rectum, whilst an attempt is made to press the cervix downwards by the right hand over the pubes, or to draw back the cervix to its normal position by the forefinger of the right hand in the vagina. The cervix may be pushed or drawn towards one or other acetabulum, whilst the fundus is directed towards the opposite sacro-iliac synchondrosis. It may be necessary to repeat the manœuvre three or four times before it succeeds. In obstinate cases continuous hydraulic pressure may be resorted to by introducing into the vagina or rectum a large-sized Barnes' bag, and then distending it with water; by this means an equable constant pressure can be brought to bear for many hours, which will sometimes be successful when manual pressure fails. After reduction the recumbent, prone, or semi-prone position should be observed for some days, the bowels and bladder being carefully attended to, and before the patient is allowed to go about the uterus should be kept in position by means of a pessary. In very rare instances it is impossible to effect reduction.

In this emergency the size of the uterus should be reduced by puncturing the membranes through the os uteri if it can be reached; or, if this cannot be done and the case is very urgent, it has been recommended to puncture them through the uterine walls. Abortion, of course, follows either operation. It only remains to be said that if cystitis has been set up, it should be treated on ordinary principles—frequent washing out of the bladder with warm solutions of boracic acid, permanganate of potass, phenosalyl (1 per cent solution), quinine, or by injection of iodoform emulsion, combined with the internal administration of buchu, pareira brava, uva ursi, triticum repens, boracic acid, salol or benzoate of ammonia.

A curious condition called *Pseudo-cyesis* or *Spurious Pregnancy* may be mentioned here, although it cannot be classed amongst the diseases of pregnancy. In well-marked cases of spurious pregnancy, not only have we abdominal enlargement, but several other symptoms of the gravid state, as sickness, capricious appetite, fulness of the breasts, with the usual changes in the areolæ, and sometimes cessation of the menses. As these symptoms all point markedly to the gravid state, considerable discrimination is called for to avoid falling into error. Medical advice is not generally sought until the enlargement has advanced to a considerable extent, or until the time for the expected labour has passed by, when vaginal examination will reveal an undeveloped uterus, and percussion of the abdomen show the swelling to be due to flatus and irregular contraction of the abdominal walls, not to any uterine enlargement. On putting the patient under chloroform, the abdomen will fall to its normal size, thus settling the question beyond dispute.

CHAPTER XI

DISEASES AND DEATH OF THE FŒTUS

We have already seen that, during gestation, some of the diseases of the mother exercise a prejudicial effect on the development of the child, and also that anomalies of the fœtal appendages may interfere with its growth or even cause its death. We now pass on to describe the diseases and injuries to which the fœtus itself is liable, commencing with infectious and contagious disorders.

Of these, *Syphilis* is at once the most common and one of the most important. The ovum may be diseased from the first owing to previous infection of the mother, or it may be directly infected by the male parent through an unhealthy spermatozoon. In the latter case the mother may be secondarily affected from the fœtus in utero, without direct infection from the father. The disease may also be communicated to a healthy embryo if the mother acquires syphilis during pregnancy. Abortion often follows, and in some cases the abortion "habit" is formed. In other cases the child is born suffering from the disease; or premature still-birth results, a macerated fœtus being expelled.

The manifestations of syphilis are numerous, various structures being affected. The *skin* may be

the seat of an eruption, which is characterised by polymorphism, just as in the acquired disease. Pemphigus, condylomata, or old stains may be seen on the living child. The various *organs* may also be affected by gummatous growths, or by diffuse infiltration with round cells; important evidence is afforded by osteitis or osteochondritis affecting the *bones*.

Other signs of the disorder may manifest themselves, or the child may merely appear puny and ill-nourished. In some instances the child is born apparently strong and healthy only to show signs of disease within a few weeks after birth.

The *treatment* to be adopted consists in the administration of mercurials and iodide of potassium to the parent or parents during utero-gestation, and to the child after birth. For adults grey powder is probably one of the best and most convenient preparations of mercury; the bichloride given with cinchona is also a favourite remedy. Iodide of potassium, with aromatic spirits of ammonia, should always be given in a systematic manner, with half-grain doses of grey powder thrice daily.

Into the question of the propriety of marriage during or soon after an attack of syphilis affecting either the man or the woman, we need scarcely enter, but it should be borne in mind that latent syphilis in one or other parent may for very many years lead to the birth of congenitally diseased children.

The zymotic diseases, variola, morbilli, scarlatina, and also erysipelas, occasionally are found to affect the child in utero.

Intra-uterine *Rickets* sometimes occurs. The bones present histologically excessive proliferation of cells with imperfect ossification similar to that observed after birth. The deformity may be extremely marked, the limbs for instance being very short,

thick, and distorted. The causation of the disease is ascribed to some anomaly of the placenta.

It is questionable whether any congenital *tuberculosis* has been found.

Affection of the serous membranes, with watery effusion, hydrocephalus, general œdema (elephantiasis), and organic disease of the organs, certainly occur in utero and may lead to dystocia; other conditions, such as fractures, dislocations, amputations of limbs, from constriction by amniotic bands or from gangrene, are to be mentioned.

External traumatism may of course produce important results to the child as well as to the mother; and serious, even fatal, injuries may happen to the child with little evidence of violence being shown by the mother. On the other hand, extreme accidents have befallen pregnant women without in any way interfering with the course of utero-gestation.

Certain conditions affecting the child-bearing woman beyond those discussed under "Diseases of Pregnancy" have sometimes a prejudicial effect on the fœtus.

Mental emotion, in several recorded cases, appears to have been the only ascertainable cause of deformity or even of death of the fœtus. The occurrence of pneumonia in the child of a woman affected with the same disease has been explained on the supposition that the child, owing to mal-aëration of its blood consequent on the semi-asphyxia of the mother, has made attempts at respiration, by which amniotic fluid has been drawn into the lungs. Again, pyrexia of the mother from any cause may seriously affect the child. A maternal temperature of 104° or higher is to be regarded as grave in its possible consequences to the child—and more especially if such rise be sudden, as in a rigor.

Finally the child suffers and may even die as a result of eclampsia, hæmorrhage, or of grave debilitating conditions affecting the mother, such as cancer or chronic poisoning from lead.

We may now pass on to consider *death of the fœtus in utero.* It is not necessary to particularly mention all the possible *causes*, but the condition may result from—

(1) Injuries or diseases of fœtus itself.
(2) Diseases of membranes or placenta.
(3) Maternal conditions.
(4) Paternal conditions, as debility, nephritis, diabetes, cancer, phthisis, chronic lead-poisoning.

The *signs* of death of the child comprise cessation of the symptoms and signs of pregnancy, subjective and objective, retrogressive changes in the breasts or uterus, and the mother experiences sensations of discomfort and weight, or cold feelings, accompanied by general languor.

Fig. 124.—Shrunken Fœtus after Retention in Utero.

As a rule after fœtal death the uterine contents act as a foreign body, incite uterine action, and expulsion soon occurs, as described under abortion and premature labour. Occasionally, however, *retention* of a dead fœtus occurs, and various changes may happen to it. *Maceration* is the most common: the tissues are swollen, the bones are loose, the skin is

darkish red and readily peels. Putrefaction speedily follows rupture of the membranes and the admission of air. *Saponification*, or conversion of the tissues into adipocere, sometimes occurs. Sometimes *mummification* takes place, especially when one twin dies and is retained and subjected to considerable pressure due to the development of the other. The tissues shrivel up, and occasionally the skeleton is flattened out of shape, forming the *fœtus papyraceus*.

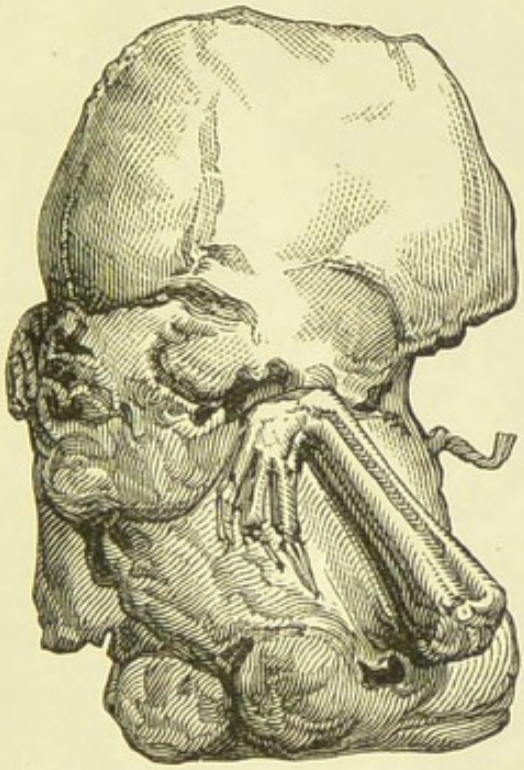


Fig. 125.—LITHOPÆDION. (Playfair.)

In very rare cases *calcification* occurs in the membranes and in the external tissues of the embryo to which the membrane may be adherent. This generally occurs in instances of long retention following death of the fœtus in abdominal pregnancy, when a *lithopœdion* is said to result.

Missed labour is a term applied to an exceedingly rare class of cases where labour fails to take place at the end of gestation, the fœtus remaining in utero

for an indefinite period. After a time disorganisation of the fœtus may take place, portions of it being discharged per vaginam. When this happens it is well to assist the uterus to get rid of its lingering

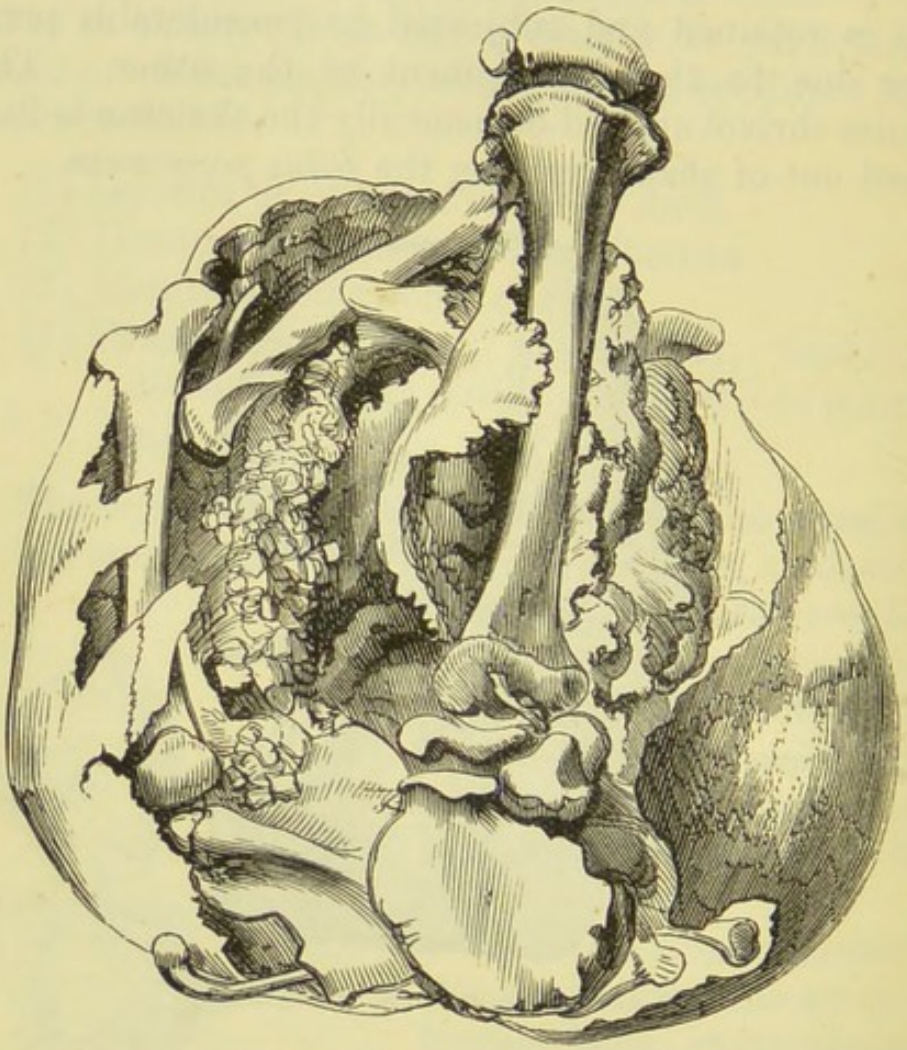


Fig. 126.—Contents of Cyst, in Dr. Oldham's Case of Missed Labour.

contents by endeavouring to break up the fœtus and bring it away piecemeal. A unique case of missed labour reported by Dr. Oldham will be found in the *Path. Soc. Trans.* for 1841.

CHAPTER XII

ABORTION

ABORTION, in the wide sense of the term, consists in the expulsion of the contents of the gravid uterus within the period of time occupied by normal gestation. Distinction is usually made between non-viable and viable children. In the case of the non-viable, pregnancy is terminated before the seventh month, constituting abortion proper. The birth of viable children is included in the interval between the seventh month and any period short of the full nine months, and is called premature labour. By some writers the term "miscarriage" has been used to denote expulsion of the ovum between the fourth and the seventh months inclusive—abortion covering the period up to the end of the third month. It is best, however, to consider the terms as equivalent expressions, which include the period from conception to the end of the seventh month. Abortion is more likely to occur during the early stage of pregnancy, before the formation of the placenta, as the ovum is then less firmly attached to the decidua; for the same reason an early abortion is not usually attended with much discomfort to the patient, as the contents of the uterus come away *en masse*, pretty much like a clot of blood, the symptoms differing

little, if any, from a profuse catamenial discharge. In abortion up to the third month the ovum frequently comes away with the membranes unruptured. The menstrual nisus is a period favourable for the occurrence of abortion. Women who have previously borne children are more liable to abort than women who are pregnant for the first time ; and if a woman aborts more than once, she is very prone to repetitions of this evil in future pregnancies. During the intermediate months of pregnancy, *i.e.* from three to seven months' gestation, abortion is often "incomplete," the retained membranes and placenta usually causing continued hæmorrhages. The patient and her friends generally attribute abortion to some immediate exciting cause, emotional or physical ; but in the great majority of cases it is due, I am disposed to think, to a morbid condition of either the uterus or its contents predisposing to premature expulsion of the fœtus. In corroboration of this view, witness the numerous cases on record of pregnant women who have met with severe accidents, as falling out of windows, sustaining fractures of the ribs, and bones of the legs, and who yet have gone to the full time. Accidents of a like nature, in which the injuries are less severe, frequently occur without producing abortion.

The *causes* of abortion are conveniently divided into those which originate in the maternal and in the fœtal organism respectively. Women of nervous and delicate constitution, and women who belong to the richer grade of society, are more likely to abort than women belonging to the working-class. Violent mental emotion, sudden changes of temperature, accidents, drastic purgatives, intestinal and cutaneous irritation, will induce reflex action and uterine contraction, the fœtus being unaffected ; zymotic diseases, lead, carbonic oxide, and other

toxic influences, and—more frequently than all these combined—syphilis, tend to produce death of the fœtus, and thus centrically bring about abortion. The so-called "habit" of aborting is acquired by some women who expel the fœtus during many consecutive pregnancies at or about the same period; I have known cases where this has happened twenty times in succession. Of these cases, many no doubt arise simply from the effect of constitutional syphilis, and under mercurial treatment the "habit" ceases. Abortion is produced likewise through congestion, displacements, cancer, fibroid and other affections of the uterus, and also occasionally by ovarian tumours. Phillips, in a paper in the *Obstetrical Transactions* for 1872, makes special mention of retroflexion of the uterus as an important factor in the causation of abortion; several cases have come under my own notice of premature expulsion of the ovum repeatedly occurring in the same woman, apparently from this cause. The use of a Hodge's pessary will often enable the uterus to carry its contents to the full time.

A variety of diseases besides those mentioned may destroy the fœtus whilst in the uterus, and thus induce abortion. The membranes and placenta are specially prone to take on morbid action; fatty degeneration or inflammation of the placenta, and effusion of blood within its substance, by interfering with the nutrition of the fœtus, cause its death. The investigations of Dr. Barnes show that the fatty deposit is confined chiefly to the cells of the villi and to the coats of the vessels which ramify in them, and that this condition seriously interferes with the nourishment of the fœtus; for, when this change is far advanced, the vascular loops become so blocked up by the fatty deposit as to be unable to transmit the blood.

Rupture of the vascular walls is also liable to take place, causing extravasation, which gradually separates the placenta from its attachment. Blood may escape between the decidua vera and the uterine parietes, or between the decidua vera and the decidua reflexa. The amount of blood effused and its situation determine the question of abortion. If the amount is small, or if it comes from the lower part of the decidua vera and escapes without much detachment of the membranes, the ovum may be retained to the full period. If, on the other hand, the quantity of blood is large, or there is much separation of the membranes, abortion will ensue. If, after considerable detachment of the membranes, the ovum remains for some time in utero, the result (as shown in Chap. xiii.) is the formation of a fleshy mole. The disease most commonly affecting the ovum is syphilis, which may be derived from either the mother or the father. The woman infected with a primary sore may transmit the disease to the fœtus; or, after disappearance of the primary disease in the man, and even of the secondary symptoms, so far as they are manifest to the eye, it may be communicated by him to the embryo, which in its turn may or may not transmit the poison to the mother by means of the placental circulation. Although the fœtal and maternal blood currents do not actually meet, yet the infection may pass through the separating membrane and communicate secondary syphilis to the mother although she has not undergone the primary disease. The existence of endometritis at the time of conception tends to produce hypertrophy of the decidua, which, if excessive, causes atrophy of the fœtus and subsequent abortion. Imperfect development, or atrophy of the decidua, is another cause of abortion.

The Symptoms of abortion vary with the period of its occurrence. In the early months the symptoms are slight; but during the later months abortion is a much more serious matter. The patient is, perhaps, suddenly attacked with hæmorrhage and uterine pain, or hæmorrhage without pain. If the pain returns at intervals and an examination reveals that the uterus is contracting, that the membranes can be felt through the os, and that they become tense and protrude with each pain, abortion is imminent. The fœtus and membranes may come away together or separately. If the fœtus is expelled alone, the case is often very troublesome, for hæmorrhage will persist until the retained placenta is expelled or extracted; or, if there is no excessive hæmorrhage, the patient may suffer from the effects of absorption of septic matter, due to decomposition of the uterine contents. Facial pallor, with lividity under the eyes, lassitude and a sensation of weight in the pelvis, together with pain in the back, are indications that the fœtus has been dead for some time. A bloody discharge, issuing day by day in small quantities, may continue for weeks before actual abortion takes place. The breasts and abdomen become flaccid, and the vaginal discharge is often fœtid.

In twin pregnancies one fœtus may be aborted, the other go on to the full time; but, as a rule, both embryos are expelled together.

Diagnosis.—In the early months, as was previously stated, the symptoms with respect to hæmorrhage and pain are very similar to those of profuse and painful menstruation; and nothing but expulsion and detection of the ovum will complete the diagnosis. In the later months the discharge may be mistaken for that produced by uterine polypus

and placenta prævia. If the os is open, a digital examination carefully made will materially assist the diagnosis. It is well to regard hæmorrhage during pregnancy as a probable indication of incipient abortion.

The Prognosis during the early months is favourable ; during the middle months less favourable, owing to the greater probability of severe hæmorrhage and the possibility of sapræmia or septicæmia, for it is in the middle months, that is, soon after the formation of the placenta, that the attachment of the ovum to the uterus is closest, and there is consequently more likelihood of retention and decomposition of the whole or part of the placenta and membranes ; later on, towards the approach of normal gestation, the prognosis again becomes more favourable.

Treatment.—To avert threatened abortion, the cause, if discoverable, should be removed, and the patient kept recumbent. Dietetic rules should be carefully observed. Effervescing drinks will be grateful to the patient, if thirsty. Large doses of opium, either by mouth or rectum, are recommended by Tanner, or preferably, in some cases, the subcutaneous injection of morphia ; astringents, as the mineral acids, or gallic acid, sometimes seem of service where the hæmorrhage is slight. If the hæmorrhage is troublesome and the ovum can be felt protruding through a dilated os, all hope of stopping abortion must be given up, and we must forthwith endeavour to procure speedy expulsion of the uterine contents, in aid of which ergot may be administered. If the os uteri be not sufficiently large to admit the finger, and the hæmorrhage be severe, the vagina must be plugged, by the aid of a speculum, with strips of lint or cotton wool dusted with iodoform, or better, with plugs or strips of antiseptic gauze impreg-

nated with iodoform or creolin. First of all, the vagina is douched with hot antiseptic lotion (corrosive sublimate, 1 in 4000; carbolic acid, 1 in 80; or creolin, 1 in 50), and then after the douche water has drained away the tampon is introduced, taking care that the first-inserted plugs or strips are pushed well up the vaginal roof, and that the amount of material used is sufficient to tightly distend the vagina. Schroeder's convenient plan is to place a large piece of antiseptic lint over the external opening of the speculum after its introduction, and then to place other smaller pieces on it, and thus the series of layers is pushed down to the cervix, and the speculum being withdrawn leaves the tampon enclosed in a kind of linen bag, so that the whole compact mass can be withdrawn in one piece. Should the cervix require it, a laminaria (sea tangle) tent which has been immersed in carbolic solution, 1 in 20, for one minute may be inserted into the os uteri before the vagina is plugged. Care should be taken that the tent is passed through the internal os. The tampon, or plug, and tent should be left *in situ* for six or eight hours, and then removed by forceps, the left index finger being used as a guide; and afterwards the vagina should again be douched.

Sometimes, even after the necessity for using the tampon (without the tent), the uterus recovers itself and retains its contents to the full time; more frequently, however, on withdrawing the tampon, the os will be found dilated sufficiently to admit of the necessary manipulation for extraction, or the uterine contents may have been expelled and lie on the top of the plug.

If the os uteri be fairly dilated, and the hæmorrhage troublesome, the uterine contents should be removed at once, otherwise they may undergo de-

composition and form a nidus for septic infection. Extraction is effected by hooking one or two fingers of the right hand round the ovum and gently with-

Fig. 127.—Ovum Forceps.

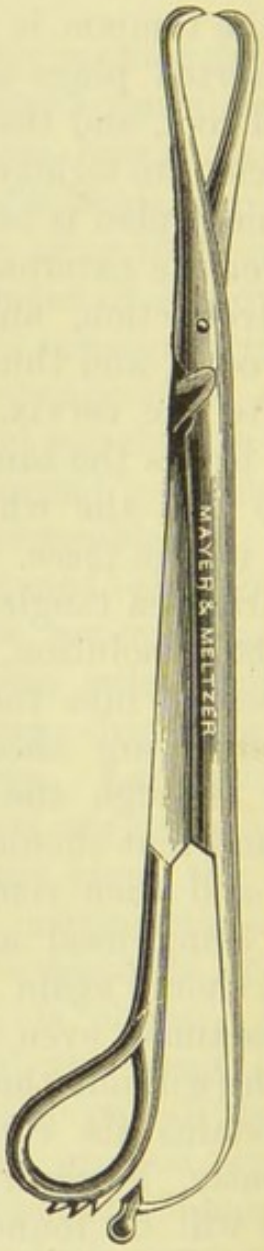


Fig. 128.—Vulsellum Forceps.

drawing it, taking care to leave nothing behind; the left hand is simultaneously placed upon the abdomen and employed in pressing the uterus down into the pelvis. If extraction cannot be thus accomplished,

the ovum-forceps should be tried, or a wire loop such as is used in the extraction of small uterine polypi. When the abdominal walls are resistant, or loaded with fat, Professor A. R. Simpson recommends that one of the lips of the uterus, usually the anterior, should be seized with a vulsellum and the uterus dragged down so as to bring it within reach of the fingers, the patient being previously anæsthetised.

Should incomplete abortion take place, and the placenta be retained, ergot may be administered if needful with a view to promote uterine action. But if hæmorrhage continue, or the placenta fail to come away, measures must be taken to thoroughly clear out the uterus.

Sir William Priestley, in an elaborate paper published in the *Obstetrical Transactions*, vol. iii., after describing the evils, such as prolonged hæmorrhage and septic poisoning, produced by the retention of the placenta in cases of abortion, strongly advocates extraction by the fingers, as with due care the risk is much less than that incurred by long retention of the placenta. He approximately limits the period of non-interference to six hours after expulsion of the fœtus, after which (and earlier if there is much discharge) he recommends treatment by manipulation. The following procedure may be adopted. If the os uteri be closed, it must first be dilated by a laminaria tent, or if rapid dilatation be necessary the patient should be anæsthetised, and Hegar's or Reid's dilators used. The os being dilated, the placenta is removed by the finger, or by the ovum-forceps guided by the index finger. The whole uterine cavity must be explored right up to the fundus; if incompletely cleared, the gentle use of the curette will remove all salient points. The intra-uterine douche is then employed, Budin's catheter (Fig. 130) being a very useful instru-

ment; or the two latter processes (*i.e.* scraping and washing out) may be combined if a flushing curette be used (Fig. 131). Lastly, the endometrium is to be swabbed with lin. iodi taken up by cotton wool fixed

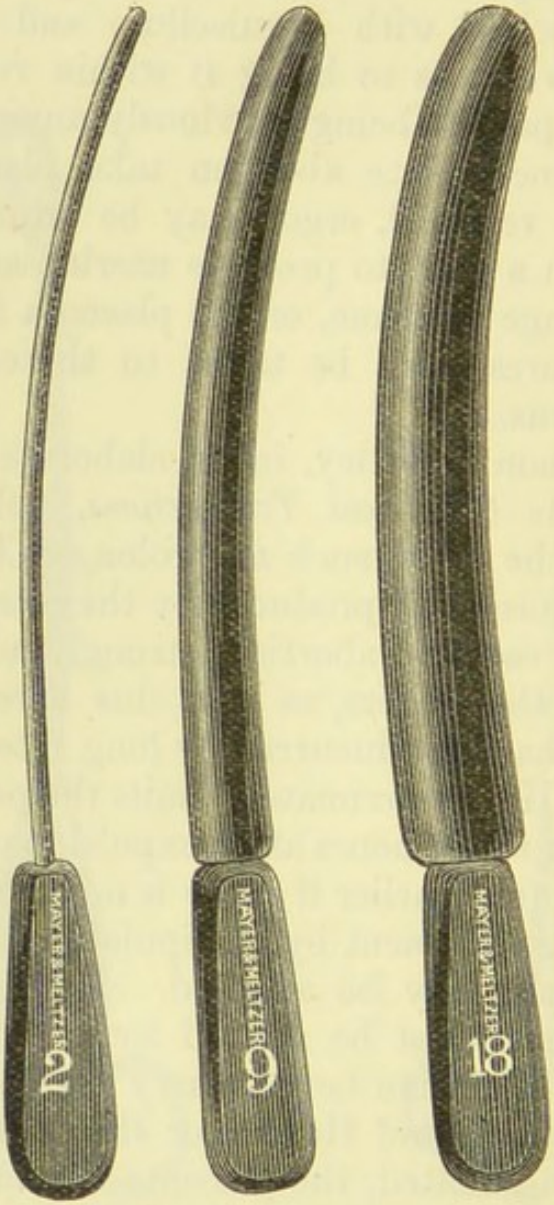


Fig. 129.—Hegar's Dilators.

on the forceps (Fig. 132). The patient should lie in for at least ten days, and be treated on the principles indicated in the chapter on the puerperium.

Prophylactic Treatment.—An endeavour should be

made to ascertain the cause of the abortion. In all

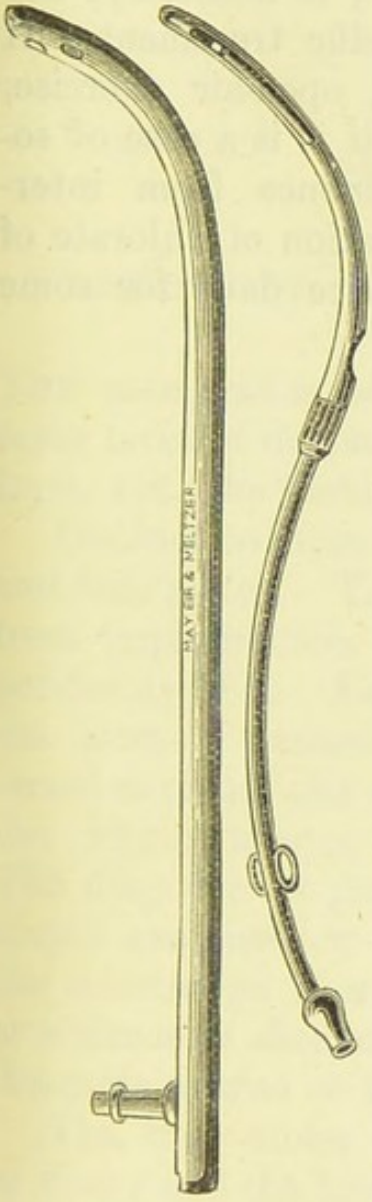


Fig. 130.—Double-Channel Uterine Douche-Tubes. (Bozemann's to right; Budin's to left.)

Fig. 131.—Flushing Curette.

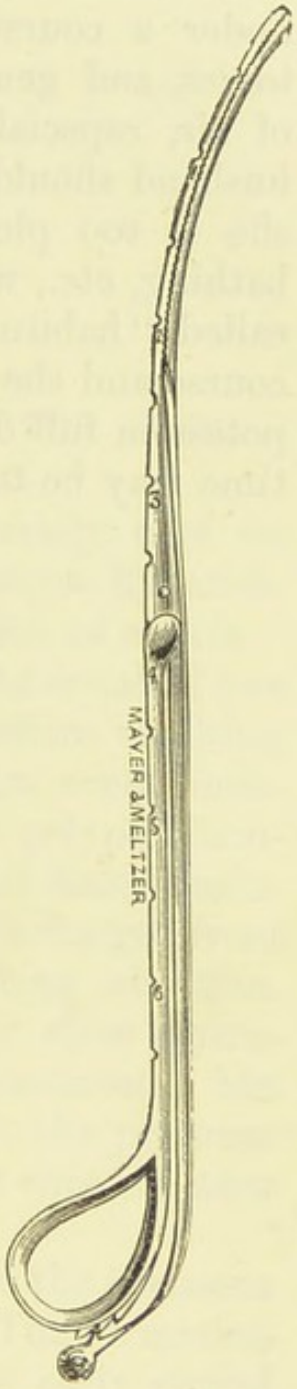


Fig. 132.—Uterine Forceps and Sound.

cases a careful pelvic examination should be made, and if the local conditions seem at fault, means

should be taken to remedy them. If traceable to constitutional syphilis, the patient should be put under a course of mercury, iodide of potassium, tonics, and gentle exercise, together with a change of air, especially to the sea-side; if necessary, her husband should also undergo specific treatment. If she is too plethoric, purgatives, open-air exercise, bathing, etc., will be of service; if it is a case of so-called "habitual" abortion, abstinence from intercourse and the internal administration of chlorate of potass in full doses (10 grains) twice daily for some time may be tried.

CHAPTER XIII

DISEASES OF THE MEMBRANES OF THE OVUM

The membranes of the ovum occasionally take on some form of degeneration, fatty, carneous, hydatidiform, etc., the result being the formation of a *mole*.

Distinction must be made between the so-called *true* and *false* moles. True moles are formations resulting from impregnation, whereas false moles occur independently of it. False moles comprise polyps, fibrinous clots of menstrual blood, and exfoliated menstrual decidua, and may of course be discharged from the virgin uterus, sometimes simulating abortion. The diagnosis is generally apparent on close macroscopic examination of the material evacuated; but the microscope is sometimes necessary, the presence or absence of chorionic villi deciding at once whether the mole is true or false.

The true moles to be described are the carneous or fleshy and the hydatidiform mole. The formation of a *fleshy mole* takes place during the early period of utero-gestation. The first step consists in extravasation of blood within the uterus, taking place usually between the uterine parietes and the decidua vera, thus cutting off the supply of blood to the fœtus and detaching the membranes from the uterus. The embryo consequently dies, and if the uterine contents

are retained *in situ* for some time, the membranes continue an abnormal form of development, whilst the fœtus atrophies and is absorbed, so that on expulsion of the mass no trace of the fœtus can be found. The effused blood becomes decolorised, and the fibrin becomes organised and converted into con-

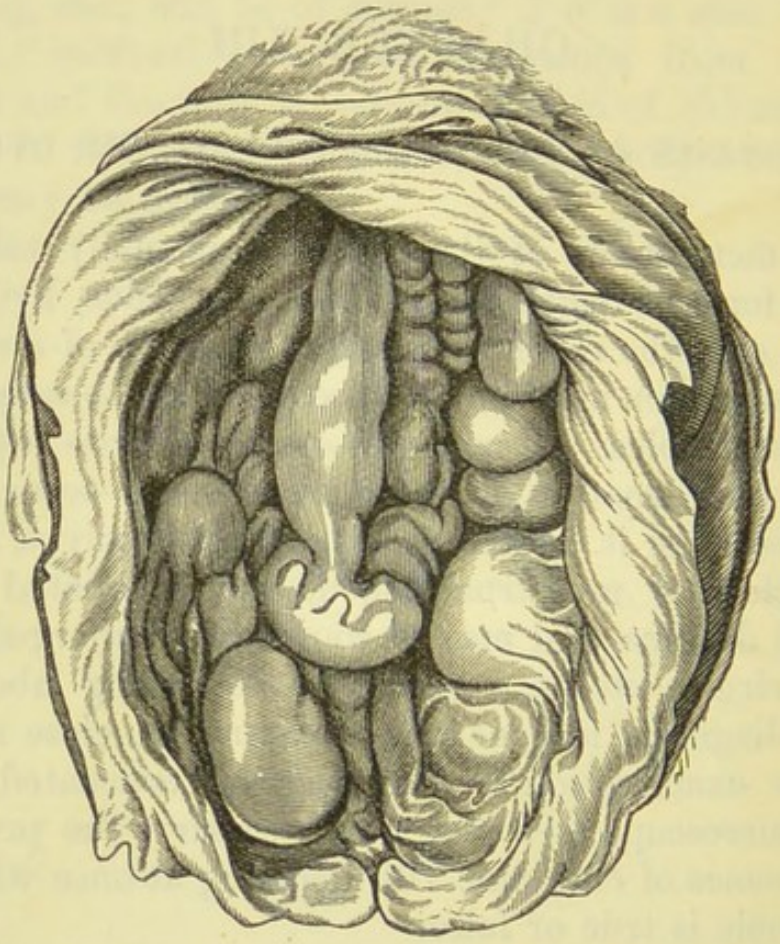


Fig. 133.—An Apoplectic Ovum: Blood being effused in Masses under the Fœtal Surface of the Membranes.

nective tissue, which then forms the channel of communication between the uterus and the membranes. It is probable that the effused blood does not entirely detach the decidua, a small portion of it retaining its original connection with the uterus, and although insufficient to nourish the fœtus, this communication

serves to supply the decidua until the extravasated blood is organised.

If the fœtus dies in early pregnancy from hæmorrhage or some other cause, such as one of those mentioned as causes of abortion, and retention occurs instead of the usual expulsion, there results what is known as a *blighted ovum*, and *missed abortion* is said

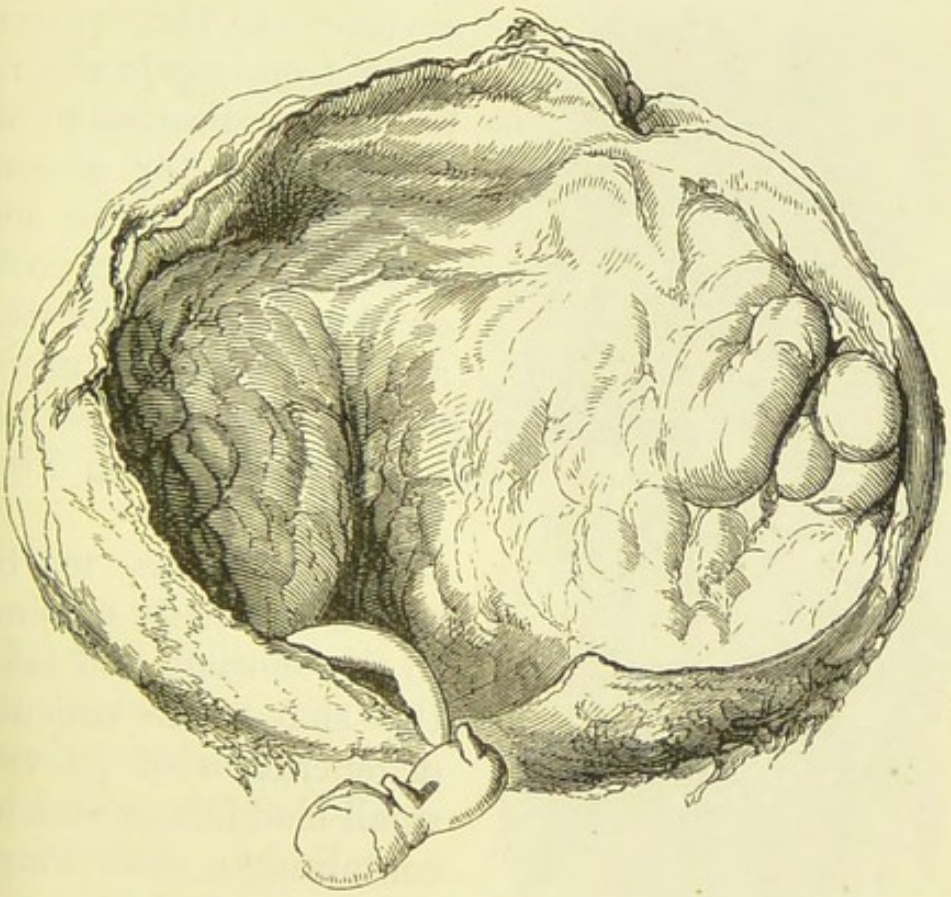


Fig. 134.—Blighted Ovum with Carneous Degeneration of the Membranes.

to have taken place, comparable to the *missed labour* which happens when a dead fœtus remains in utero beyond the usual time of gestation.

The presence of a fleshy mole or blighted ovum is indicated by the size of the uterus failing to correspond with the period of gestation, or thereabouts; and by disappearance of the general symptomatic

evidences of pregnancy, the patient being left with the sensation of a dead weight in the uterus, together with a feeling of *malaise*. There may be amenorrhœa or a more or less continuous reddish or brownish serous discharge.

In the absence of any serious local or general condition, the treatment of the case should be passive; but if the discharge be severe or the patient suffer from septic absorption, the indication would be to secure the evacuation of the uterine contents. The means to be employed for exploration and clearing the uterus are sufficiently described in the chapter on abortion.

Fig. 135.—Commencement of Hydatid Degeneration of the Chorion.

When the morbid action is chiefly confined to the chorion, and takes the shape of vesicular degeneration of its villi, small bladders or vesicles, containing a clear limpid fluid, attached to each other in countless profusion, form a *hydatid mole*. The pathological changes in the villi are initiated by proliferation of the epithelial cells which line their interior; the villi thus distended are afterwards filled with fluid from rupture of the cells. The natural tendency of the villi to development continues in this perverted form until

the cavity of the uterus is filled with vesicles growing from each other, varying from the size of a pin's head to that of a hothouse grape, or even larger. Some observers hold that hydatidiform degeneration of the chorion is invariably preceded by death of the fœtus, the vital force being then solely expended on abnormal development of the villi; others are of opinion that the primary cause originates in the maternal organism. Sometimes vast quantities of these hydatids are discharged from the uterus, causing hæmorrhage of an alarming kind. Uterine hydatids were formerly considered to originate independently of impregnation, and consequently it was held that they might be discharged from the virgin uterus; but the pathology of this abnormality, as described by Graily Hewitt, proves that they are the direct sequence of impregnation, resulting from morbid action being set up in one of the products of conception. It must be remembered, however, that the echinococcus—the true hydatid—*may* be evacuated by the uterus, and this, it need hardly be remarked, is not a product of conception. Care therefore must be exercised not to

Fig. 136.—Portion of an Hydatid Mass.

impugn recklessly the chastity of a woman who has discharged what appears to be a vesicular mole, but which *may* be a bunch of real hydatids. The microscope should be resorted to in cases of doubt, the hooklets of the echinococci, once seen, affording absolute proof as to the nature of the growth. It must also be borne in mind that a true hydatid mole, or a portion of one, may be retained in utero for months or even years—a fact having an important bearing with regard to widows or to women separated from their husbands. The vesicular mole is usually discharged from the uterus not later than the sixth month; if it remains for a much longer period it frequently gives rise to prolonged and dangerous hæmorrhage. The main sign is an undue and rapid enlargement of the uterus, which becomes much larger than in ordinary pregnancy of the same duration. Its contour is often uneven, and its consistence doughy. There is often a characteristic, clear, watery discharge, which should be examined for the presence of cysts; when the uterus attempts to expel its contents, more or less hæmorrhage, sometimes to an alarming extent, takes place. If a portion of a hydatid chance to come away, the nature of the case is of course satisfactorily proved. The treatment consists in restraining hæmorrhage and assisting the uterus in its expulsatory efforts; in plugging the vagina, if the hæmorrhage is great, together with the internal administration of ergot; and, if it be possible to dilate the os uteri, in detaching and bringing away the mass with the fingers. The procedure should be modelled on that described in the treatment of incomplete abortion, but it should be remembered that cases have been described in which the hydatid has invaded the muscular wall of the uterus to a considerable depth, and therefore no undue

force should be used lest rupture of the uterus occur.

Dropsy of the Amnion (*Hydramnios*) consists in an excess of liquor amnii, which, beyond adding to the size of the uterus and consequently to the inconvenience of the mother, is not usually productive of ill effects. Occasionally, however, the quantity of fluid is so excessive as to endanger life, by interfering with the action of the lungs or heart. In such cases the abdominal enlargement increases preternaturally, the uterus being extremely distended, thinned out, tense, and fluctuating. The patient is very ill, has much abdominal tenderness, and may require immediate relief. The only treatment is to puncture the membranes, which of course induces premature labour, and is therefore permissible only when it is obvious that the patient cannot otherwise survive to the full term. The pregnancy is often multiple, and the children are nearly always still-born. The converse of this, namely, deficiency of the liquor amnii, may cause union to take place between the amnion and the external surface of the fœtus.

A discharge of fluid sometimes occurs previous to rupture of the membranes, to which the name *Hydrorrhœa* has been given. The fluid, which is clear and watery, comes away either slowly, drop by drop, or in a sudden gush, which may be repeated at intervals. Hydrorrhœa is most common in the later months of pregnancy, but it may occur at intervals during the whole period of utero-gestation. The discharge is unattended with pain, and will often come on when the patient is perfectly quiescent. Its origin is somewhat doubtful, probably it is secreted between the amnion and chorion; some consider that it is lodged between the chorion and the uterine parietes. The possibility of

this extra-ovular discharge taking place should be borne in mind when a painless escape of fluid occurs about the period of labour, since uterine action may not set in for some time after.

The *placenta* is liable to congestion and inflammation, which may interfere with a due supply of blood to the fœtus. Blood is occasionally effused, giving rise to what has been called *apoplexy of the ovum*, and forming later the fleshy mole. Calcareous deposits are occasionally noticed on the maternal aspect of the placenta—probably the results of old inflammatory action; in other instances the placenta in parts is atrophied and hardened, probably also the effect of localised inflammation. Fatty degeneration, by no means of rare occurrence, is often the cause of abortion. According to Druitt, fatty degeneration exists to a limited extent in all cases at the end of pregnancy. When this change occurs at an early stage of pregnancy, the embryo, deprived of its nourishment, dies and becomes absorbed, the uterine contents being afterwards expelled in the form of a mole. Many of the inflammatory and fatty changes in the placenta are ascribed to syphilis. In many cases the syphilitic placenta is large and pale, and in some instances a diffuse gummatous infiltration has been detected. Finally, various tumours and cysts of the placenta may occur, the growths being fibroid or sarcomatous. Cysts are found on the fœtal surface covered by the amnion.

CHAPTER XIV

MULTIPLE PREGNANCY

In the human female the process of utero-gestation usually terminates in the birth of a single child; in a certain proportion of cases, however, women give birth to twins, more rarely triplets, and still more rarely quadruplets. Plural pregnancies are abnormal, inasmuch as the children resulting therefrom are subject to much higher rates of mortality and disease, both mental and physical, than are children born singly; moreover, the risk to both mother and child is greater in multiple than in single pregnancy. In this country twins occur in the proportion of about 1 in 80 cases; triplets about 1 in 6000. Twins are most frequently of opposite sexes; when of the same sex, females predominate over males. The tendency to multiple pregnancy is hereditary to a marked extent, the females of families thus gifted being very prone to the production of twins; apart from this hereditary proclivity, women who have once borne twins are more liable to plural pregnancies than women who have not. In plural births the children are smaller and feebler than those born singly: in twin cases it is not unusual to find one fœtus much more developed than the other: sometimes one fœtus dies and is expelled, the living fœtus being retained to the full

term : or the dead fœtus may shrivel up and harden, and in this state remain in the uterus until the birth of the living child. The duration of pregnancy in twin cases is usually shorter than the normal period. Ordinarily the children are born within a short interval of each other, but occasionally the interval is prolonged over several hours, and very exceptionally it has been known to last weeks, or even months. The mortality of infants is much greater in plural than in single births, in the case of twins being about one in twelve.

The cause of multiple pregnancy originates in some deviation from the normal physiological action of the ovaries ; two Graafian follicles in one ovary, or one in each ovary, may mature and rupture at the same time ; or, one follicle may discharge two ovules ; or, again, a single ovule may contain two germs ; in any of these cases it is quite possible for the two ovules or germs to be fecundated by one insemination, resulting in the formation of twins. In the two instances first mentioned where the ovules are separate and distinct, each embryo has its own amnion, chorion, and placenta, the placentæ being sometimes matted together but without any vascular intercommunication. In the early stage of development the ova are surrounded by their respective deciduæ reflexæ ; the partition between the two amniotic cavities being thus built up of six distinct membranes, namely, two layers of decidua, two layers of chorion, and two layers of amnion. As the ovular membranes enlarge, the two layers of decidua reflexa become more or less absorbed from pressure against each other, the partition between the two embryos then consisting of only four membranes—the amnion and chorion of each embryo. When twins are developed from a single ovule having two germs, they are

enclosed in one common chorion surrounded by the decidua; the partition in such cases consists solely of two layers of amnion, one surrounding each fœtus; in very rare cases the partition thus formed is destroyed at some period of utero-gestation, leaving the two embryos enclosed within the same amniotic cavity. Two embryos developed from the same ovule are of the same sex.

The diagnosis of dual pregnancy previous to delivery is difficult. As a rule the abdominal distension is great and pressure symptoms are more marked than usual. Sometimes, in thin women, the presence of twins may be detected by palpation, and occasionally the two fœtal hearts may be differentiated either by a difference in the rapidity of their respective beats, or by their position, as when two distinct and separate spots exist on the maternal abdomen where the fœtal heart sounds can be plainly heard, the sounds dying out in the intermediate space.

In ordinary twin cases a single coitus has fecundated two ovules at the same time. This dual impregnation may, however, be the result of two separate acts of intercourse, constituting either *superfecundation* or *superfœtation*. If an ovule escapes from a Graafian follicle at the time of, or shortly after coitus, and is fecundated, a second ovule may present itself, and remain exempt from the influence of the previous intercourse; it can, therefore, only be impregnated by a second insemination; this is called *superfecundation*. From time to time cases strongly in favour of the possibility of the separate impregnation of two ovules have been reported; the most striking instances are those where twins have been born, the one child being white and the other black, resulting from the immediate successive intercourse of two males, a white and a black, with the same white woman; the

question, indeed, does not admit of doubt. *Superfœtation*, on the other hand—that is, impregnation of a second ovule *after the formation of the decidua*,—has been considered by many writers to be physically impossible. The opponents of superfœtation explain the cases usually cited in its favour as resulting either from ordinary twin impregnation, one fœtus being developed in excess of the other, or from the existence of a bifid or double uterus. In the latter case it is very easy to understand how each division of the organ may be separately impregnated, and a more or less extended interval of time elapse between the expulsion of the contents of the respective cavities. If, however, previous to the union of the decidua vera and decidua reflexa the condition of the gravid uterus is examined, no positive barrier is found to the passage of either the ovule or spermatozoa into the uterus, the openings of the Fallopian tubes and cervical canal being still patent. The canal is, indeed, plugged with thick mucus, but this differs but slightly from the mucus which is found in this situation in the unimpregnated state, and will offer no obstruction to the spermatic filaments. Thus it is evident that superfœtation is possible up to the third month of utero-gestation, when the union of the decidua vera and decidua reflexa takes place, but that later it is impossible. It appears, then, that as there is no mechanical obstacle to superfœtation, the rarity of its occurrence must be otherwise explained, and it has been stated that during pregnancy no Graafian follicles are ruptured, and consequently no ovule escapes—a fact in itself sufficient to prevent the occurrence of superfœtation; so that in the few cases of superfœtation this exceptional act of ovulation must take place.

CHAPTER XV

STAGES OF LABOUR

LABOUR is divided into three stages—1st, dilatation of the os uteri; 2nd, expulsion of the fœtus; 3rd, separation and expulsion of the placenta and membranes. At the completion of the period of normal gestation, preparations for the expulsion of the uterine contents begin to manifest themselves, both locally and generally, in the maternal system. The uterus sinks into the pelvis; pain, which after a time becomes periodic, is felt in the loins, abdomen, and hips; there is frequent desire to empty both bowels and bladder, and the patient becomes restless and uneasy, and often suffers from mental depression. On vaginal examination the os is found little, if at all, changed from its previous condition, but after a time, as labour goes on, dilatation commences, and the bag of membranes begins to protrude, feeling tense and firm during a pain; in the absence of a pain the tension is generally so far relaxed as to allow the presentation to be made out.

It should be remembered that the medical man is often hurriedly summoned to attend a patient "in labour" because of "pains" which are not true labour pains. These are usually due to some stomachic or intestinal derangement, and they subside on the

administration of an enema and carminatives. Such *false* pains may be distinguished from *true* labour pains as follows :—False pains are irregular in rhythm and character, while true pains recur at fairly regular intervals, and each gradually rises to a pitch of intensity before dying away; false pains are felt in the abdomen, true pains are felt in the back; and finally, false pains have *no* effect on the os uteri, while true pains, as stated before, give rise to dilatation of the os and increased tension of the bag of waters.

Sickness is a frequent accompaniment of the first stage; often also a kind of shivering fit or rigor marks the full dilatation of the os, and from the vagina there flows a discharge of mucus tinged with blood, called by the nurse "the show"; this is good evidence that labour is actually progressing.

The pains themselves are of a grinding or tearing nature. They usually commence in the back and gradually extend to the thighs and abdomen, remaining entirely uterine, the voluntary muscles are not as yet called into requisition, so that the patient is unable to assist herself, and at this stage is generally restless and anxious.

So the labour goes on until the os is fully dilated, when the assistance of the abdominal muscles is evoked, and the pains become of an expulsatory character; at this period the membranes, having fulfilled their duty in dilating the cervix and os, usually undergo rupture. The pains now increase in strength and duration, the intervals become shorter, the nervous anxiety gives place to physical exertion, and the patient becomes bathed in perspiration, with a flushed and bloated face and accelerated pulse. The fœtus, passing through the various evolutions described in Mechanism of Labour, is gradually forced along the parturient canal until the presenting part rests on the

perineum, and this, with each pain, undergoes more and more distension, until eventually it becomes so far relaxed and thinned as to allow the head to pass through the vulvo-vaginal opening. A pause now usually takes place ere the uterus, by a final effort, expels the body of the child and completes the second stage of labour. Sometimes there is no pause, the uterine contractions proving so vigorous as to drive the child bodily into the world by one violent throe.

A remarkable change is now apparent in the patient's condition; the state of active exertion suddenly subsides into a state of placid inaction and contentment, accompanied with profuse expressions of thankfulness for the release vouchsafed to her from her sufferings.

After an interval of variable duration, the uterus, again contracting, detaches the placenta from its walls, and with it the decidua serotina which remains adherent to the placenta, thus exposing the uterine sinuses and giving rise to the gush of blood which follows the extrusion of the placenta; the continued contractions of the uterus propel the placenta into the vagina, closing at the same time the open mouths of the uterine sinuses. Although the vagina is competent by its independent contractile efforts to expel the placenta, yet it is usual to expel it by pressure from above.

The condition of the abdomen and of the organs of generation after delivery affords evidence sufficiently pronounced and trustworthy to enable the practitioner readily to decide whether parturition has, or has not, recently taken place. This question frequently arises in a medico-legal aspect; in cases of infanticide, for example. Immediately after delivery the abdominal walls are wrinkled and flaccid, the extreme and prolonged distension they have recently undergone having

stretched the skin to the last limits, and even beyond, for we find that the cutis vera has given way in such a manner as to leave under the epiderm visible fissures which persist throughout life (striæ gravidarum). These fissures, in the absence of other causes for distension, as dropsy, or abdominal tumours, afford presumptive proof of previous pregnancy. During the first week after delivery the uterus may be recognised through the abdominal walls as a hard round ball; the uterine cavity also may be measured with the sound, care being taken not to penetrate the walls, which, at this period of involution, are very friable and easily perforated. During the first four or five days the lochial discharge affords strong evidence of recent childbirth. At first the discharge is coloured with blood, but after the fifth or sixth day it assumes more the appearance of dirty water, day by day becoming more like the ordinary vaginal discharge, but remaining somewhat yellow for two or three weeks. Cracks and excoriations in the vaginal mucous membrane are indicative of recent delivery, but they soon heal up and disappear. In primiparæ the absence of the fourchette is very suggestive. The presence of milk, together with increased development of the mammary glands, and change of colour in the areolæ, are signs easy of recognition. The investigation, if possible, should be made within a week or ten days after delivery, although indications, sufficient for the purpose, persist for a much longer period.

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CHAPTER XVI

ANTISEPTICS IN MIDWIFERY

No apology is needed for a short chapter on antiseptics in midwifery. The reduction of mortality in lying-in hospitals, and the general reduction of morbidity—that is to say, the reduction in the number and in the severity of non-fatal septic troubles after childbirth—furnish very marked evidence of the value of antiseptic precautions.

The extreme prevalence of sources of contagion makes it impossible to secure absolute asepsis; but by the systematic observance of certain details a sufficiently near approach to it can be attained. Before indicating the methods, it may be observed that in hospitals the technique is more complex than is usually necessary in private practice. In this chapter will be given an outline of routine treatment sufficient to ensure safety even under adverse conditions: this, in private cases, will usually be sufficient; in hospital work some amplification may be necessary.

First, as regards the *room* in which the patient is to be confined. It should be an inviolable rule that no woman ought to run the risk of delivery in an apartment where there is, or has recently been, a patient suffering from infectious or septic disease.

The chosen room should be light and airy, containing only what is necessary for comfort and for the proper management of labour. It is much too common to find the chamber crowded with furniture, curtains, and clothes, all of which may be sources of danger. If a nurse be in attendance, she should be instructed to have all unnecessary articles and persons transferred elsewhere. There ought to be a fire in the room, and plenty of cold and boiling water. In addition to washing-basin, soap, and towels, there should be various dishes or bowls for lotion. The best antiseptics for external application and for instruments are 1-1000 corrosive sublimate, 5 per cent carbolic acid, or 1 per cent lysol solution. There should be at least a couple of bowls, each containing about a quart of the chosen antiseptic; the means of making more being at hand. Permanganate of potash solution is kept in many houses, and, in the absence of other antiseptics, may be used, but it is not so reliable and effective a germicide as those above described. Of the antiseptics named, corrosive sublimate is the best, though it is not without some drawbacks: thus, its poisonous nature is indicated neither by colour nor odour; and, in addition, instruments placed in it soon tarnish. To obviate the former disadvantage, the pellets or powders used for making the lotion (10 grains to the pint equals 1-1000) are usually tinted with some colouring agent; a little tartaric acid or common salt is also added to prevent deposit when solutions are made with alkaline water. Lysol solution has a somewhat soapy lubricating action, whereas carbolic and sublimate lotions produce an opposite effect, as though they roughened the skin and mucous membranes. The difference is very obvious when a vaginal examination, or an attempt to introduce the whole

hand, is made without other lubrication than that afforded by the lotion.

For vaginal or intra-uterine douching the lotions are to be diluted with 3 or 4 times as much water, *e.g.* 1-4000 corrosive, 1-80 carbolic, and 1-300 or 400 lysol would be appropriate strengths. The temperature should be nearly 110°; a ready test being that the liquid should be as hot as can be comfortably borne when the *whole hand* is immersed in it.

In regard to the proper treatment and choice of the antiseptic itself Dr. Boxall ("Chemical Incompatibility of Antiseptic Agents," *Brit. Med. Journ.* vol. i. 1888, page 898) gives the following interesting table:—

	1. Sublimate.	2. Carbolic.	3. Iodine.	4. Salicylic.	5. Condy.	6. Olive Oil.	7. Vaseline.	8. Glycerine.	9. Soap.
1. Corrosive sublimate solution (bichloride of mercury) .	...	...	×	...	...	...	...	...	×
2. Carbolic solution (phenol) .	...	...	×	...	×	×	...	...	...
3. Iodine solution (iodine and iodide of potassium) .	×	×	...	...	...	...	...	...	×
4. Salicylic solution (salicylic acid)	...	...	...	...	×	...	...	...	×
5. Condy's fluid (permanganate of potassium) . . .	...	×	...	×	...	×	...	×	×

Note.—Wherever a × occurs, interaction takes place between the two ıbstances in the corresponding horizontal and vertical columns.

In the course of his lectures on "Antiseptics in Midwifery" he explains the table thus:—

"The crosses in the table, which occur at certain intersecting points of the horizontal and vertical columns, indicate that interaction takes place between

the agents which stand at the head of these columns, as follows:—Corrosive sublimate and iodine, corrosive sublimate and soap, carbolic acid and iodine, carbolic acid and Condy's fluid, carbolic acid and olive oil, iodine and soap, salicylic acid and Condy's fluid, salicylic acid and soap, Condy's fluid and olive oil, Condy's fluid and glycerine, and Condy's fluid and soap. I give the above merely as examples; I must ask you to draw on your chemical knowledge for other instances in dealing with other antiseptics.

"In condemning these admixtures as chemically incompatible, I am prepared to admit that in some instances the newly-formed compounds may possibly be powerful antiseptics, though this remains to be proved; and I submit that any observations made with a view to determine this point are practically valueless, unless either these newly-formed compounds be isolated and used in pure solution, or the admixture be made in such proportion that at least no appreciable excess of either one or other of the original antiseptic constituents be suffered to remain in the solutions employed. Take, for instance, this, which is commonly known as iodised phenol, as an example. It is an admixture of tincture of iodine and carbolic acid. In the presence of water the free iodine disappears, as is seen at once by the decolorisation of the solution. But that it is still capable of acting as an antiseptic after water has been added I do not deny, for it contains much more carbolic acid than is necessary to destroy all the free iodine present. But that it possesses antiseptic powers superior to the unaltered carbolic acid remaining in solution is extremely doubtful.

"One of the least commonly recognised but constantly occurring examples of the use of an antiseptic agent in combination with another body,

whereby it is rendered inert, was to be found, at any rate until quite recently, in the employment of carbolised oil for various antiseptic purposes. In fact, at one time, as a lubricant supposed to possess antiseptic properties, the employment of carbolised oil was almost general. And yet it has all along been recognised that, in cases of carbolic poisoning, olive oil proves one of the best antidotes. Moreover, many years ago, Koch of Berlin showed that anthrax spores are capable of living and developing after having been immersed in carbolised oil (1 in 20) for four months. And yet the fallacy survives, that carbolised oil is a reliable antiseptic product. But that this product contains no free phenol, unless the strength be raised above 1 in 8, is easy of demonstration. The application at the onset of a little chemical knowledge would have settled the point at once, without requiring years of clinical experience to draw attention to the fallacy by slow degrees."

As to the question of *lubricants*, it will be seen from Dr. Boxall's table that both vaseline and glycerine can be used with either carbolic acid or perchloride of mercury. Glycerine, or vaseline hyd. perchlor. 1-1000, are the lubricants most commonly used; but as it is undoubtedly an advantage to employ an antiseptic lubricant which will facilitate subsequent washing, sapo mollis B.P. with 5 per cent carbolic, or 1 per cent lysol, may be recommended.

The arrangement of the *bed* upon which the delivery is to take place demands only a few words. There should be a sufficiency of clean clothes; in hospitals they may be sterilised. It is well to have a draw-sheet and mackintosh across the bed, and for the actual delivery an extra mackintosh and sheet or wood-wool pad placed lengthwise on the right-hand side of the bed.

The *patient* requires both local and general cleanliness. At the time of labour antiseptic treatment is to be directed to the condition of the vulva and of the "show." That germs exist in the vagina, and theoretically it would be well to get rid of them, must be admitted, but whether a preliminary vaginal douche should be administered or not depends upon circumstances affecting each individual case. Generally, however, this preliminary douche may be safely dispensed with, for, as a rule, the vaginal germs are comparatively innocuous, and, even with the most complete cleansing of the parts, it is barely possible to obtain absolute sterility; finally, unless the douche be administered with considerable attention to detail, the procedure is attended with more risk than that which attends the condition sought to be remedied.

The local treatment, then, resolves itself into antiseptically cleansing the parts, and, by means of an antiseptic vulval pad, endeavouring to preclude admission of germs from the air and bedclothes. In attending to the vulva any discharge must be removed by pledgets of cotton-wool dipped in 1 per cent lysol or 5 per cent carbolic solutions, wiping the vaginal entrance from the orifice radially outwards, and commencing each radial cleansing with a fresh portion of cotton wool. If corrosive sublimate solution (1-1000) be used, the parts must be swabbed anew after all discharge has been removed, as this antiseptic reacts chemically with blood, and consequently its activity is diminished. Such cleansings will be required several times during the course of the labour, and after each an antiseptic cotton-wool or wood-wool pad should be brought into apposition with the parts.

There is no need to insist upon the necessity for surgical cleanliness on the part of *medical attendants*

and *nurses*. Various systems of disinfection of the hands are available; perhaps the most convenient is the following, which, while perhaps not securing complete asepsis, will sufficiently approach it if rigorously observed. With the sleeves well rolled up, the hands and arms are assiduously washed for some minutes, a specially-kept nail-brush being used; thorough cleansing under the free edges of the nails is facilitated by keeping them short. After drying, all greasy matter may be removed by turpentine, which is subsequently washed off; finally the hands are immersed and well bathed in the lotion selected. If bichloride of mercury be employed, it is necessary before immersing the hands to wash all soap off the skin.

As regards delivery, there only remain to be considered the *method of examination* and the proper *preparation of instruments*. In making an examination, a definite system must be observed. First, the position of the patient is seen to, and the external genitals are made aseptic in the manner above described; then, after dipping the hands afresh in the lotion, the examination is made. Care is to be taken that no furniture nor bedclothes are touched by the examining fingers after they have been cleansed; in fact, the lotion should be actually dripping from them when the vagina is explored. It is right also to mention that for two reasons the fewer examinations, consistent with the proper management of labour, the better:—first, because of the difficulty of procuring absolute asepsis, and, second, because repeated examinations interfere with the natural lubrication of the parts.

In the case of instrumental labour, it is good practice to administer a preliminary vaginal douche. The instruments themselves should be boiled for five

minutes, and then immersed in lotion—carbolic being perhaps the best; the instruments must subsequently touch nothing that is not itself aseptic; the slightest negligence in this respect may neutralise the most elaborate preparations. After the operation is over, it is best to administer an intra-uterine douche. The instruments should be thoroughly cleansed before being returned to the obstetric bag; in private practice, if there is no nurse to attend to them, they may be wrapped up in the operator's mackintosh apron, and subsequently cleansed at home.

During the *puerperium* the local treatment is intended to fulfil two conditions—to remove material which may act as a nidus for the development of germs, and to prevent the access of any contagium. The vulva requires frequent cleansing, and the lochial discharge is to be received on absorbent antiseptic pads which should often be changed. Whilst performing these duties, the nurse must of course have due regard to the state of her hands. The question of douching is an open one: if well done by a trustworthy nurse it is of great advantage in removing clots and decidual débris from the vagina; in hospitals it is often part of the routine, but in private practice it is not as a rule needed. For promoting drainage it is usually advisable to allow the patient to roll on her side, and to sit up in bed as early as possible.

The proper management of the various injuries incidental to some labours—lacerations, bruises, and the like—need not be discussed in detail; it is sufficient to state that the broad principles so many times enumerated, of providing free drainage, and preventing access of contagion, must be adhered to. With the simplest of treatment it is remarkable how rapidly the healing of bruised vaginal tissues takes place, and with what little amount of

general reaction; on the other hand, without proper attention, there is a grave risk of systemic infection in addition to the probable occurrence of local mischief.

Finally, with regard to the normal puerperium, there are still one or two points requiring brief mention. These are the management of *lactation*, the dressing of the child's *funis*, and the care of its *eyes*. The "natural history" of mammary abscess, and the necessity for having the nipple properly "out," have been dwelt upon whilst considering mastitis. It is only necessary here to repeat that the nurse should cleanse the nipple and the child's mouth both *before* and *after* suckling, and should repeatedly change the receiving pads if there is overflow of milk—the nipple should not be allowed to remain bathed in sour milk. If any antiseptic be used for the breast or the child's mouth, a weak solution of permanganate of potash or of boracic acid will be found satisfactory.

The stump of the umbilical cord is to be kept as dry as possible, dusted with boracic powder, and carefully folded in a piece of clean lint: it is usual to pass it through a hole in the centre of the dressing. Commonly some old linen is used, which serves well enough if sufficiently clean; incidentally we may remark that the old-fashioned plan of burning the hole through the rag was not without its hygienic advantages.

To prevent ophthalmia neonatorum it is customary in lying-in institutions to drop a little hyd. perchlor. solution, 1-1000, into the eyes after the child is first washed; another plan, perhaps more successful, is to paint the conjunctivæ with argent. nitrat. solution, 10 grs. to the ounce. Away from hospital surroundings it is usually enough for the doctor to lave the

conjunctivæ with clean tepid water which has been boiled. Whatever may be the chosen plan, it is necessary for the doctor to inspect the child's eyes at each visit, and should any inflammatory action show itself, to commence *at once* with appropriate treatment.

CHAPTER XVII

MANAGEMENT OF NATURAL LABOUR

THE practitioner in the lying-in room should possess plenty of patience, or, at all events, the art of concealing any shortcoming in this respect; otherwise, in addition to the discredit which follows any rash treatment he may be led into by lack of patience, he will assuredly be blamed for anything that goes amiss, although it be not his fault. Presence of mind is a very important element, as is also the avoidance of a fussy officious manner which tends to excite the patient. Nowhere is the *suaviter in modo, fortiter in re*, more demanded than in the lying-in chamber.

The summons to a labour should be promptly obeyed, it being good policy to regard every case as one which may possibly require early interference; and in view of this, the practitioner should go provided with all instruments, drugs, etc. The obstetric bag should contain the articles comprised in the following list:—

Nail-brush.
Some antiseptic, *e.g.* 10-grain tablets of corrosive sublimate.
Lubricant in collapsible tube.
Ergot and ergotine } and hypodermic syringe.
Opium and morphia }

Chloroform.
Æther for anæsthesia or subcutaneous injection.
Chloral hydrate.
Perchloride of iron.
Catheter.
Higginson's syringe, and Budin's catheter.
Forceps, long and short.
Funis repositor (tape and double-eyed catheter).
Perforator.
Craniotomy forceps.
Braun's cranioclast.
Cephalotribe.
Crotchet and blunt hook.
Decapitating scissors.
Perineum needle and sutures.
Curved needles, needle-holder, and sutures for cervix.
Vulsellum forceps.
Sims' speculum.
Curette.
Transfusion apparatus; scalpel, forceps, funnel fitted with rubber tube, and canula; ligatures, sutures, and needles; bandages and dressings.

The arrival of the attendant should be announced to the patient before he reaches her room, else his unexpected advent, especially if he be a stranger, is often sufficient to cause entire cessation of the pains. An early examination being requisite, the subject should be approached by inquiring from the nurse about the character of the pains, etc., after which the patient, if not already in bed, should be requested to lie down on her left side, with her knees drawn up towards the abdomen, and her back towards the attendant. The obstetric position varies in different countries, the above being the one usually preferred

in England; in France, and elsewhere, the patient is delivered on her back. The arrangement of the bed of course devolves upon the nurse, who places a sheet of waterproof cloth under the hips of the patient, and prepares the necessary napkins, thread, scissors, etc. It is well, however, to cast a glance around to see that all is at hand when required.

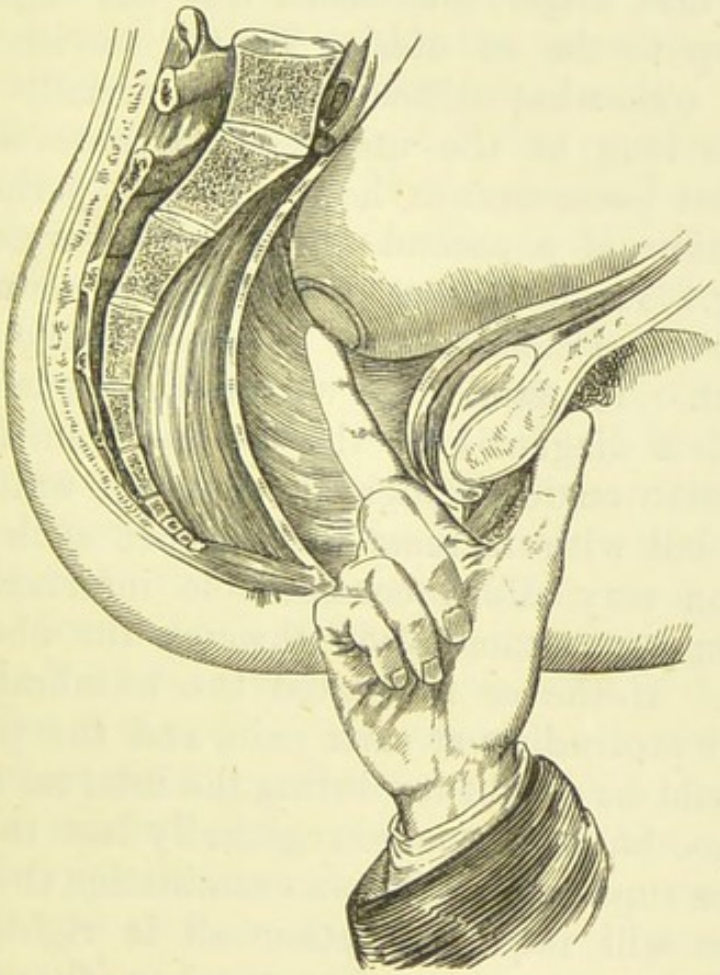


Fig. 137.—Examination in the Stage of Dilatation.

First preparing perchloride lotion 1 in 1000 (one tablet to a pint of water), the doctor then washes his hands, using the nail-brush assiduously, and after rinsing off any remaining soap-suds in fresh water, he scrubs and bathes his hands with the antiseptic solution for a minute. In the meantime the nurse should cleanse the external genitals, finally using

some 1 in 2000 corrosive solution. Sometimes it is advisable that a preliminary vaginal douche of 1 in 6000 perchloride lotion, followed by plain hot water, should be administered by the nurse. Then after lubricating the right index finger with some antiseptic lubricant, the hand is passed under the bedclothes, the vulva separated by the thumb and second finger, and the first finger introduced into the vagina and passed up to the os uteri. To the novice this is often a somewhat difficult feat, especially if the vagina is long or the uterus at all anteverted; a little quiet perseverance, however, with perhaps the introduction of a second finger, will overcome the difficulty. If the labour is only just commencing the os is found closed, when of course little can be made out. The student is warned that it is difficult to found a diagnosis of the presentation from an examination made through the anterior wall of the uterus; but with increased experience such an examination may afford considerable information, as indeed may an examination through the abdominal parietes. If the os is dilated the membranes will be found protruding at each pain, and the presentation should be sought for during the interval between the pains, but not too energetically lest the membranes be ruptured. After an examination the patient or nurse will inquire whether all is right, that is whether the presentation is natural or otherwise, and the attendant must therefore be prepared to answer. The patient is also likely to ask, "How long shall I be?" This question not being so easy to answer, she should be told that all depends upon the strength and frequency of the pains. We may hint here that proper attention to the bowels and bladder during the first stage has often considerable influence in shortening the duration of labour. If the presenta-

tion is natural, little is to be done in the way of treatment; the patient should be cheered and comforted from time to time with the assurance that all is going on well, an occasional examination being made to ascertain that this is really the case. When the os is fully dilated and the membranes still intact, they should be ruptured during a pain by pressure with the finger-nail, when the waters will come away in a gush, and thereby enable the expulsatory efforts of the uterus to act more advantageously. In some cases the membranes may well be ruptured before the os is fully dilated. If the cervix be very soft, and very dilatable, there can be no objection to comparatively early artificial rupture when the presentation is normal; and further, as Dr. Stephenson says, "when we find dilatation tardy from defect in degree or direction of the power alone, and not from any inherent character of the tissues, when once it is evident that the lower segment of the uterus is well expanded, the rupture of the membranes is the most effectual means of favouring the dilatation, by bringing the axial force into full action, and this irrespective of the degree of the size of the os." Also when the liquor amnii is in excess, producing undue tension of the membranes during a relaxed state of the uterus, the condition "must be regarded as unfavourable to the mechanism of labour and as warranting an earlier rupture of the membranes than under other circumstances."

Abdominal examination during labour, briefly referred to above, is worthy of being more cultivated, as it is indubitable that repeated vaginal examinations are prejudicial unless conducted with the greatest regard to asepsis. Without going into the matter at length, we may briefly indicate the lines on which such an examination is to be conducted, and we may add that it is generally possible to ascertain if twins are

present, and in a majority of cases of single pregnancy to diagnose the presentation and position without having recourse to the vaginal touch. To begin with, it is not difficult to tell whether the long axis of the child corresponds with or lies across the uterus, and the hard globular head is as a rule readily felt anywhere except at the pelvic brim. The lower segment of the uterus is examined in the following way:—Both hands are placed flat on the abdomen parallel with one another, one on each side of the median line, with the fingers just above the inner part of Poupart's ligament. The abdominal wall is then gradually depressed, so that the anterior half of the pelvic brim is examined; and if the fœtal skull be situate in the lower segment of the uterus, it will be felt between the two hands. Now as regards position of the head, it will usually be found that the fingers of one hand can be pushed into the pelvic cavity more readily than those of the other. If the deeper hand be the right, as is most often the case, it means the head is occupying the right oblique diameter of the pelvis, *i.e.* the anterior end of the long axis of the fœtal skull is to the mother's left, and therefore obstructs the hand on that side. It only remains to make out whether this anterior pole of the fœtal skull is occiput or forehead; in other words, we have to decide whether the dorsum of the child is forwards or backwards. On palpation in dorso-anterior cases the firm back is generally to be felt, and on auscultation the fœtal heart-sounds can be clearly heard somewhere near the umbilicus; whereas absence of the sensation of the firm flat back, and indistinctness or absence of the fœtal heart-sounds in the umbilical area, indicate a dorso-posterior position.

In the second stage it is usual for the patient during her pains to pull at some object, as a roller-towel

fixed to a bedpost, or to grasp the hands of the nurse, in order to obtain a fixed point for the action of the abdominal muscles; sometimes the patient aids her efforts by pushing her feet against some resisting object, as the footboard of the bed, and so bringing more voluntary power into action. Pressure applied by the hands of the nurse to the lower part of the back also affords comfort.

The anterior lip of the uterus is sometimes carried down before the descending head, a displacement easily rectified by pushing the lip gently up over the head during an interval between the pains. Prolapse of the anterior lip is more common in occipito-posterior presentations, and whether the case is occipito-anterior or occipito-posterior, it is usually a sign of deficient flexion of the fœtal head, consequently in occipito-anterior cases it is advisable to try and increase the flexion by pressure about the anterior fontanelle at the same time that the prolapsed cervix is pushed up in front.

When the head distends the perineum, graduated pressure may be applied by laying a folded napkin on the hand and pressing on the part. This manœuvre used to be strongly insisted upon, but has latterly fallen into comparative disuse; Graily Hewitt, who has written on this subject with considerable fulness, is averse to the procedure, and believes that "in many cases it has led to the very evil it was intended to prevent." The perineum may be relaxed somewhat in the following manner:—The practitioner, sitting on the side of the bed, may with the fingers and thumb of his left hand make the perineal tissues looser by pressing on the sides of the vulva in the direction *from* the pubes. At the same time with the right fingers and thumb from the ischio-rectal regions the fœtal head may be

pushed slightly *towards* the pubes, thus taking the strain off the perineum. Besides this manipulation, if expulsatory action be very strong, bearing-down efforts should be discouraged, the curled-up attitude relaxed, and the patient directed to cry out, when of course the auxiliary forces will cease to come into play; and, if necessary, the progress of the presenting part may in some degree be retarded by a slight digital pressure. It should be remembered that it is not well to hurry the labour at this stage: the gradually increasing distension produced by recurring pains gives time for the perineal structures to undergo natural relaxation; this may be aided by fomentation of the parts with hot water from time to time.

During the expulsion of the child the attendant should make firm pressure on the maternal abdomen and follow down the uterus in its final contraction; indeed, it is a good rule to keep the hand on the uterus after the birth of the child's head until the third stage has been some time completed, and the patient is ready for the bandage. As soon as the head is born the trunk quickly follows, and after wiping the child's eyes with some clean soft linen and removing any mucus from the nostrils or mouth, the next step is to separate the child. It is usual to wait until pulsation ceases in the cord before tying it with a few strands of thread or worsted. Two ligatures are applied, one a couple of inches from the child's abdomen, another an inch or so nearer the placenta, and the funis is then cut through by scissors between them. As the gelatinous structure of the cord renders it very elastic, the ligatures therefore should be firmly and gradually tied, lest hæmorrhage ensue, either from want of tightness or from a tear. Before tying the second ligature the blood contained in the portion of the cord be-

tween the two ligatures should be pressed out in order to avoid the disagreeable spurt which otherwise occurs on dividing the cord. The attendant should then ascertain the sex and look for any obvious deformity about the face, head, spine, abdomen, genitals, anus, and limbs. The cord is finally inspected to see that the ligature is effectual, and if all is well the child is taken away and kept warm for a while in a blanket.

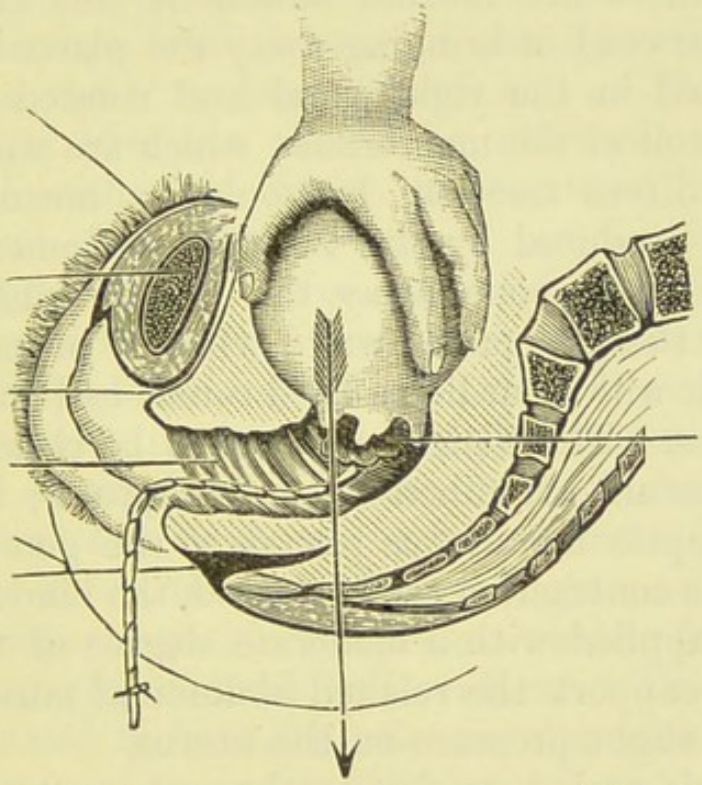


Fig. 138.—Expression of the Placenta. (After Credé.)

The placenta remains to be brought away, but it is well to allow some little time, say twenty minutes, to elapse till thrombi form in the uterine sinuses, the hand meanwhile being kept on the fundus to control its size and encourage contraction by slight friction; the older accoucheurs were accustomed to do nothing but wait inordinate periods for further uterine contractions, which sometimes did not recur for hours, but still the rule was "wait." This loss of

time can usually be avoided by gently but firmly compressing the uterus with the hands after the method advocated by Credé, the uterus being thereby stimulated to contract and to loosen the attachment of placenta and membranes, sometimes even expelling them wholly from the vulva. Taking advantage of a pain induced by the friction, the uterus is compressed by the left hand and pressure is exerted upon it in the direction of the axis of the pelvic brim. Unless there are morbid adhesions this manœuvre should succeed in bringing away the placenta, which is received in the right hand and rotated so as to make a coil of the membranes, which are withdrawn, not by direct traction, but only by means of the traction produced by the twisting movement. The placenta having come away, the uterus should be felt through the abdominal walls, when if properly contracted it will seem like a hard round ball just above the pubes. The patient is then to be cleansed, and the perineum examined for any rupture; a pad of some aseptic material is placed to the genitals, and if uterine contraction remains good, the binder should now be applied with a moderate degree of tightness so as to support the relaxed abdominal muscles, and to exert slight pressure on the uterus.

At this period, or during the management of the third stage, the nurse attends to the washing of the child. It is well to begin and end with cleansing the eyes with clean plain water or boracic lotion; the practitioner should personally supervise this part of the proceeding, and also the dressing of the funis.

Fœtal asphyxia, or suspended animation of the newly born, may be conveniently referred to here. It may occur in two forms; one, the milder, in which the child is born of a livid colour; and the other, severer, the fœtus being limp and the skin

pale. In the former the cause is probably interference of short duration with the respiratory functions of the placenta, or its premature detachment, injury to the cord, etc. In the latter prolonged pressure on the child and placenta has resulted in more or less complete loss of tone in the nerve centres. The child should be quickly separated and examined for funicular or cardiac pulsation. In the apoplectic form stimulation of the skin with perhaps untying of the ligature so as to allow one or two teaspoonfuls of blood to escape from the cord is usually sufficient to cause the child to breathe and cry. The child's mouth and pharynx should be cleansed, its body sprinkled with cold water or immersed in warm water, and then slapped with a towel and swung in the air. Should these means fail, and in the graver cases of asphyxia pallida, recourse is to be had to Silvester's method of artificial respiration, which consists in drawing out the tongue, placing the child on its back, and alternately elevating the arms above the head, and bringing them down to the sides, so as to make moderate pressure on the thorax, repeating this manœuvre twenty-five times each minute for at least half an hour. This should be conducted in front of a fire or alternated with a hot bath, so as to prevent prolonged cooling of the child; and Dr. Champneys observes that the inspiratory manipulation is much more effective if the arms are rotated outwards while being drawn up. The explanation is that the pectoralis major being inserted into the outer lip of the bicipital groove of the humerus, the traction on the elastic chest walls through the muscular fibres is considerably increased when the arms are everted.

Schultze's [1] "swinging" method is also very use-

[1] *Der Scheintod Neugeborner*, B. S. Schultze. 1871.

ful. The operator stands stooping forwards and holds the child with its back towards him with both hands, so that the thumbs rest on the front of the thorax, the forefingers in the axillæ from behind, the other fingers being spread over the back of the thorax ; the child's body is in the vertical position, its head being supported between the operator's wrists. The child is now swung upwards, at first sharply and then more slowly, until its legs fall down in front of its body. The thorax is thus compressed by the child's own legs, aided by the operator's hands. This position is maintained for a few seconds, when the child is sharply swung down to its former position, care being now taken not to compress the chest. These alternate movements are repeated every four or five seconds.

Inversion of the child, *i.e.* holding it with the head down, is often of help in clearing the larynx, and occasionally it is found useful to insert a catheter into the larynx during the performance of artificial respiration. Sometimes insufflation of the lungs seems of great service :—an assistant places a clean piece of linen over the child's mouth, and, closing the nostrils with the fingers, puts lips to lips with the cloth intervening, and, whilst the operator is doing the inspiratory movement, blows so as to fill the chest. This is to be done three or four times, then the ordinary artificial respiration is maintained for a longer period, insufflation being performed at intervals if necessary.

Recently, rhythmic traction by forceps of the child's tongue, 20 to 25 times in the minute, has been highly recommended as inducing reflex respiratory efforts, and is reported to have been successful in a number of cases where other methods of procuring artificial respiration failed to elicit any response.

CHAPTER XVIII

THE PUERPERAL STATE

CLEANLINESS and rest are the most important points in the treatment of the puerperal state. After delivery a warm dry pad of some antiseptic material is applied to the vulva so as to absorb and prevent infection of the lochial discharge. The pad is to be changed frequently, the soiled one being burnt; each time the genitals are cleansed with cotton wool and an antiseptic wash of corrosive sublimate (1 in 4000), carbolic acid (1 in 100), or permanganate of potash (1 in 8000).

It is customary not to change the underclothing of the patient for some hours after delivery, but the change should be effected as soon as she has recovered from the shock, since it tends greatly to promote her comfort. The patient should be kept free from all excitement, the room efficiently ventilated and maintained at an even temperature, and the light modified by curtains—all the usual precautions of the sick-room being observed.

When the patient is quietly resting after her exertions, the pulse will be found to have considerably slowed down, often below the normal rate; occasionally the beats are only 40 to 50 in the minute. Within the next few days it gradually attains the

usual speed. Immediately after labour a quick pulse may indicate actual or impending hæmorrhage ; later, with an elevated temperature, it may be due to nervous shock, mammary congestion, or septic disturbance of any kind.

The temperature, like the pulse, usually becomes subnormal a few hours after labour. As a rule, it regains the normal height within the next twelve hours, where it remains in an uncomplicated puerperium. It is, however, very liable to aberration ; nervous influences, and the condition of the bowels, breasts, or genitals may readily give rise to febrile excitement.

An essential duty during the early puerperal state is to inquire on the first and two or three subsequent visits as to the evacuation of the bladder. If there is reason to suspect retention of urine, the hand placed on the abdomen will, if the bladder is full, detect its distended contour above the pubes. As dribbling from a full viscus may be mistaken for voluntary micturition, the novice is warned—if the symptoms lead him to suspect inaction of the bladder—against being satisfied with the assurance of the patient that she passes water. The evils resulting from prolonged distension of the bladder are so evident that they need not be dwelt on. I have known cases treated for metritis in the most orthodox fashion, the symptoms being solely due to neglect of a paralysed bladder and consequent accumulation of urine ; in such cases the catheter draws away an enormous quantity. Retention is usually met with after tedious labours, when the neck of the bladder has been for a long time compressed between the fœtal head and the pubic arch ; catheterism is obviously the treatment.

On the other hand, incontinence of urine without

retention is occasionally seen; this may be due to some tear or sloughing involving the urethra or bladder, or it may result simply from loss of tone of the bladder sphincter. In the former case, a plastic operation will be required at a future period; in the latter, all that is needed is scrupulous cleanliness with regular catheterism until the normal functional activity is restored. Nux vomica will be found valuable in such cases.

During lying-in the diet should be light and easy of digestion; for the first few days it may consist of gruel, beef, or other soup, and farinaceous puddings; after the third or fourth day a mutton chop or a little chicken may be allowed either with or without wine or beer. Previously to changing the diet on the third day after delivery, if there has been no previous evacuation, the bowels should be opened with castor-oil, Gregory's powder, liquorice powder, confection of senna, Seidlitz powder, rhubarb pills, or other aperient. Should the bowels be very costive, the administration of the laxative may be followed in a few hours by an enema of soap and water; when the bowels are obstinate it is often requisite to repeat the aperient on alternate days for some time.

Women who have previously had children are more or less troubled with "after-pains," the result of post-partum uterine contractions. To a certain extent these contractions are useful in promoting the expulsion of clots, shreds of decidua, etc., but when excessive and painful, they must be checked by the administration of sedatives—*e.g.* 15 minims of tincture of opium—otherwise they deprive the patient of sleep and weary her by their frequent return, every fresh application of the child to the breast causing their recurrence by reflex action. Primiparæ

are not troubled with after-pains, multiparæ suffer in direct ratio to the number of children they have borne.

If the patient feels well, she may be allowed to sit up in bed for an hour or two each day after the fourth or fifth, but an interval of not less than eight or nine days after delivery should elapse ere she leaves her bed. This length of time at least is required for the initiatory processes which the uterus undergoes in returning to its normal state. Should the coloured discharge persist longer than normal, or return after having disappeared, the recumbent posture should be maintained or resumed for some time, the liquid extract of ergot being administered thrice daily in 20-minim doses. When all goes well, some weeks should pass before the patient undertakes any duties involving muscular exertion.

We have only briefly referred to the lochial discharge which comes from the parturient canal after labour. It is derived chiefly from the uterus, especially from the placental site, but comprises also secretions from the cervix and vagina. At first it consists of pure blood; in a day or two it is a serous fluid mixed with decidual débris and tinged with blood; it has a characteristic sickly odour, and fades in depth of colour day by day, becoming about the eighth or ninth day more or less puriform. The lochia should now be inconsiderable in amount; the parts remain more than usually moist, however, for three or four weeks. The local treatment consists in frequent cleansing, and in the prevention of infection from without by the application of absorbent pads. The douche is not ordinarily required in private practice, but in cases where the discharge is scanty, or is more than usually offensive, much

good will be done by warm antiseptic vaginal irrigation twice each day. Cases in which the loss of blood is too profuse and is not relieved by absolute rest and ergot should, in the absence of pelvic inflammation, be regarded as cases of secondary hæmorrhage, and treated by clearing out the uterus.

Lactation occurs in the majority of women without much trouble; in some, milk is present before delivery, in others it does not appear until after three or four days. The average time for the appearance of milk is probably from twenty-four to forty-eight hours after labour. The symptoms of incipient lactation are turgescence of the mammary vessels, shooting pains in the glands, accompanied with a sensation of tension, a slight rise of temperature, and in some cases increased vascular action, shivering, furred tongue, anorexia, etc., often due, I think, to slight septic influences, rather than to the mammary condition alone. On applying the child a peculiar yellow fluid called colostrum is obtained; this "first milk," containing albumen, coagulates with heat, and under the microscope reveals the presence of free fat granules, with large fatty and granular corpuscles, the so-called colostrum corpuscles, which are really cells shed from the secreting acini; it acts aperiently on the child, and serves to clear out the infantile alimentary canal. After a day or two colostrum gives place to ordinary milk, which, containing casein instead of albumen, is not coagulable with heat; the breasts then lose their sensitiveness, and lactation is established. In some women there is great difficulty in inducing the flow of milk to appear, and sometimes still greater in maintaining it. Early but not too frequent application of the child to the breast, hot fomentations, and friction with mild stimulating liniments, are the means

usually adopted to promote lactation ; to these must be added a carefully regulated diet, and, later on, a fair amount of outdoor exercise. Sometimes the mammary secretion is greatly in excess of the infantile requirements, and the persistent overflow of milk causes much annoyance. In many cases this excessive secretion diminishes when the patient becomes able to move about ; if not, belladonna may be applied in the form of a plaster, the ingested fluids reduced to a minimum, iodide of potassium and saline purgatives, such as the following mixture, administered :—

℞.	Magnes. Sulphatis . . .	oz. 1
	Mannæ	oz. ½
	Acidi Sulphurici Diluti . .	min. xx.
	Sp. Chloroformi . . .	fl. oz. ½
	vel Syrupi Zingiberis . .	fl. oz. 1
	Infusi Rosæ Co. ad. .	fl. oz. viii.

An eighth part, with an equal bulk of water, to be taken early every morning.

When the milk is tardy in making its appearance, the child may be temporarily fed with a few spoonfuls of cow's milk mixed with an equal quantity of water, to which a few grains of sugar have been added—only a couple of ounces being taken by the child each time of feeding. As previously stated, the application of the child to the breast should not be too frequent until the flow of milk is established, twice or thrice a day being quite often enough to stimulate the glands into activity. When lactation is established the child should be accustomed, as much as possible, to take its nourishment at stated intervals, two or three hours being allowed to lapse, and a little longer during the night-time,

between each application to the breast. It is injurious to both mother and child to be constantly putting the infant to the breast in obedience to its every cry.

In primiparæ the nipples are occasionally so flat that the infant is unable to seize them and to draw the breast, hence various forms of exhausting glasses have been invented with a view to remedy this defect. They should be carefully used, otherwise excess of pressure may lead to inflammation of the mammæ. Sometimes another and older infant, with more tact in the art of supplying its wants, is able to draw out the nipple, or the assistance of an adult may be put in requisition for this purpose.

One of the most painful of the minor mammary affections is excoriation of the nipples. This usually occurs in cases where the nipple projects insufficiently, and in others where, after suckling, milk has been left to go sour and irritate the parts; the excoriations scab over during the intervals between suckling, but on reapplying the child the scab is torn off, and by degrees a simple excoriation is converted into the still more painful affection—fissure of the nipple. So acute is the pain that the mother frequently looks upon her maternal duty with the utmost dread, and the mental depression arising from this condition may eventually lead to suppression of the lacteal secretion. It is well to provide against the possibility of excoriation by frequently bathing the nipples during pregnancy with brandy, spirits of wine, or a solution of tannin (1 in 20). Gentle passive movements are useful also in cases of retracted nipple; but not the least important prophylactic measure is to cleanse both child's mouth and nipples with borax solution before and after the breast is given, and to pay particular attention to

keeping the nipples dry. When excoriation or fissure has occurred, the only effectual remedy, other than weaning the child, is to protect the nipple with a shield, so as to prevent direct contact with the child's lips, and thus give time for the sores to heal; this may be facilitated by keeping the nipple very clean and bathing it with a solution of borax and tannic acid, or painting it with a strong solution of nitrate of silver.

During lactation the breasts are liable to attacks of acute inflammation, which not unfrequently result in the formation of that most painful and troublesome ailment known as milk or *mammary abscess.* This accident is most common during the first two months after delivery, though it may occur at any period of lactation, or even before labour. Mr. Nunn, in a paper published in the *Obstetrical Journal* for 1862, states, as the result of his experience, that milk abscess occurs at the rate of 56 per cent during the first two months after parturition, at the rate of 14 per cent during the subsequent seven months, and rises to 29 per cent after the ninth month. The increased percentage after the ninth month is attributed by Mr. Nunn to a vitiated condition of the system induced by over-lactation. Mammary abscess may result from various causes; perhaps the most frequent is a fissured or ulcerated nipple, which, by infection through the open lymphatics, and the constant irritation produced by the act of suckling, causes inflammation and subsequent suppuration of the breast. Mechanical injuries, colds or surface chills, or over-distension of the lacteal ducts, caused either by blocking up of their orifices or by prolonged abstinence on the part of the infant, are also important factors.

The *Symptoms* commence with acceleration of the

pulse and elevation of temperature, the amount varying with the gravity of the case. If the mischief is considerable, the constitutional symptoms are very marked; a well-defined rigor usually announces the formation of a large or deep-seated abscess. The affected breast is tense and very painful to the touch; at first there is no change either in colour or contour, but in a little time a localised swelling appears, the skin immediately over it first blushes and then deepens in colour until the well-known glazed fiery hue is attained which indicates that pus is finding its way to the surface. The whole gland, especially the site of the abscess, is now exquisitely painful, the least movement or touch being productive of the greatest agony; if allowed to take its course, the abscess in time bursts, and relief is at last obtained. Such is the progress of a single mammary abscess, but unfortunately this affection is apt to take on a multiple form, abscess after abscess forming, until in severe cases the whole organ is riddled in all directions, and the gland itself sloughs away leaving a number of fistulous openings, often exceedingly difficult to heal.

The *Treatment* of mammary inflammation necessarily varies according to its stage of development. From the first it is generally necessary to withdraw the child from the affected breast, any attempt at suckling being attended with excessive pain. Fissures or excoriations should be promptly attended to in accordance with the methods previously described. The primary stage of inflammation should be combated by "drawing" the breast with the breast-pump, by smearing it with extract of belladonna rendered fluid by the admixture of either water or glycerine, followed by the application of hot fomentations and poultices, simultaneously with

which salines and bromide, or iodide of potassium, should be administered internally. By these means the tendency to lacteal secretion is checked, and resolution of the inflammatory products promoted. Should the breast suppurate, the first decided manifestation of pus demands the use of the bistoury. If a free opening is made, the operation should be performed with the antiseptic precautions now usually adopted in surgical operations of this kind. After evacuating the matter, which can only be done in many cases by breaking down a number of septa within the gland, drainage should be provided for, and equable pressure by means of plasters and bandages should be maintained over the breast to promote closure of the abscess. In the case of multiple abscesses the resultant sinuses, if slow to heal, should be laid open, the suppurating cavities made one, and treated with stimulant antiseptic applications. During the earlier stage, when the pain is great, relief must be afforded by the administration of morphia, either by the mouth or hypodermically. After suppuration is established, quinine and iron, with generous diet, including stimulants, are required to compensate for the systemic depression produced by the exhaustive effects of the purulent discharge and loss of rest.

The question of nursing is sometimes referred to the practitioner. Broadly speaking, every mother ought to nurse her child, or at least to provide a healthy and efficient substitute. Exceptions, however, are obliged to be made on behalf of those who, from constitutional or local causes, are unfit to perform the duties of nurse, and are at the same time unable to procure a wet-nurse. Flat or retracted nipples and a lack of milk of course interfere with suckling. Amongst the constitutional affections pro-

hibiting nursing, such as phthisis and syphilis contracted during late pregnancy, I should like particularly to refer to chronic heart disease, there being little doubt that many patients thus afflicted are materially injured by being allowed to suckle their offspring. Angus Macdonald, in his elaborate treatise on chronic disease of the heart in pregnancy and childbed, states that in such cases suckling tends to keep up the cardiac hypertrophy and to increase the risks likely to arise from the diseased condition.

As a substitute for the breast, diluted cow's milk sweetened with a little white cane-sugar or sugar of milk may be administered by the feeding-bottle. For the first few weeks two parts of water should be added to the milk. After a month the proportion of added water may be gradually lessened till at three months equal parts of water and milk are used; at six months two of milk to one of water; and at nine months the child may take pure milk with some wheaten food (bread) and a little beef-tea or gravy. If possible, the milk should be obtained from one particular cow, and if any length of time be occupied in transit, as is usual in towns, the milk should always be boiled before being used.

Cow's milk, as compared with human, has the disadvantage that the casein is precipitated in the child's stomach in the form of large curds, difficult of digestion, and not as a flocculent deposit fairly readily acted upon by the gastric juice. This is to some extent obviated by the dilution, and to this end barley water may be substituted for plain water, or even peptonising the milk may be tried. Should the curds still irritate, one part of cream to three of water may be given, and after the third month some artificial food for infants, such as Liebig's.

Condensed milk, though containing too much sugar,

may often be employed with benefit, especially in cases where there is a tendency to diarrhœa. One part to twelve of water is about the proportion for the first month, and later it may be strengthened by degrees. The infants fatten on it, but if continued beyond three months its use probably tends to the production of rickets. Unsweetened condensed milk is better, but it only keeps a short time after the tin is opened.

I take this opportunity of protesting against feeding-bottles furnished with a long snake-like tube. They have two serious disadvantages—first, the tube, from its inordinate length, cannot be properly cleaned, for the mere passage of hot water through it is insufficient to free it from the decomposing taint which contact with milk leaves behind; and secondly, it facilitates the obnoxious plan adopted by many nurses of placing the teat in the child's mouth, and allowing it to remain until the contents of the bottle are exhausted; this may not take place for several hours, and in the meantime the milk is rapidly approaching the condition of lactic acid, and as a consequence the child is ill nourished, and is perpetually troubled with the symptoms of indigestion. The old-fashioned boat-shaped form of feeding-bottle obviates both these defects, as there is nothing to clean except the bottle and teat, the teat being readily turned inside out for thorough purification, and the shape of the bottle renders it necessary for the nurse to hold it whilst the child is feeding, thus guaranteeing the supply of food only when required. After each feeding the bottle should be immediately placed in cold water containing a little borax, and before being used again it should be scalded out, the teat being treated in the same way.

When the services of a wet-nurse are deemed requisite, the choice usually devolves upon the

medical attendant; in making the selection attention should be paid to the general health both of the candidate and of her offspring. The nurse should be between twenty and thirty years of age, well developed, good-tempered, and free from cachectic taint. The breasts should be plump and firm, giving evidence of a good supply of milk, which on microscopic examination should reveal abundance of milk granules; the nipples should be prominent, and free from fissures or excoriations. The condition of the teeth, tonsils, cervical glands, skin, and hair, should be investigated to guard against the selection of a scrofulous or syphilitic subject. The nurse's child should be examined as to the state of the anus, skin, and nasal cavities, and also as to its general condition. The age of the infant should be nearly the same as that of the child about to take its place. The diet of a wet-nurse should consist of plain nourishing food, over-feeding either in quantity or quality being avoided. It must be remembered that the rank of life occupied by women who usually fulfil this duty has not accustomed them to rich and varied food, and consequently that a sudden change in the character of their food is apt to disorder the digestive organs and consequently to impair the quality of their milk. For the same reason it is well to see that the customary potations of beer and stout are not excessive. A regular system of out-door exercise is also obviously necessary for the maintenance of health.

CHAPTER XIX

OBSTRUCTED LABOUR

DEFORMITY of the maternal pelvis, the anatomical varieties of which have been previously described, is a frequent cause of obstructed labour.

With small degrees of deformity delivery at full term by natural powers is possible in cases where the presentation is normal, and the uterine and auxiliary forces are strong. Some modification in the mechanism is to be noted. *First*, in cases where the contraction is limited to the conjugate of the brim, *i.e.* in simply flattened pelves, the head enters the brim in the transverse diameter while flexion is at first deficient, the anterior fontanelle being as low or lower than the posterior. The bi-temporal rather than the bi-parietal diameter engages with the conjugate, and to facilitate its passage the Naegele obliquity of the head is well marked, and the anterior parietal bone is therefore much lower than the posterior. Once the brim is passed the skull then is at liberty to undergo the usual flexion and rotation.

Secondly, in cases of general contraction the mechanism varies according as the deformity is uniform or accompanied by marked flattening. In the former case the head enters the brim in the oblique diameter with the posterior fontanelle low

down, flexion being exaggerated, but there is little or no Naegele obliquity. When there is combined pelvic flattening and general contraction, the head enters the brim in the transverse diameter, necessitating both extreme flexion and Naegele obliquity.

With regard to the extent of contraction consistent with *natural* delivery, we may say that, other things being favourable, a child at full time may possibly be delivered through a simply flattened pelvis with a conjugate of 4 to $3\frac{1}{2}$ inches; on the other hand, a comparatively small degree of general contraction may necessitate skilful operative interference.

We now pass on to those cases of deformity where the obstruction is greater than the natural powers can overcome, indicating the steps advisable to be taken in the varying degrees of abnormality.

Granted an average-sized child at full term, live birth might (*v. infra*) be effected—

1. by *forceps*, where the conjugate is not less than $3\frac{1}{4}$ inches;
2. by *version*, where it is not less than $2\frac{3}{4}$ inches;
3. by *Cæsarian section*, where it is below $2\frac{3}{4}$ inches.

Symphyseotomy, of course, has to be considered. Its merits and demerits will be discussed later when the operation is described; it should *never* be performed when the conjugate diameter is less than $2\frac{3}{4}$ inches.

Craniotomy remains as a means of delivery *per vias naturales*. It obviously involves the death of the child, and, on the mother's account, should not be undertaken with a conjugate below 2 to $1\frac{3}{4}$ inches. Above this, say between $1\frac{3}{4}$ and $2\frac{3}{4}$ inches, the risk to the mother is not so great, therefore the choice between craniotomy and Cæsarian section must be

influenced by her condition, the wishes of both parents, and the signs of life in, or of death of the fœtus in utero.

The above indications as to treatment must be understood as referring chiefly to the simply flattened pelves. Other factors beyond the mere size of the conjugate have to be considered, and may materially influence the selection of the proper operative procedure. On the one hand, we have the mother's state, exhausted or not by the labour, her general health, and the complications of labour such as convulsions or placenta prævia; on the other hand are the fœtal conditions, as its presentation, position, prolapse of funis, and the presence or absence of signs of life, together with the estimated size of the head, and its state of ossification. Finally, as regards the pelvis itself, contraction in other directions as well as the conjugate greatly increases the severity of the operation needed for delivery. Forceps (in these cases preferable to version) will rarely succeed below $3\frac{1}{2}$ inches; symphyseotomy is inadvisable below 3; and where there is uniform contraction beyond an inch in all diameters, Cæsarian section is perhaps indicated. Craniotomy may be done even when the conjugate is 3 inches, but should always give place to abdominal section when it is below 2 inches.

If malformation is detected in the early months of pregnancy, the question of inducing premature labour should be considered. The rules to guide us relative to the necessity of performing this operation will be found in the section on Operative Midwifery.

Certain abnormalities of the soft structures of the parturient canal or contiguous parts are liable to give rise to obstructed labour.

Uterus.—The os may be partially or totally occluded. Total occlusion is a rare incident, since it must take place during gestation. The usual form of occlusion of the os consists in a superficial agglutination of its lips, which may be overcome by forcible pressure of the finger-nail during a pain, aided, if there is much resistance, by imparting a rotary movement to the finger. When once the os is permeable, dilatation proceeds in the ordinary manner. In very rare cases a more permanent kind of union takes place, resulting either from inflammation of the cervix or from injudicious cauterisation of the canal. This form may require the assistance of the knife, a careful examination being made to find any dimple which may represent the os; in its absence the most dependent part is to be selected. By means of a guarded bistoury directed by two fingers of the left hand, a very small opening is made consisting of a series of extremely short radiating incisions. In this way the bladder and rectum are avoided, as also are the laterally-placed uterine arteries. Further dilatation is obtained by Barnes' bags, or by gentle digital manipulation under chloroform.

Cases have occurred of adhesion between the fœtal membranes and the internal surface of the uterus in the neighbourhood of the os. The treatment is forcibly to separate the adhesions with the finger.

Rigidity of the os uteri is an important factor in the causation of obstructed labour, and often follows too early rupture of the membranes; it may be spasmodic or organic, varying from a mere inaptitude to dilate, to a cartilaginous and obstructive degree of induration. The treatment, as a matter of course, must vary with the degree of rigidity. General depletion and tartar emetic were formerly the trusted

remedies, but other less debilitating and disagreeable means are now preferred. Chloral hydrate in 15-grain doses, repeated every half-hour until it takes effect, is a very valuable remedy. Chloroform also, by relaxing spasm and lulling pain, is of great service. Belladonna used to be a favourite local application, but its efficacy is very doubtful. The two most effectual methods of treatment, however, are irrigation and hydrostatic dilatation. Irrigation is performed by passing the vaginal tube of a Higginson's syringe up to, but not into the os, and douching it with warm water for ten minutes at a time, repeating the operation at intervals until the os becomes soft and dilatable. Hydrostatic dilatation is effected by introducing within the os, with the aid of a uterine sound, one of Barnes' bags of suitable size, or similarly using de Ribes' bag. The bag is filled with warm water, and when distended remains *in situ* for about quarter of an hour, or until it is expelled. In the case of Barnes' bags, larger sizes are used in turn till the os is sufficiently dilated and the cervix is softer. By this means dilatation of the os is effected as in the ordinary process; for the rubber bag with its aqueous contents acts in precisely the same way as the natural "bag of waters."

In some cases where the rigidity is not excessive much help may be given by digital dilatation, which is effected by passing the thumb and two or three fingers within the os, and spreading them out in the form of a cone. This expedient, however, is best made use of under chloroform, as without an anæsthetic it is very painful for the patient; it will only succeed in slight cases, for the fingers rapidly become cramped and unable to continue their action.

Malignant disease of the cervix causes great

anxiety as regards delivery. When the disease is not far advanced, such softening of the growth may take place as to admit of labour being completed naturally ; but in severe cases, delivery of an average-sized child at term is attended with great danger to the mother from tearing of the cancerous tissue. Generally, therefore, it becomes a question of abdo-

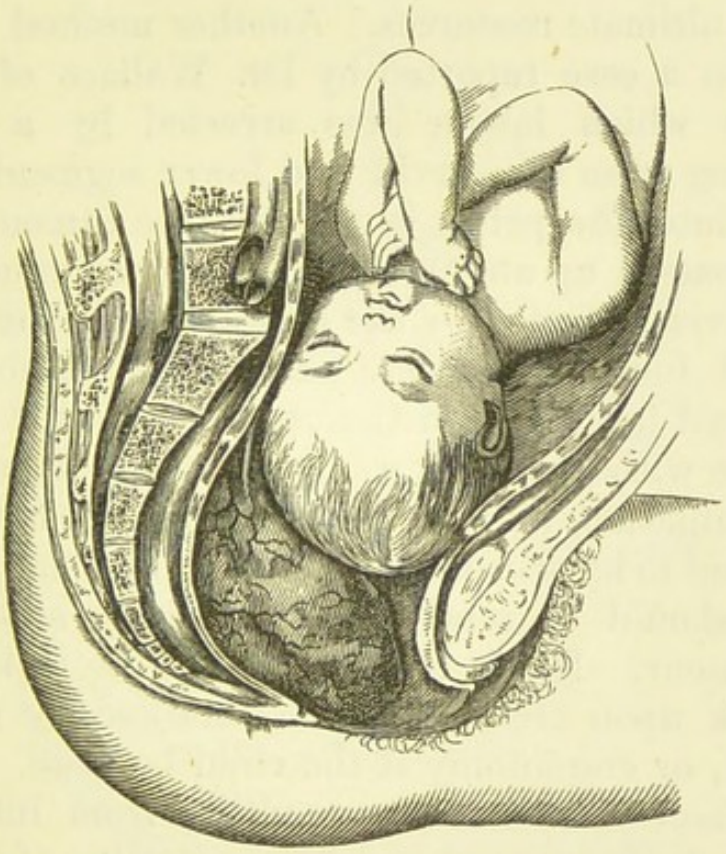


Fig. 139.—Labour impeded by Uterine Polypus.

minal section, Porro's operation being preferable to the Cæsarian ; the risk is probably smaller, and the removal of the uterus facilitates shrinkage of the growth sometimes to a marvellous extent. The alternative to abdominal section is craniotomy, but this is nearly if not quite as severe an operation for the mother, and gives no chance to her offspring.

Fibrous tumours of the uterus are occasionally the cause of obstruction to delivery. Sub-peritoneal

pediculated fibroids should, if possible, be passed up into the iliac fossa during an early stage of labour; chloroform being administered. Then the head of the child is made to engage in the pelvic brim, or if the cervix admits, forceps may be used to complete delivery. In intractable cases, or where a large interstitial fibroid of the lower segment of the uterus impedes labour, craniotomy and abdominal section are the ultimate resources. Another method is illustrated in a case reported by Dr. Wallace of Liverpool, in which labour was arrested by a fibroid projecting from the cervix and lower segment of the uterus into the pelvic cavity; as the tumour could not be passed up above the brim, it was enucleated, and delivery effected by the long forceps; the fibroid weighed fourteen ounces. A second tumour was discovered higher up in the uterus, but as it did not interfere with labour it was allowed to remain, and on examination, after an interval of two months, it was found to have disappeared by absorption. Fibrous polypi should be removed by twisting, scissors, or the écraseur. If this be not possible, the methods to fall back upon are enucleation, followed by forceps-delivery, or craniotomy if the child be dead.

Vagina.— Constriction resulting from inflammation, or cicatrices produced by the healing of wounds caused by previous instrumental or tedious deliveries, should be treated, after the inhalation of chloroform, by artificial dilatation with air or water bags, or, in the case of cartilaginous bands, by careful incision. Vaginal cysts and tumours may obstruct labour; they are to be treated on general principles.

Vulva.—Rigidity of the vulvar orifice, causing difficulty of delivery, should be treated by assiduous fomentations of hot water. Lubrication of the vaginal aspect of the perineum is also very useful; in cases

of extreme rigidity small lateral incisions of the perineum may save extensive rupture. Serous infiltration to a degree incompatible with the application of the forceps without considerable bruising, should be allowed to escape by puncturing with the point of a lancet. Hæmorrhagic infiltration, or thrombus of the labia, may be checked by the applica-

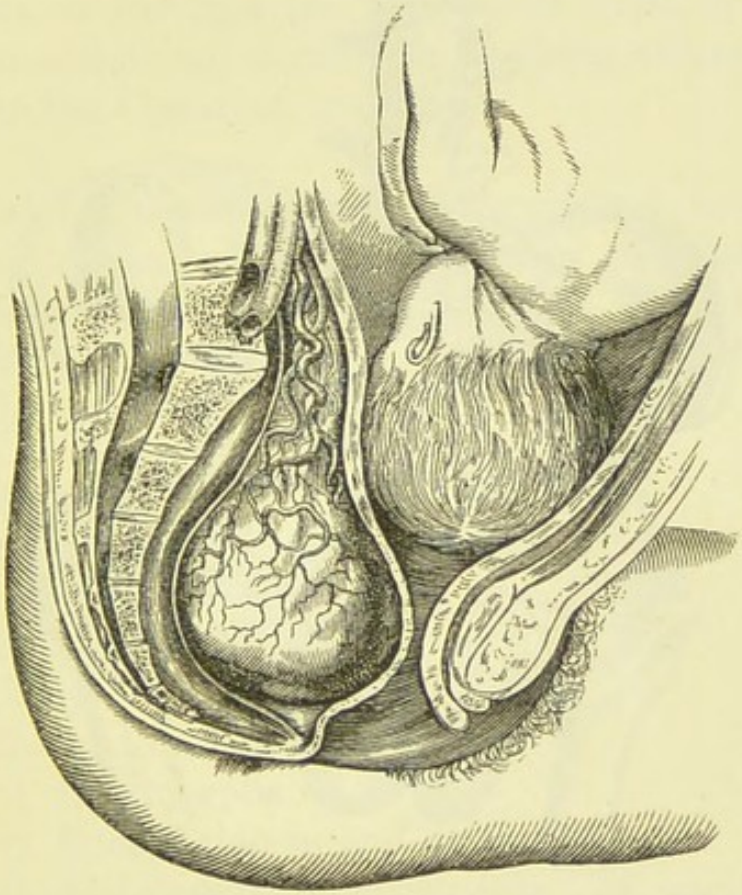


Fig. 140.—Labour impeded by Ovarian Tumour.

tion of cold, but if the swelling still increases and is likely to burst, it is better to lay it open with the knife and to apply styptics. Labial neoplasms occasionally obstruct delivery, and must be dealt with according to circumstances.

Hymen.—A persistent condition of this membrane has ere now impeded delivery; if it will not give way, the knife must be resorted to.

The *bladder* may constitute an obstruction to the passage of the child. A distended bladder, normally placed, may cause much delay; if prolapsed, forming a cystocele, it will, unless relieved of its contents, still further interfere with due progress. Vesical calculus should also be borne in mind. If found

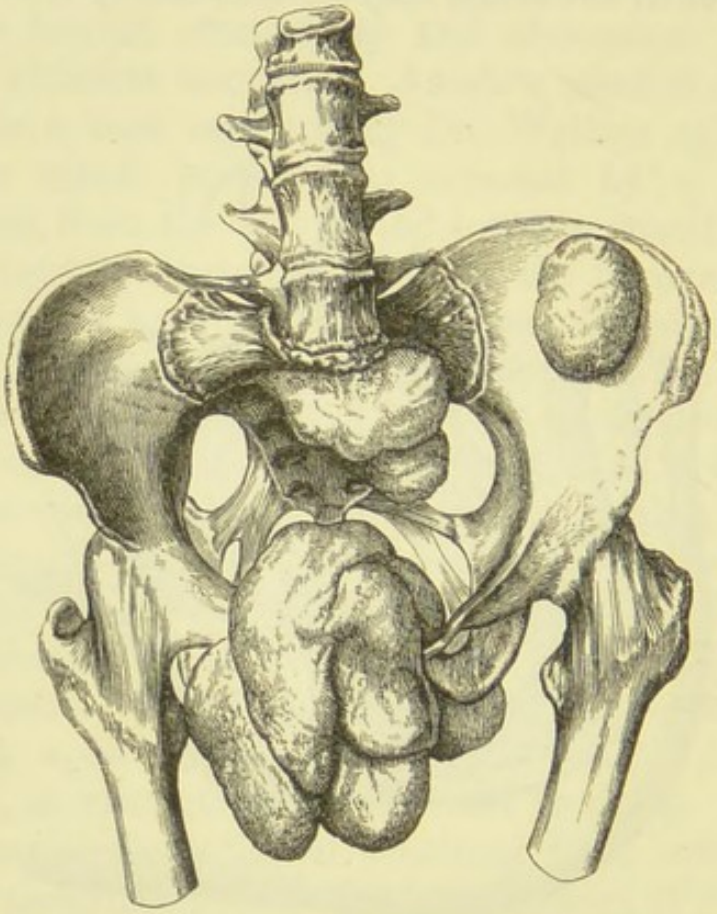


Fig. 141.—Cancerous Growths from the Bones of the Pelvis, causing Deformity.

early, the stone should be lifted above the pubes; but if this cannot be done and delivery is prevented, rapid dilatation of the urethra and extraction of the stone, or vaginal lithotomy, must be performed.

Rectocele and impacted fæces may also be present. Diagnosis is easy on first examination, and if scybala are felt through the vaginal wall, the treatment is obvious.

There only remains to be added that some other pelvic affections, such as tumours of various kinds arising from bone, ovary, etc., may give rise to difficult labour. New growths of bone necessitate delivery on the lines indicated when considering pelvic deformity. Ovarian cysts obstructing the pelvis should be lifted above the brim if possible, but if adhesions prevent, it may be necessary to tap per vaginam, or through the abdominal walls, or even to perform abdominal section, comprising either ovariotomy or the Cæsarian operation.

Fœtal Organism.—Having considered labour obstructed by maternal causes, we now pass on to the fœtal conditions which may interfere with delivery; these may be enumerated in some such list as the one following :—

Large child.
Short funis.
Malpresentations :
  Transverse.
  Complex.
Malformations of single fœtus :
  (*a*) Hydrocephalus.
  (*b*) Encephalocele and spina bifida.
  (*c*) Abdominal enlargements, as ascites, distended bladder, hydronephrosis, tumours of liver, kidneys, uterus, etc.
  (*d*) Extroversion of viscera.
  (*e*) Acardiac, acephalic, or amorphous monster.
  (*f*) Anencephalic monster.
  (*g*) Supernumerary limbs.
Conjoined twins :
  (*a*) Trunks joined in front.
  (*b*) Trunks joined behind.

(*c*) Dicephalic, single-bodied monsters.
(*d*) Double-bodied, single-headed monsters.
(*e*) Irregular forms, *vide* Figs. 149, 150 (Hall and White).
Locked twins.

Undue size of a child of normal type will obviously occasion more or less delay in parturition, and may

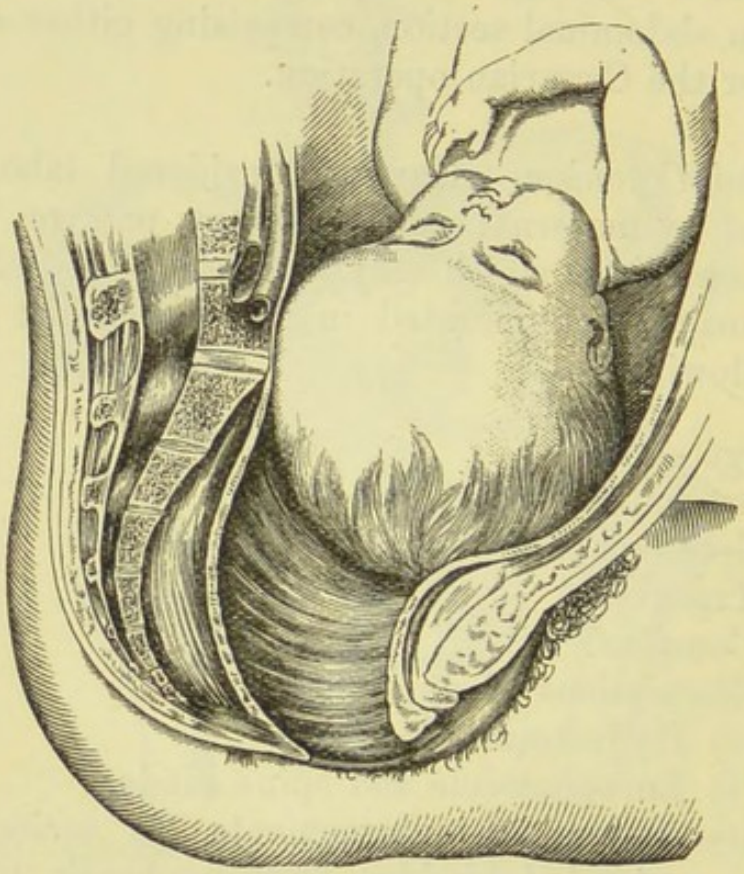


Fig. 142.—Labour impeded by Hydrocephalus.

necessitate treatment identical with that which is required when the disproportion arises from contraction of the maternal pelvis.

It is evident that *shortness of the funis* may hinder delivery. The shortness may be real, as in a case in which Dr. Braxton Hicks divided in utero a funis only four inches long; or simulated, when the

available length is diminished by coils and loops round part of the fœtus. In the latter case, if the funis cannot be freed, it should be quickly divided between ligatures, delivery accelerated, and artificial respiration promptly adopted.

Obstruction from *malpresentations* has already been referred to in the chapter on the Mechanism of Labour.

Fig. 143.—Hydrocephalus: Breech Presentation.

A most important cause of obstructed labour on the part of the fœtus is *hydrocephalus*. Sometimes the fœtal head is immensely enlarged; and although its contents are mainly fluid, rendering the head capable of being moulded to a considerable extent, the obstruction to delivery is usually so great as to require the intervention of art. This is accounted for by Tyler Smith on the ground that the head,

by reason of its abnormal shape, does not undergo the necessary rotation in its passage along the parturient canal, and therefore has to be expelled by sheer force. In cases of hydrocephalus, pelvic presentations are more frequent than with healthy children.

Diagnosis.—When the head presents, it gives to the fingers, especially during a pain, the sensation of a bag containing fluid; the wide separation and irregular projection of the cranial bones lead also to a suspicion of hydrocephalus. In pelvic presentations the diagnosis is more difficult, and indeed can hardly be established until the head becomes arrested in the pelvis.

Fig. 144.—Encephalocele.

Treatment.—If the diagnosis is certain, and the uterus is unable to expel the fœtus, the proper plan is to puncture the head and cause it to collapse from liberation of the fluid. Then, if the head is not too low, it is advisable to bring down the feet, as the

flaccid cranium, by not participating in the necessary movements, hinders expulsion. If the head is advanced too far for version to be easily performed, the case must be left, after perforation, to the efforts of nature, or the cephalotribe may be used. In pelvic presentation, perforation, when necessary, should be

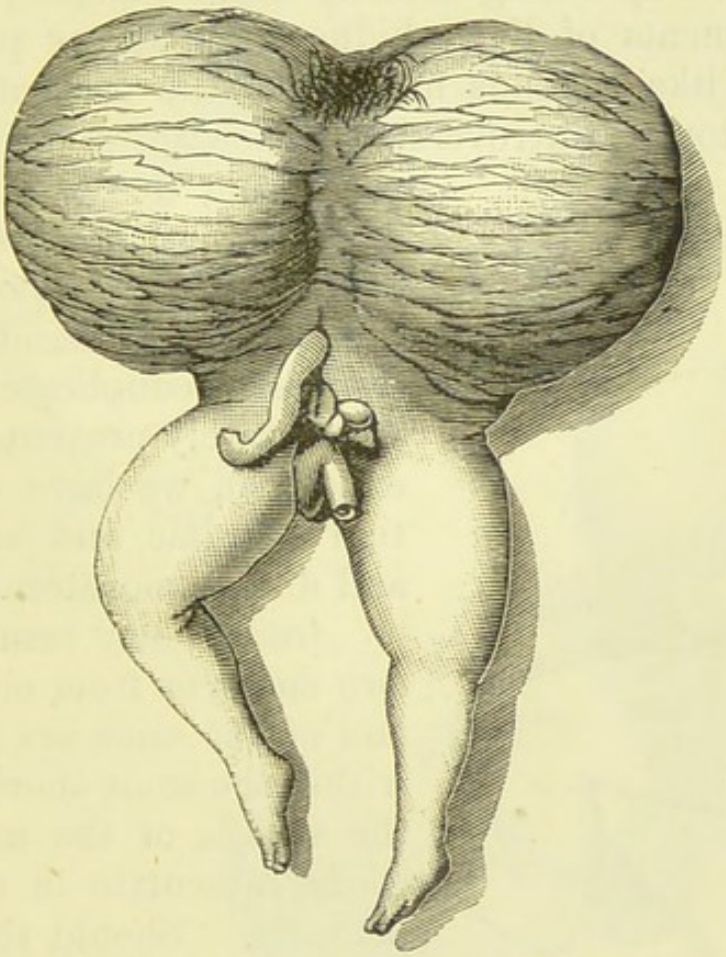


Fig. 145.—Acardia. (Lusk.)

done through one of the spaces between the cranial bones.

Cranial meningocele or encephalocele, and spinal meningocele (*spina bifida*), usually do not greatly impede parturition. In cases of the former class the head and tumour are usually born separately by a process of evolution. Fig. 144 shows a well-marked specimen which was delivered in the manner indicated—the

head coming first, the body next, the watery tumour being removed by traction.

Abdominal swellings may lead to impaction of the fœtal body in the pelvis. Fluid collections, as ascites, distended bladder, hydronephrosis, or hæmatometra, when interfering with the course of labour, may be evacuated by a long trocar. Solid tumours, such as enlargements of liver, kidneys, spleen, or pancreas, may on like grounds necessitate the performance of embryotomy. Extroversion of the viscera, whilst often perplexing in the matter of diagnosis, is not usually a cause of difficult labour.

Fig. 146. — ANENCEPHALUS. (Radford Museum, St. Mary's Hospital, Manchester.)

Monsters. — Besides instances of reduplicated limbs, which rarely prevent natural expulsion, we have to mention acardiac and acephalic and double monsters.

Acardia may result when two embryos from one ovum and of the same sex develop within the same chorion, and the vessels of the umbilical cords inosculate in a single placenta. Should the heart of one be proportionally very strong, the blood-stream in the umbilical arteries of the other may be reversed:—its heart is undeveloped, and an amorphous mass is formed, or an embryo without head (acephalic), having more or less perfect lower extremities. The Fig. 145 from Lusk shows the latter condition. Delivery of the normal fœtus usually precedes that of the monster.

An *anencephalous* fœtus (Fig. 146) when the head

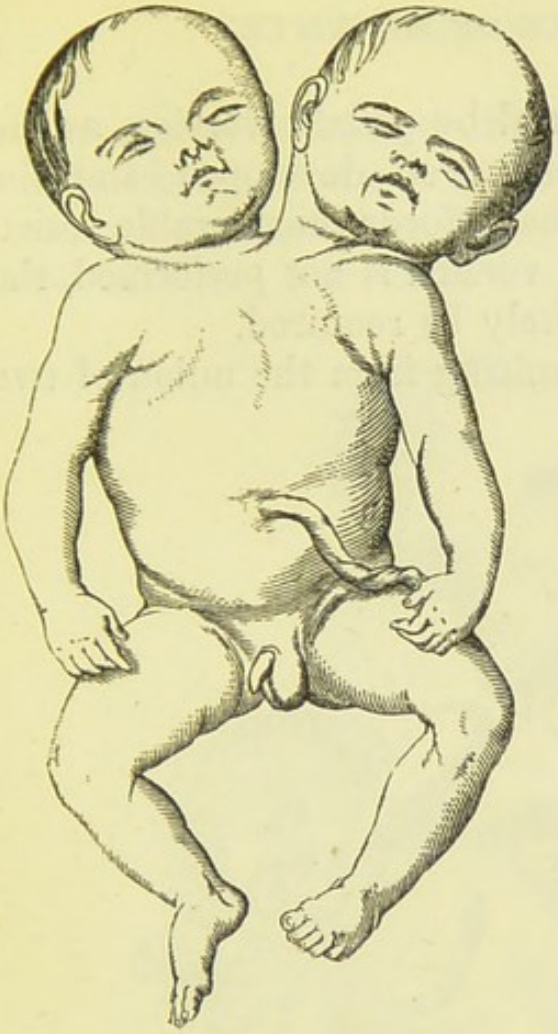


Fig. 147.
DOUBLE-HEADED MONSTER.

Fig. 148.—DOUBLE MONSTER.

(From a specimen in the Radford Museum, St. Mary's Hospital, Manchester.)

presents is best delivered by podalic version, as the trunk is generally pretty well developed, and the undilated parturient canal affords considerable resistance to its passage. If version is not performed, the blunt hook will most likely be required.

In *double monster*, resulting from the union of two

Fig. 149.—Fœtal Monstrosity. (After the late Richard Hall, St. Mary's Hospital, Manchester.)

ova, no rule can be given either for diagnosis or extraction, since cases differ so greatly in degree and kind. It is evident that the greatest obstruction will result from a double-headed condition. The single or double body generally affords little hindrance of itself. In these cases, in cephalic pre-

sentation, evolution usually takes place, one of the heads being expelled, whilst the other is retained above the pubes; the trunk belonging to the first head follows, and then the second fœtus is born

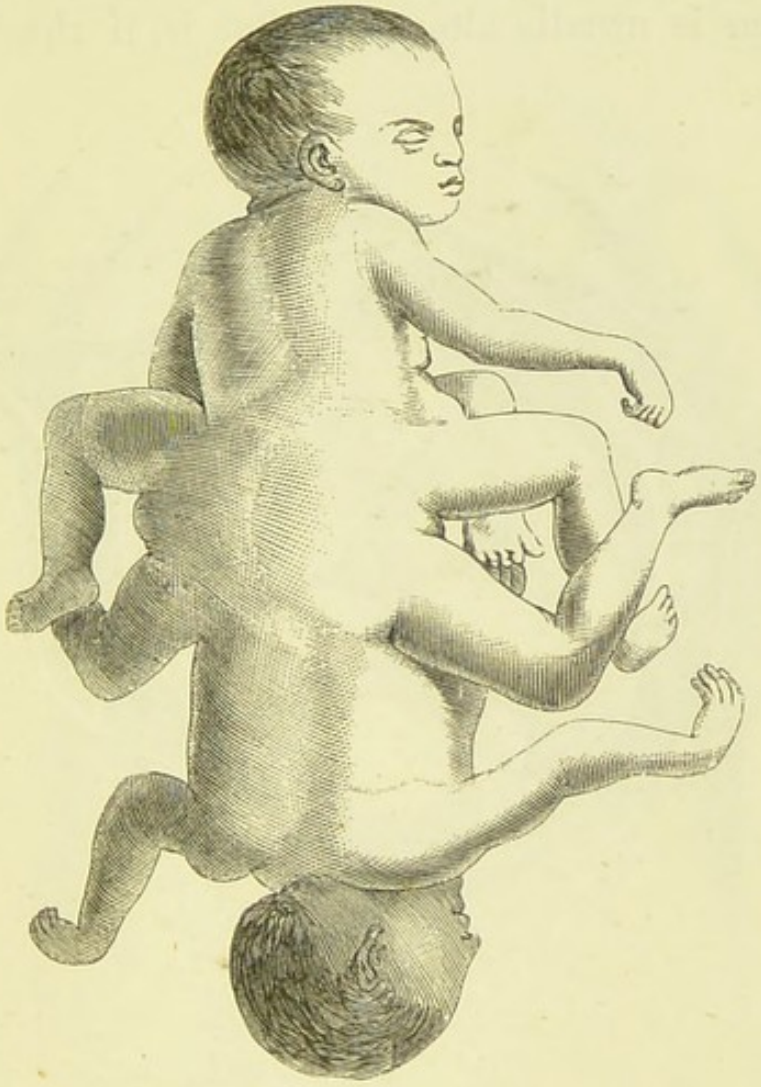


Fig. 150.—Double Fœtal Monstrosity, united at the Lower End of each Trunk. (After the late Thomas White, St. Mary's Hospital, Manchester.)

breech first. In other cases the heads are successively born, and the trunks follow; if labour be brought to a standstill with one head in the pelvis, decapitation and version may be performed. In breech presentation the posterior head may be brought into the

pelvis before the anterior one by carrying the delivered bodies well towards the mother's abdomen, but perforation of one head may have to be resorted to in order to effect delivery.

Locked Twins.—In ordinary twin births the presentation is usually alternate, that is, if the first is

Fig. 151.—Twins.

cephalic the second will be breech. As a rule no more difficulty is encountered in expulsion than may be naturally expected from the force of the womb, whilst extruding the first child, being transmitted indirectly through the second fœtus, a condition much less favourable to speedy delivery than the usual

direct uterine action. In some instances when the first child presents by the breech, the head of the second approaches or enters the pelvis before the first is born, and the two heads become locked together : in these cases it is always advisable to try manipulation with the patient in the genu-pectoral position. It may be

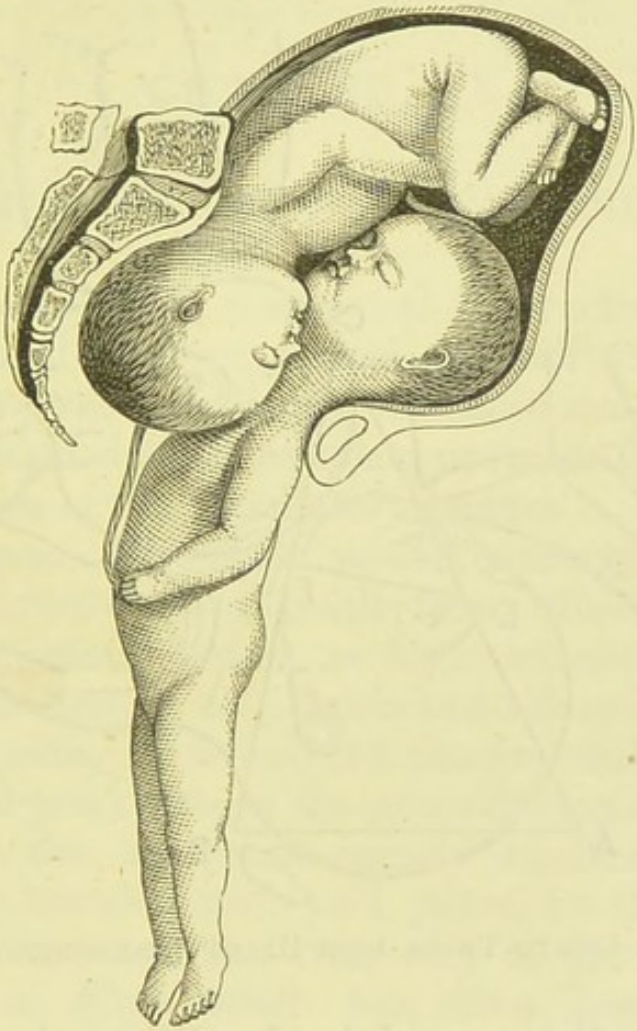


Fig. 152.—Locked Twins.

possible to push up the obstructing head above the brim so as to free the passage for the head belonging to the breech already delivered. If this cannot be done, further operations must be undertaken, and it must be remembered that, of the two, the second child will be the more likely to be alive. Possibly the head of the *second* child may be extracted along-

side the body of the first by forceps; but the head of the *first* child may have to be perforated, or severed from the trunk and pushed back whilst the second fœtus is extracted with the forceps, after which the forceps or cephalotribe is introduced to

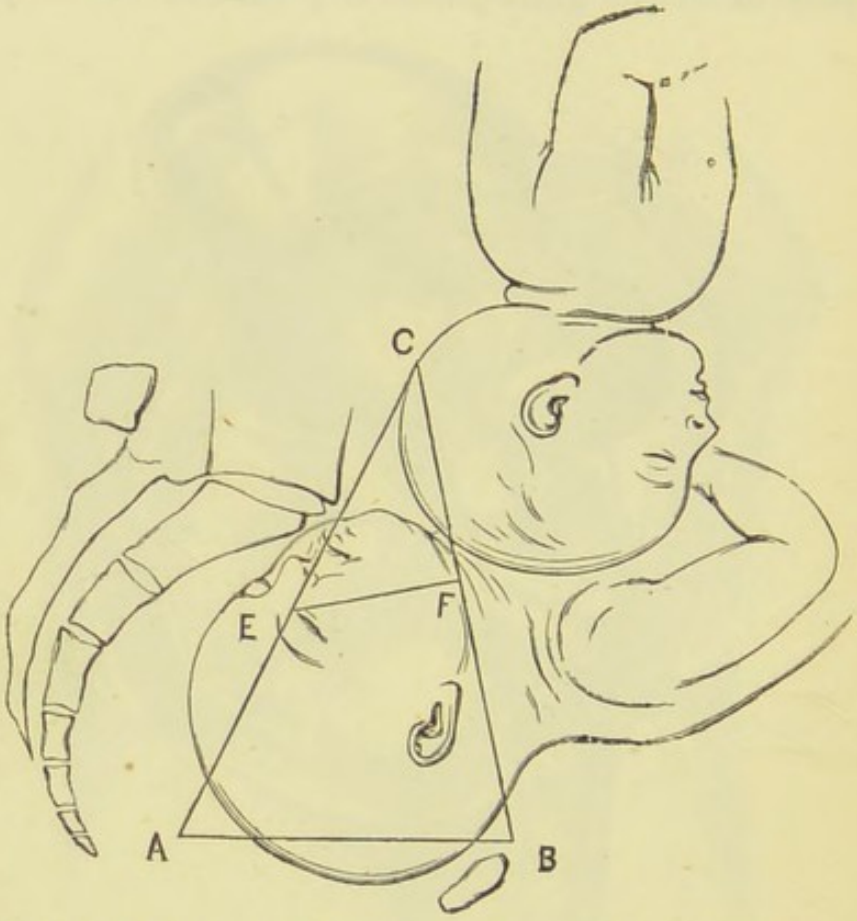


Fig. 153.—Locked Twins, both Heads presenting. (Barnes.)

bring away the severed head. When the heads of both children present, the forceps should be applied to the lowest, the other being pushed out of the way as much as possible during extraction; an anæsthetic will aid measures of this kind. Craniotomy, though rarely necessary, is a last resource.

CHAPTER XX

PROTRACTED AND HASTY PARTURITION

HAVING considered mechanical obstructions in the maternal and fœtal organisms as hindrances to parturition, we will now discuss the cause and treatment of retardation, dependent solely upon insufficiency or misdirection of the expulsatory powers.

Feebleness of uterine action, otherwise known as *uterine inertia*, may result from causes affecting either the general system, or from causes localised in the uterus itself. In a feeble and relaxed condition of the system, it is easy to comprehend that the uterus will participate in the general want of tonicity, and that the assistance usually rendered by the voluntary muscles will, *pari passu*, be diminished. The sedentary and luxurious way of life of women dwelling in large towns too often leads to this enervated condition. It must be remembered that, in cases of obstruction, when a patient has been in hard labour for some time without advancing towards delivery, the rhythmical action of the uterus gives way to one of continuous contraction. Dr. Braxton Hicks, in calling attention to this subject, shows that such a state is frequently mistaken for powerless labour, it being supposed that the uterus is inactive and relaxed. If this condition of continuous contrac-

tion is allowed to go on without interference, the genital canal becomes hot, dry, and tumid, the pulse rises to 100 or more, the tongue becomes furred and dry, and if relief is not at hand the symptoms will assume a typhoid form, and the patient will die. There is also much risk to the child in the earlier stage of continuous uterine contraction, partly from the sustained pressure and partly from the diminution of the calibre of the uterine blood-vessels depriving the placenta of its due supply of blood. Continuous contraction may be diagnosed by the uterus being so closely in contact with the child as to assume its shape, percussion showing, when the fœtal outline is passed, an immediate cessation of dulness, instead of its continuing some distance, as is the case in relaxed uterus; the womb feels firm, and the head, moreover, is fixed in the pelvic brim, and cannot be easily moved. Retraction may be so marked that Bandl's ring can be plainly felt some distance above the pubes. The condition is most often due to obstruction, and rarely ends in natural delivery, the forceps being usually required. Ergot is absolutely contra-indicated in these cases of tetanic uterine action, and version is difficult and is attended with considerable risk of laceration.

Certain diseases, as bronchitis and other pneumonic affections, cardiac disease, and paraplegia, by interfering with the action of the respiratory muscles, may deprive the uterus of the assistance it usually receives and consequently retard delivery. Painful pre-existing disease, by withdrawing nerve force from the uterus, will considerably modify its action. Angus Macdonald, in the work previously quoted, stated that the presence of cardiac disease ought always to lead us to lessen, as far as possible, the effects of the bearing-down efforts either by timely

application of the forceps, or by the performance of version, especially if the second stage of labour is prolonged.

Amongst the purely uterine causes of tedious labour are malformations, as double uterus, congenital imperfection in development, inflammation, over-distension through excess of liquor amnii, or the presence of twins, and premature or retarded rupture of the membranes. The age of the patient—excessive youth or the converse—and rapidly recurring pregnancies, by interfering with the efficient development of the organ, tend to enfeeble the expulsatory power.

Temporary suspension of uterine action may be produced by mental causes, such as the presence of a strange accoucheur, or the reception of unwelcome news.

Misdirection of the expulsatory force is another cause of tedious labour. If the uterus is anteverted, as in cases of "pendulous belly," the child is driven against the promontory of the sacrum, the anterior uterine lip occupying the position normally occupied by the os, and thus helping to prevent a downward movement of the child. If the uterus is retroverted, the child is forced against the symphysis pubis, and the passage is blocked by the posterior uterine lip. Undue lateral obliquity also places the uterine force at a disadvantage, and moreover tends to the production, in vertex presentations, of the deficient eflxion which has already been mentioned as a cause of delayed labour.

Treatment.—Many of the causes of tedious labour can only be treated prophylactically; when, therefore, the opportunity for giving advice presents itself, we should urge upon a patient the necessity of regulating her mode of life, of taking a due amount of exercise,

being careful in the matter of diet, and attending to the daily evacuation of the bowels. Any tendency to obliquity of the uterus during pregnancy must be rectified as much as possible by bandages and by the adoption of certain positions of the body. In anteversion an abdominal bandage so arranged as to lift up the uterus into a position more in accordance with the axis of the pelvic inlet, and the assumption of the supine position are indicated; in the case of retroversion all conditions which lead to this misplacement, as tight lacing and bandages, should be avoided. These remarks apply equally to the pregnant and parturient states, with this addition, that in retroversion, if miscarriage or abortion come on, the patient should be delivered on her hands and knees, so as to bring the os away from the pubic symphysis, while in anteversion the woman should lie on her back, to enable the child to escape the promontory of the sacrum, and the anterior uterine lip to ascend to its proper position; in furtherance of this object the fingers may be used between the pains to push up the protruding lip. In lateral deviation of the uterus during labour the patient should be made to assume the position which tends best to bring the uterus into the middle line of the belly.

Feeble action of the uterus in the second stage may be improved by encouraging the patient to bear down during the pains, and to rest during the intervals, since persistence of the expulsatory efforts between the pains serves only to fatigue the voluntary muscles. The uterus may also be excited to more vigorous action by the occasional introduction of the finger within the os, and by pressure on the perineum and abdomen. Of the medicinal excitors of uterine action ergot, quinine, and perhaps strychnia are alone to be relied on. Ergot may be given in the form of

powder or as a liquid extract. One scruple of the powder infused in hot water for five or ten minutes forms a dose; the fluid preparation may be administered in warm tea, the dose being half a fluid drachm. Quinine may be given in doses of ten to fifteen grains, repeated if necessary in a couple of hours; it has been recommended in the first and second stages of labour because it does not tend to produce tetanic contraction of the uterus.

The action of ergot usually becomes manifest in from ten to fifteen minutes; the pains increase in severity and duration, the uterine action gradually merging into a condition peculiar to the influence of this drug, that is, becoming continuous instead of intermittent. It will then be found, by placing the hand on the abdomen, that the uterus, between the pains, is in a state of tonic contraction. This state, inasmuch as it impedes the placental circulation, and thus interferes with the due supply of oxygen, is a cause of danger to the child, and if long exposed to this influence it will die asphyxiated. The mother may also be placed in jeopardy through the continuous violent action induced by ergot, for, should there be any mechanical impediment to delivery, the persistent and misapplied force of the uterus is liable to produce laceration of the soft parts, or even to rupture the organ itself. Therefore *never give ergot without ascertaining that there is no mechanical impediment to immediate delivery.*

The coexistence of a painful disease with parturition, or the violent pain produced by pressure of the head on the sacral nerves, may be mitigated by a few whiffs of chloroform. The same drug, too, is sometimes required for a hysterical or hyper-excitable patient who rapidly exhausts her strength by ill-timed exertions.

Irregular spasmodic contraction of the uterus, especially during the first stage, is best treated by the administration of opiates or chloral ; chloral is very comforting to the patient, as it soothes the nervous excitability whilst it permits the uterus to perform its function.

In a tedious labour, when the vaginal secretions are arrested and the canal becomes hot, dry, and painful, much relief is sometimes afforded by plentiful lubrication of the passage with some antiseptic unguent ; better treatment, however, consists in carefully expediting delivery by the forceps or other means, the risk of interference being smaller than that of delay.

HASTY LABOUR

This may be defined as the converse of the previous condition, the child being expelled in a preternaturally brief time after the commencement of labour. The causes are twofold—excess of power and diminution of resistance. So excessive sometimes are the uterine contractions that they resemble those produced by ergot, the whole function of parturition being performed with surprising celerity under pressure of a rapidly accumulating series of pains. This impetuous uterine action may be idiocratic, some individuals, or even whole families, invariably performing the final act of gestation with undue haste. It may be induced also by violent mental emotion, especially sudden and intense terror. Smallpox, and other febrile diseases, albuminuria, and the accumulation of carbonic acid in the blood, tend also to a like result.

The second cause—lack of normal resistance—may result either from excess of pelvic development,

or, what amounts in effect to the same thing, small bulk of the fœtus.

Amongst the evils to the mother which may result from too rapid delivery are rupture, prolapse, or inversion of the uterus, laceration of the perineum, post-partum inertia, and irregular uterine contraction, causing retention of the placenta or hæmorrhage. Temporary mania has also been induced by the extremely painful character of the uterine contractions.

The child is also liable to injury within the womb from undue compression, and in some cases externally, especially if the mother, not suspecting so rapid a termination to her sufferings, happens to be standing when expulsion takes place; fracture of the skull may result from a fall, or the child may lose considerable blood from rupture of the umbilical cord. Great risk also attends the infant in deliveries such as accidentally take place in the bath or water-closet.

Treatment.—When this condition is suspected, the patient should be kept in bed, and chloroform or opiates should be given. It is well for the patient to avoid the dorsal position. On the other hand, lying on the face or in the semi-prone posture removes any assistance which gravity might render to the expulsatory forces. Care should be taken not to irritate the uterus by frequent examinations, and the woman should be cautioned against making any voluntary efforts. If the perineum be in great danger, the progress of the head should be delayed by digital pressure, so as to allow time for relaxation, which may be aided by hot fomentations to the part. Should the uterus become prolapsed, it must be supported by a bandage or by the hand of the accoucheur. Other complications are to be treated as they arise.

CHAPTER XXI

PLACENTA PRÆVIA

Placental Presentation.—This, which is also frequently called *placenta prævia*, consists in the attachment of the whole or part of the placenta within that portion of the lower segment of the uterus which is subject to dilatation during labour. Three varieties are described: (1) *complete*, when the placental attachment involves the whole circumference of the os; (2) *partial*, when the placenta partly covers the os; and (3) *marginal*, when the edge of the placenta is close to the os, and can be felt by the finger introduced just within the os.

The usual position of the placenta is on the anterior or posterior wall of the uterus, more commonly the latter; it is more frequently on the right side than on the left.

The *causes* of abnormal attachment are not satisfactorily established.

The ovule, generally supposed to be impregnated prior to its arrival in the uterus, usually selects a spot on which to attach itself adjacent to the opening of the Fallopian tube. Leishman supposes that the tumid and rugose condition of the uterine mucous membrane existing during menstruation and for a short time afterwards mechanically arrests the ovum,

which would otherwise gravitate towards the cervix; so that if through any delay the ovum makes its appearance after this turgid condition of the mucous membrane has subsided, it may descend and be arrested lower down; or, which probably happens more frequently, it may escape altogether. If the ovum attaches itself to the lower segment of the uterus, placental presentation must result. Again, in the case of a subinvoluted uterus with a large cavity, the fertilised ovum, after emerging from the opening of the Fallopian tube, is more likely to be arrested in the comparatively narrow lower segment of the uterus than in the wide upper part. This is probably the explanation of the clinical fact that presentation of the placenta is most common in multiparæ. Another theory is that uterine contractions may displace a normally situated ovum without necessarily abortion resulting, the ovum securing a new site lower down the uterus. To these must be added instances of placenta prævia due to extreme size of the placenta, and others in which, as Tyler Smith suggests, the ovum has only become impregnated on its arrival in the lower segment of the uterus.

In the earlier months of pregnancy there is nothing to indicate the existence of placenta prævia, though, at this period, the fact of the attachment of the placenta to that portion of the uterus immediately above the cervix may cause uterine irritation, followed by abortion. In the later months, placental presentation usually gives rise to more or less severe attacks of hæmorrhage, and their recurrence should warn the attendant to be on the alert to take the necessary precautions. When summoned to such an attack of flooding, it is imperative to make an examination, so that if the

placenta does present, the patient may be treated in accordance with the gravity of the case. Examination, perhaps, reveals to the finger a thick and turgid condition of the os, owing to the increase in size of the vessels, which have become enlarged for the purpose of supplying the placenta. Recognition of the

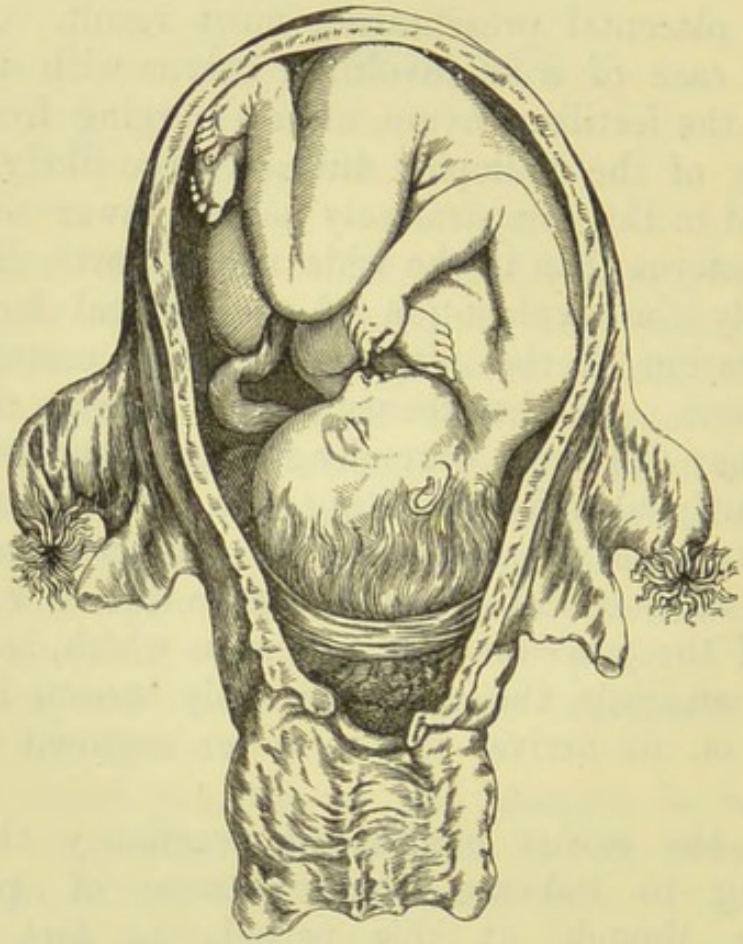


Fig. 154.—Entire Placenta Prævia.

presenting part may be interfered with by the thick boggy mass beneath it, and it may be impossible to get ballottement. If the os is partially dilated, the soft mass of the placenta, differing in its fibrous texture from a clot, may be felt; this is much easier to make out if the head presents, as it affords a background, so to speak, on which the examination can be made.

In other presentations the result is frequently less satisfactory. The placental bruit will be heard most distinctly in one of the iliac regions. Dr. John Wallace recommends vaginal stethoscopy as an aid in diagnosis. A point of difference between hæmorrhage from placenta prævia (or unavoidable hæmorrhage) and that which arises from detachment of the placenta when it occupies its normal position (accidental hæmorrhage), is that in placenta prævia the hæmorrhage increases during a pain, from further detachment of the placenta, whilst in accidental hæmorrhage, the presenting part, acting like a ball valve, blocks up the os uteri during each pain, and thus stops the egress of blood, which, in this form of bleeding, is poured out higher up in the uterus. The loss of blood in placental cases varies from a few insignificant spurts to a sudden and alarming outpouring, sometimes even causing the death of the patient ere assistance can be procured. The bleeding often takes place prior to the commencement of labour, being due to accidental detachment of small portions of the placenta, each detachment causing a more or less severe attack of hæmorrhage. It is when the lower uterine zone begins to dilate after the commencement of labour that hæmorrhage in its most violent and alarming form comes on. Profuse discharges of blood may be repeated several times during labour, as successive portions of the placenta are detached. In such cases it behoves the attendant to be ready to act with promptitude, for in the whole range of midwifery none require more self-possession.

The *treatment* of placenta prævia naturally involves consideration of the lives of both mother and child. Whilst it must be remembered that no procedure short of emptying the uterus renders the mother free from liability to hæmorrhage, still in very mild cases

before the seventh month it may be allowable to make use of palliative treatment and temporise until the child is viable. In severe cases, however, it is best to proceed at once with measures directed on the lines indicated below towards terminating the pregnancy. After the seventh month, *i.e.* when the separate existence of the child is possible, temporising only increases the risk to both mother and child, and labour should be induced at once or as soon as conditions will admit. The principal methods of treatment are the vaginal plug, cervical dilators, rupture of the membranes, partial digital separation of the placenta, version, or rarely the application of forceps.

Cases have occurred where the excessive violence of the uterine contractions has driven all before them, detaching the placenta and forcing it along the vagina with the child behind it. This example was formerly imitated by detaching the placenta artificially in the expectation that the hæmorrhage would cease, and the necessity of turning be thus avoided. Kinder Wood and Radford of Manchester were the first to adopt this treatment, and subsequently Sir James Simpson advocated it in his usual vigorous manner. He held that in placenta prævia the source of hæmorrhage was the surface of the detached portion of the placenta, the blood being supplied through the uterine vessels connected with the portion of the placenta still attached. Whilst allowing that some little bleeding does occur from the detached portion of the placenta, the general and correct view is that the bared uterine wall is the site from whence the principal hæmorrhage takes place. It is, however, agreed that entire detachment of the placenta arrests flooding by setting up contraction of the uterine muscle, especially at the placental

site. Sir James Simpson collected statistics on the subject of total artificial separation of the placenta, which put the proposed plan in a very favourable light with regard to both mother and child; but unfortunately the value of these statistics was lessened by the inclusion under the same head of cases both of natural expulsion and artificial extraction. That very rapid natural expulsion of the uterine contents is favourable to the life of the child may be readily conceived if the child is born very quickly after the placenta is detached; but in cases of artificial extraction of the placenta we have no security that uterine action will follow with such rapidity as to save the child, and nowadays this method is given up in favour of the lines of treatment indicated below.

If the os uteri be little dilated, and an attack of flooding sets in, followed by a continued drain, the *plug* is the proper initiative treatment, though it must be remembered that plugging is but a temporary resource till more efficient measures can be taken. Various materials are made use of to form the plug; long strips of iodoform gauze, or clumps of antiseptic cotton wool about the size of an egg, with a string attached for removal, or in lieu of these strips of lint are passed, with the aid of a speculum, one by one up the vagina until it is filled (*vide* the method of plugging given in the section of abortion). It is well to empty the bladder previous to plugging. The object of plugging is to compress the placenta between the presenting part of the fœtus and the substance introduced, and thus to check hæmorrhage and favour coagulation of the blood already effused. At the same time the irritation of the plug is effective in setting up uterine contractions and dilatation of the cervix. The patient should be fed on simple diet,

and kept perfectly quiet, lying on a hard bed with the pelvis slightly raised, in a cool and airy room. The objection to plugs is that the discharges are liable to become fœtid, therefore the vagina should be emptied and douched in from four to six hours, after which the plug may be renewed, or some other method of treatment adopted.

Combined with the plug, or continued after this has served its temporary purpose, the use of cervical dilators is to be mentioned; as, for instance, a sponge or tupelo tent inserted into the cervix before the vagina is packed, both tent and plug being removed in a few hours, and the vaginal douche employed. If the os be of sufficient size to admit the finger, a Barnes' bag may be introduced, followed up by larger ones of the series, or by Champetier de Ribes' bag, or by version, as mentioned below.

Puncturing the membranes, strongly recommended by Dr. Barnes, can be resorted to when the os is too small to admit of any other procedure save plugging. The operation is performed either by the finger, or, if the os will not admit the finger, by a probe or trochar, that side of the os being selected which is free from placenta. Its advantages are that the evacuation of the liquor amnii reduces the size of the uterus, diminishes its blood-supply, and facilitates the induction of labour where turning is impossible; and the presenting part of the child pressing against the cervix uteri acts as a plug to restrain the hæmorrhage. On the other hand, puncturing the membranes renders turning far more difficult, and puts the child's life in greater peril. Moreover, evacuation of the liquor amnii does not always promptly induce labour, nor arrest hæmorrhage, flooding not unfrequently taking place when there is no liquor amnii. Puncturing the membranes, then, should only be done when

a leg can be at once brought into the os, or when the cervix is so widely dilated as to admit of immediate delivery by forceps.

Partial digital separation of the placenta, combined with *version*, is now the accepted treatment in the great majority of placental presentations. Dr. Barnes, who has devoted much attention to the causes and treatment of placenta prævia, divides the uterus into three zones—fundal, meridional, and cervical, the cervical being the unsafe placental region. He includes in the cervical zone all that portion of the uterus which retracts to give passage to the fœtus, and fixes its limits at a distance of about 3 inches from the os internum, maintaining that hæmorrhage ceases if the placenta is detached from the cervix for this distance. One or two fingers are passed as far as they will go through the os between the placenta and the uterine wall, then swept round the uterus as far as they will reach, so as to separate the placenta for this distance. At the same time the membranes are ruptured, and a foot is seized by the fingers, and the leg brought down through the os, this operation being aided by the other hand through the abdominal wall. If the os be of sufficient size, delivery should be completed without delay; but if not fully dilated, delivery should be gradually and slowly accomplished, so as to allow of sufficient dilatation of the cervix for the passage of the after-coming head. This method of treatment gives the greatest chance to both mother and child. The arrest of the hæmorrhage is attributed by Dr. Barnes to active contraction of the muscular structure of the uterus closing the mouths of the vessels. It will be seen that there is a wide difference between Simpson's method of total detachment and extraction of the placenta and Barnes' detachment from the cervical

zone only : Simpson's being a formidable and difficult operation ; Barnes' plan, though equally efficacious, being comparatively easy of performance. Objection has been raised to Barnes' theory on the ground that the cervical portion of the uterus is sparingly supplied with muscular tissue, as compared with the body of the organ, and therefore that the stoppage of the hæmorrhage is really due to general contraction of the uterus (induced by detachment of the placenta), which forces the presenting part of the fœtus against the cervix. In answer to these objections, Barnes states that the "cervical" zone does not consist of the cervix proper, but of the lower zone of the uterus immediately above the cervix. Barnes' procedure, as compared with Simpson's, has the obvious advantage that in many cases a considerable portion of the placenta is still attached and is available for the nourishment of the child.

CHAPTER XXII

ACCIDENTAL AND POST-PARTUM HÆMORRHAGE

One form of hæmorrhage during labour has been described under the head of placental presentation; another, known in England as *accidental hæmorrhage*, now claims attention. The term "accidental" was given to this form of hæmorrhage by Rigby in contradistinction to that produced by placenta prævia, which he called "unavoidable" hæmorrhage.

In the form of hæmorrhage under notice the placenta is normally situated, but, from some cause or other, part or the whole of the placenta becomes prematurely separated. Conditions which predispose to such separation are general debility, as from repeated child-bearing, and disease or deficient attachment of the placenta. Usually there is some traumatic exciting cause in the shape of external injury or muscular exertion, but mental emotion may be the determining factor. If detachment takes place at the circumference of the placenta, the blood will generally find its way between the uterine wall and membranes and appear externally. The blood may, however, be retained within the womb, constituting *concealed* accidental hæmorrhage. In this case it is generally effused between the membranes and fundus uteri; or if the detachment occurs at the

centre of the placenta, all the circumferential implantation remaining intact, it may be imprisoned between placenta and uterus; more rarely the blood passes into the amniotic cavity. The *ordinary* variety of accidental hæmorrhage is diagnosed by the history, by the degree of collapse which is proportionate to the amount of blood lost, and by absence of the placenta when the lower uterine segment is examined with the finger passed within the os. It is distinguished also from placenta prævia by the hæmorrhage ceasing instead of increasing with each pain, in consequence of the source of hæmorrhage being above the fœtal head; during the pains the cranium is forced against the os uteri, and the uterus being thus plugged the blood is unable to escape. In *concealed* accidental hæmorrhage there is the history with the symptoms of internal hæmorrhage—pallor, faintness, rapid small pulse, restlessness, laboured breathing—together with severe abdominal pain and uniform or irregular distension of the uterus. The womb is very tender, and its enlargement and peculiarly altered elastic consistence may be perceptible on palpation. This variety is somewhat difficult to diagnose; it may be distinguished from rupture of the uterus by the previous absence of violent uterine contractions, by the increased bulk of the uterus, and by want of the extreme mobility of the presenting part so characteristic of rupture.

The prognosis is unfavourable for the child, and gravely riskful for the mother. In concealed accidental hæmorrhage nearly all the children are still-born, and more than half the women die. (Goodell.)

Treatment.—In mild cases it is sufficient to rupture the membranes and to encourage uterine action by friction on the uterus, to apply a binder, and to administer small doses of ergot. Plugging the vagina

is as a rule inadvisable, as it may tend to cause concealed bleeding, the difficulty being to ensure efficient contraction of the uterus. In severe cases, especially of concealed accidental hæmorrhage, the contents of the uterus should be evacuated as soon as possible. If necessary, the cervix should be dilated digitally or by means of hydrostatic dilators (Barnes' or Champetier de Ribes' bags), care being taken to ensure uterine action during this process; delivery is then completed by forceps or version. As there is always considerable risk of post-partum hæmorrhage supervening from atony of the uterus, delivery should be accomplished cautiously and without haste, the hand of a trustworthy assistant following the uterus well down, so as to induce it to contract upon and to aid in the expulsion of the fœtus.

Cæsarian section has been proposed and successfully performed; but if, on account of an obstinate cervix, laparotomy is advisable, Porro's operation offers a better immediate result to the mother, as it renders post-partum hæmorrhage impossible; it has the disadvantage, however, of permanently terminating child-bearing.

The anæmic collapsed state of the patient during or immediately after delivery may occasion considerable anxiety, and may necessitate transfusion (*vide post*). As a rule, however, it is sufficient to keep the patient warm, with the foot of the bed elevated, and to feed her frequently with brandy and milk or beef-tea. Should vomiting be troublesome, nutrient and stimulating enemata should be administered. During the lying-in period quinine and iron should be prescribed, and a light assimilable diet given in plenty. Excessive discharge should be checked by ergot or full doses of quinine, and the most stringent antiseptic precautions should be

observed as regards the lochia, because of the increased liability to septic infection which results from the anæmia.

Post-partum Hæmorrhage. — This, like placenta prævia, is a most serious complication, and demands all the energy, self-reliance, and resources of the practitioner to be brought into immediate play with a predetermined and definite plan of treatment. Hæmorrhage may occur during or after the third stage of labour, and in amount may vary from a slight to an exceedingly severe loss. Its source is generally the uterine cavity, especially the placental site; but in some instances it is derived from other parts of the genital tract, owing to the complication of labour by local disease, or injury.

The *causes* of post-partum hæmorrhage are many, and require mentioning in detail.

1. *Complete or partial inertia of the uterus* is one of the most frequent and important. It may be caused either by general debility of the system, as from malnutrition, repeated child-bearing, or constitutional disease; or by conditions leading to atony of the uterine muscle specially. Amongst such conditions are the following: prolonged labour, too rapid labour, especially hasty labour assisted under chloroform, over-distension of the uterus by twins, hydramnios, concealed accidental hæmorrhage, etc., and any local interference with contraction, resulting from adherent secundines, clots, or the presence of a fibroid in the uterine wall. It must also be recollected that mental emotion and distended bowels and bladder may lead to uterine atony.

2. *Retention of the placenta or membranes* comes next in importance. This may be due to an excessively large placenta, to obliquity of the uterus, uterine inertia, morbid adhesion to the uterine wall, or to

irregular partial contraction of the uterine muscle. Undue size of the placenta and obliquity of the uterus lead to retention, because they tend to obstruct delivery, and thus cause uterine inertia, which results in either incomplete detachment or non-expulsion of the placenta. Adhesions between the placenta and chorion and the uterine wall may vary considerably in extent and firmness; this is not so common a cause of retention as is usually supposed, the placenta generally remaining adherent because of insufficient uterine action and not on account of actual morbid adhesion. It is somewhat strange that morbid adhesion has scarcely if ever been seen in cases of Cæsarian section; it may, however, occur as a result of disease or of non-development of the loose areolar superficial layer of the decidua serotina.

As a consequence of great nervous irritability, or of morbid adhesion, or of ill-advised administration of ergot, an irregular spasmodic contraction of the uterine muscle may occur in such a manner as to encyst and imprison instead of expelling the placenta. The spasm usually affects the circular fibres about the internal os, giving rise to a condition to which the term *hour-glass contraction* is applied, the uterus being divided into two compartments, with the placenta in the upper division. It was formerly considered that the narrowed portion was higher than is above stated, but the older view is probably erroneous. The lower cervical segment of the uterus is generally very flaccid

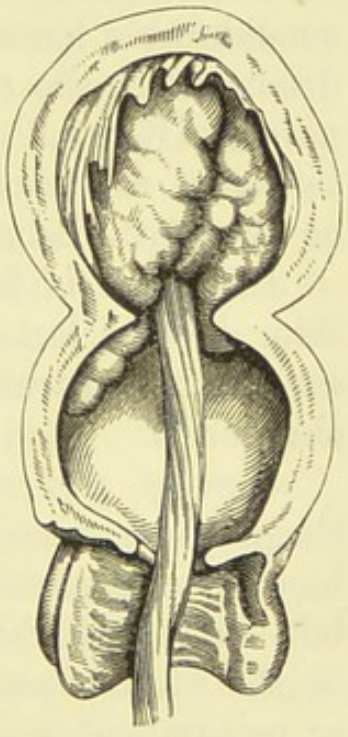


Fig. 155.—Hour-glass Contraction.

and roomy, whilst above the firm constriction there is usually some little uterine action, so that the lower segment may seem as large or larger than the upper; this no doubt led to the idea that the spastic muscular contraction was higher up than the true internal os.

3. *General conditions* of the maternal system may lead to undue hæmorrhage during or after the third stage of labour. Amongst these are hæmophilia, plethora, altered states of the blood interfering with clotting, or high vascular tension, as in albuminuria, which leads to dislodgment of the clots which have formed in the mouths of the torn uterine vessels.

4. Finally, *rupture or laceration* of some part of the genital tract and *inversion* of the uterus require to be mentioned as causes of post-partum hæmorrhage. Tears may occur in the body of the uterus, in the cervix, vagina, or perineum, and may give rise to considerable hæmorrhage. They will be more fully discussed in the chapter on "Rupture and Inversion of the Uterus." Rupture of a varicose vein of the vulva or neighbouring part may give rise to severe or even fatal hæmorrhage.

Inversion is fortunately a rare cause of bleeding after labour, but it may occasion profuse loss. Its causation and treatment will be referred to in a later chapter.

Signs of post-partum Hæmorrhage.—When hæmorrhage supervenes, it is usually the result of uterine inertia; contraction may have duly taken place, but for some cause or other the muscular coats of the uterus lose their contractility, and the organ is metamorphosed from a compact hard ball into a loose flabby bag, leading to the reopening of the mouths of the uterine vessels, and to the outpouring of blood with a copiousness to be expected

from canals of such large calibre. Hæmorrhage may manifest itself at once by the blood flowing from the vulva; but if the uterus is retroverted, or if a clot blocks the os, the blood may collect in and distend the uterus, little, if any, appearing externally—an accident manifested by the patient becoming pallid and faint, and by the increased size and soft, quaggy condition of the uterus. If the blood escapes without accumulating, the uterus may be scarcely perceptible through the abdominal walls, having lost all its solidity and become flaccid as an india-rubber bag. Should the uterus be felt small and firm and still the discharge continues, laceration of the cervix or some similar condition is to be suspected. But whatever the cause, if, as is frequently the case, the flow of blood is rapid — and it may be to an appalling degree — the patient is brought to the brink of the grave in a very few minutes, becoming suddenly blanched, and presenting a singularly corpse-like appearance; she calls for help, and wildly tosses about her arms; vision and hearing fail, and she gasps for more air; the surface becomes cold, and the pulse fails to reach the wrist; in a few minutes more, her strength exhausted, she wishes to be left to die in peace, which consummation will quickly come to pass unless energetic steps are taken to prevent the extinction of, literally, the "vital spark."

Treatment.—Before giving in detail the plan of treatment for this grave condition, a word or two as to its prevention will not be out of place. In the case of delivery by natural forces the proper "following down" of the uterus during the second stage, as described in the management of labour, will, in the majority of cases, counteract any tendency to inertia; and the plan recommended for maintaining control

of the womb from the birth of the child till some time after the delivery of the placenta will usually be effective—in any case the hand would quickly detect relaxation. If there is any reason to expect uterine inertia because of too speedy delivery or a long and tedious labour, or the existence of Bright's disease, or the occurrence of floodings after previous labours, it may be advisable to administer ergot during the final expulsatory stage. Proper management and, if necessary, assistance in the first and second stages will form the best prophylactic treatment against lacerations; particular attention should be directed to the condition of the cervix and perineum, especially if artificial completion of delivery be needed by forceps or version, when these parts principally are liable to injury.

A further point is that all things required for the proper treatment of post-partum hæmorrhage should be ready beforehand, in anticipation of the possibility of their being needed. For instance, a syringe, hot and cold lotion, ice and perchloride of iron, brandy, æther, ergotine, morphia, and hypodermic syringe, hæmostatic forceps, transfusion apparatus, ligatures, and needles should all be at hand, together with iodoform gauze and cotton-wool.

As soon as hæmorrhage does occur, the first step is to place the patient on her back, with her head low, and to grasp the uterus through the abdominal wall, so as to induce it to contract; an intermittent compressing movement of the hands will often succeed when uniform pressure fails. The placenta, if within the uterus, should be expressed, and afterwards ergot may be given by mouth, or ergotine administered hypodermically (into the muscle). Putting the child to the breast is sometimes a useful stimulus to reflex uterine action.

Should hæmorrhage continue, the next measures comprise the introduction of the hand and the complete emptying of the uterine cavity, followed if necessary by the hot douche and bimanual compression of the uterus. If hour-glass contraction interferes with the passage of the hand and the removal of clots, membranes, or placenta,

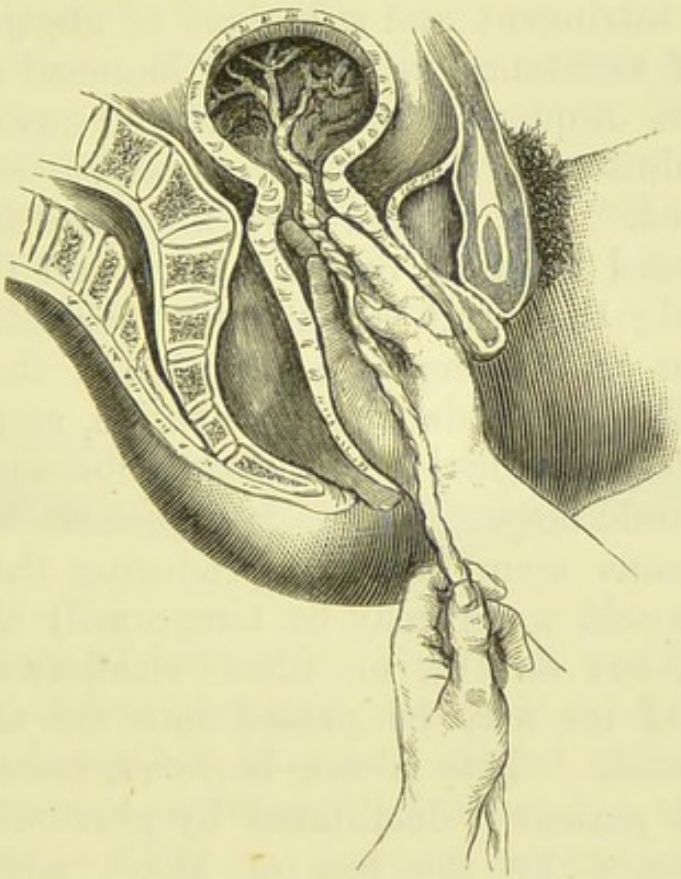


Fig. 156.—Extraction of Encysted Placenta.

the spasm is to be overcome in the following manner: the cord is taken in the left hand, and the right hand is passed along it with the tips of the fingers brought together so as to present the appearance of a wedge or cone until it reaches the constriction, when the left hand should be transferred to the fundus uteri, so as to steady the womb and make the necessary pressure, whilst the right is

gently and very gradually insinuated beyond the contraction; the placenta or membrane is then peeled off by the border of the hand or the fingers, and then the uterine contractions, aided by external pressure, generally expel the loosened contents along with the hand.

The hot douche, at a temperature of 110° to 115° F., should then be used. It will be found very useful as an astringent and stimulant to uterine action, and is of assistance in removing loosened clots and membrane. A quart or two of 1 in 8000 corrosive sublimate solution or some other antiseptic lotion will be required. The douche-tube, filled and free from air, is passed right up to the fundus, and the lotion is injected; the result is generally very satisfactory, the uterus contracting with cessation of the hæmorrhage. Whilst the douche is in action, and after its withdrawal, bimanual rubbing or compression of the uterus should be performed. In rare cases where the above means seem tardy in producing the desired result, ice-cold water may be temporarily alternated with the hot douche, or, after withdrawal of the tube, solid ice may be passed into the uterus for a little while. This is not, however, recommended when the patient is debilitated by previous disease, or exhausted by the loss of blood, and in any case it should not be continued too long. Cold induces reflex action by the sudden abstraction of heat, thus causing nervous excitation, but if prolonged the part loses so much heat that the difference in temperature between it and the cold-producing agent is insufficient to evoke further contractions. Moreover, the continuous application of cold depresses the system greatly, and tends to produce congestion of the internal organs.

Meanwhile it must not be forgotten that the

administration of stimulants is of the utmost importance; brandy is perhaps the best, and should be given freely. Æther, subcutaneously injected, is of course a powerful stimulant to the circulation, and has produced most beneficial results in cases of impending syncope. It is necessary to pass the needle of the hypodermic syringe well down into the subcutaneous cellular tissue, otherwise abscesses may form at the seat of puncture.

The above measures are almost always successful in producing uterine contraction, but, finally, we may have to try the Faradic current, one electrode being applied to the cervix and the other to the fundus through the abdominal walls. If, however, the uterus, either through extreme loss of blood or

Fig. 157.—Hayes' Silver Tube.

a total want of contractile power in itself, remains absolutely and persistently passive, it is obvious that remedies of another kind are needed. I allude to the injections of astringent solutions into the cavity of the uterus. For this purpose several substances have been used, but the most efficacious, and the one now generally adopted, is a solution of perchloride of iron, a salt long known as a powerful styptic, causing instant coagulation of the blood, and corrugating mucous or other secreting surfaces. 4 oz. of Liquor Ferri Perchloridi Fortior with 12 to 16 oz. of water is, after all blood has been removed from the uterus by the plain douche, to be slowly injected through a long tube (Fig. 157) passed well up to the fundus. The effect produced is the im-

mediate formation of clots or thrombi in the openings of the uterine vessels, and a general corrugation of the internal surface of the organ, with the production, in some cases, of more or less muscular action, the sum of these effects resulting in speedy suppression of the hæmorrhage. Unfortunately certain ill effects are liable to occur; the principal fear is lest a clot of coagulated blood be carried into the circulation and reach the heart, or be arrested in some of the important vessels, producing in either case serious results. There is also the risk of some of the fluid finding its way through the Fallopian tubes into the abdominal cavity and producing virulent peritonitis. Dr. Barnes very fairly and openly discusses these objections, and cites certain fatal cases due to this practice. He grounds his defence of the iron injection on the urgency of the cases leaving no choice between death from hæmorrhage on the one hand, and on the other the possible occurrence of the above-named mischances. The deduction to be drawn is, that when other means fail, it becomes our duty to resort to a method of treatment which, though avowedly not free from risk, yet affords the sole chance of preserving life.

It will be observed that practically the plan of treatment recommended so far has been almost solely that appropriate for hæmorrhage due to inertia of the uterus or retention of placenta, membranes, or clots; and it is obvious that other measures will be required in the case of tears of the genital tract. In these cases, as previously mentioned, hæmorrhage is found persisting although the uterus is well contracted and hard. The treatment of rupture of the body of the womb itself and of inversion will be entered into in the next chapter, but we may note here that the commonest laceration causing hæmor-

rhage is a torn cervix. This generally occurs on one or both sides, more rarely in front or behind, and it may or may not extend higher than the vaginal roof, in which case it opens up the cellular tissue of the broad ligament. It is not always easy to diagnose or to recognise a torn cervix by touch alone, because of the extreme softness and indefinite outline of the cervix after labour. However, if the diagnosis be made by touch or inspection, the cut edges should be brought together by sutures, the cervix being drawn down by vulsella. The vagina may then be plugged with iodoform gauze, so as to give support to the stitches, and exert some pressure on the parts. In the absence of sutures, a well-applied cervical and vaginal tampon may be sufficient, if the contracted fundus be well pressed down by a pad under the binder.

Purely vaginal tears and ruptured varicose veins at the vulva are most conveniently treated by the elastic pressure of medicated cotton-wool applied as a plug or pad—rarely is suturing necessary or advisable. Ruptured perineum should always be sutured before the patient is left.

In all cases where plugs are employed they should be removed in twenty-four hours, when their use can generally be dispensed with; but, if necessary, they may be replaced by others after douching the parts.

Before passing on to the general treatment of hæmorrhage, two other local measures may be briefly referred to; these are compression of the aorta and the uterine (not vaginal) plug,—lately the plan of well plugging the whole uterine cavity with iodoform gauze has been brought forward to replace the use of the iron solution. The local irritation of the introduced material has been found to lead to contraction of the uterine muscle when other treat-

ment of inertia has failed, but the practice is not as yet general in this country.

Finally, in desperate cases, compression of the abdominal aorta may prove useful; although it can only reduce and not arrest the flow of blood into the uterus, still any means of gaining time is invaluable. Pressure may be applied through either the posterior wall of the uterus or through the abdominal wall. If through the abdomen, the thighs should be flexed on the trunk to relax the muscles of the belly, and pressure applied should be near the umbilicus so as to compress the aorta against the left side of the vertebral column, and thus to avoid the vena cava.

Transfusion.—When a patient is dying solely from loss of blood, it is obvious that if a fresh supply can be thrown into the system, the fatal result may be warded off and time gained for recovery. The operation may be performed in two ways: immediately by placing a direct channel of communication between the blood-giver and blood-receiver, or mediately by receiving the blood into an open vessel, and thence transferring it to the patient.

For immediate transfusion Aveling's instrument is simple and efficacious; it consists of an india-rubber tube furnished at each end with a small silver canula, and having in its centre a bulbous swelling unfurnished with valves, the fingers of the operator supplying their place. A vein is then opened in the blood-giver's arm, into which one end of the apparatus, first carefully filled with warm (98° F.) saline solution, is inserted; a vein is also opened in the blood-receiver's arm, which, owing to the bloodless condition of her body, is frequently a matter of some difficulty. Her vein should first be carefully dissected out and a probe passed under it before making the opening, which should

be along the course of the vessel; the other end of the apparatus should then be passed into the

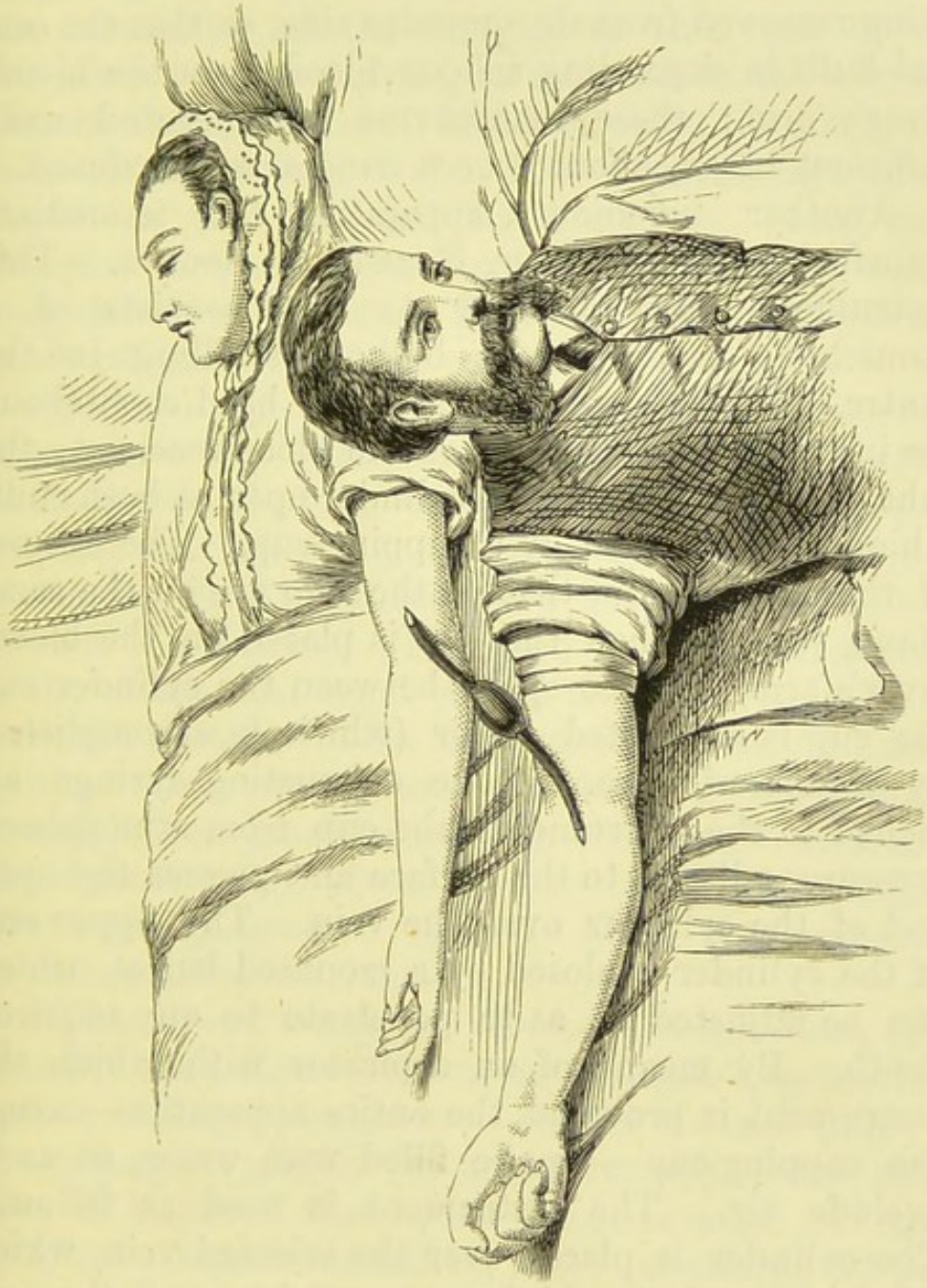


Fig. 158.—To illustrate Dr. Aveling's Method of Immediate Transfusion. (After Aveling.)

opening and held secure. This done, the tube is pinched between the finger and thumb on the blood-giver's side of the central bulb, which is *slowly* com-

pressed so as to force the contents into the blood-receiver's arm. When this is done the tube is pinched on the blood-receiver's side of the bulb, the fingers being removed from the opposite side, so that the central bulb in expanding solicits blood from the blood-giver's arm; these manœuvres are repeated until sufficient blood, about 6 or 8 ounces, is transfused.

Another ingenious apparatus for immediate transfusion is that of Dr. Roussel of Geneva. This instrument, like that of Aveling, consists of a caoutchouc tube, with a bulbous swelling in the centre. At one end is a canula of hard caoutchouc for insertion into the vein of the blood-receiver; the other end is attached to a cylinder open at both ends, which is surrounded by a cupping-cup. The bottom of the cylinder and that of the cup are on the same plane, so that when the cup is placed on the blood-giver's arm, and the space between the cylinder and the cup is exhausted of air (which is accomplished by means of a caoutchouc exhausting-syringe attached to the instrument), the cup, from atmospheric pressure, adheres to the surface and presses the open end of the cylinder over the vein. The upper end of the cylinder is closed by a mounted lancet, which can be adjusted so as to penetrate to any required depth. By means of an aspirator with which the instrument is provided, the entire apparatus—except the cupping-cup—can be filled with water, so as to exclude air. The instrument is used as follows: The cylinder is placed over the selected vein, which has been made turgid by compression, and the cupping-cup exhausted of air. The lancet is then fixed into the cylinder, the apparatus filled with tepid water, and the vein opened by the concealed lancet, after which the water is allowed to escape through a special canula provided for the purpose, the orifice

of which is closed as soon as all the water has been discharged. The instrument having filled with blood, communication is established between the circulation of the blood-giver and that of the blood-receiver, by turning a stopcock in the efferent canula, and the flow of blood is aided by manipulation of the central bulb. Dr. Roussel lays great stress on the fact that his apparatus, being constructed of pure caoutchouc, is less liable to cause coagulation of the blood than instruments which are made of glass, metal, or vulcanised caoutchouc.

Mediate transfusion is performed by receiving the blood into an open vessel and using this after defibrination (beating with a glass rod) or after preventing coagulation by adding a few drops of liquor ammonia (Dr. Richardson), or a solution of phosphate of soda (Dr. Hicks). The fluid is then transferred to the mechanical agent chosen to propel it into the patient's system. This may consist of an ordinary syringe with fine nozzle, or one on Higginson's principle, or a glass funnel with elastic tube attached, the funnel being placed at a considerable height above the patient, so that the blood may gravitate in the required direction.

When blood cannot be obtained, it has been proposed to use a saline solution, as Dr. Little's, mentioned below, adding 2 drachms of alcohol to each pint; a much larger quantity (60 to 80 ounces) of this solution is required than when blood is used. If this solution cannot be obtained, water containing ·75 per cent of common salt—that is, about one teaspoonful to a pint—may be substituted. Dr. Little's formula is as follows :—

Chloride of sodium . .	60 grains.
Chloride of potassium . .	6 ,,

Phosphate of soda . .	3 grains.
Carbonate of soda . .	20 „
Distilled water . . .	20 ounces.

In whatever manner transfusion is performed, and the funnel-tube apparatus is the simplest and probably the best, the great danger to be avoided is the introduction of air with the blood into the patient's

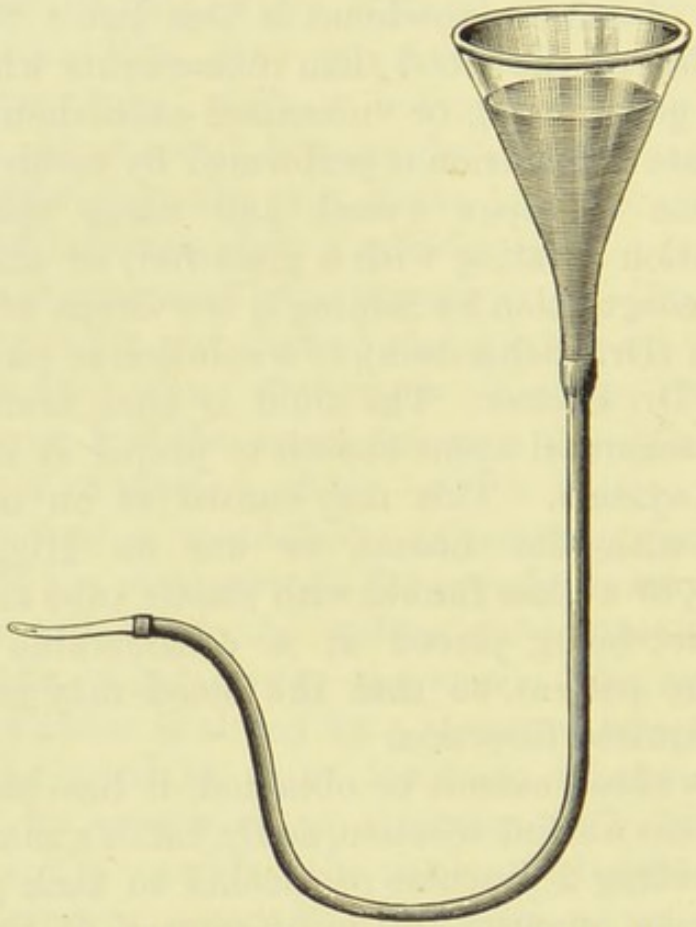


Fig. 159.—Funnel-Tube Transfusion Apparatus.

system. The late E. Martin of Berlin reported a series of fifty-seven cases of mediate transfusion after delivery, of which forty-five recovered, whilst the death of the other twelve cases did not result from the operation. The blood used was not defibrinated. Graily Hewitt also advocated the use of undefibrinated blood.

Professor Schäfer, F.R.S., has made a series of experiments for the Obstetrical Society of London on transfusion. I cannot do better than give Professor Schäfer's conclusions in his own words :—

"1. Ordinary milk is highly detrimental, and ought never to be used for transfusion.

"2. Solution of salt and any other watery fluid is without permanent benefit, and should never be used for transfusion.[1]

"3. The blood or serum of the lower animals is highly detrimental, and in large quantities fatal, and ought never to be used for transfusion in the human subject.

"4. The only fluid which can be employed with any benefit for transfusion in the human subject is human blood, and this may be either in the normal or in the fibrinated condition.

"5. The less the blood used for transfusion is suffered to come in contact with foreign surfaces, the better is likely to be the ultimate result.

"6. Consequently, the more the apparatus used is simplified, the better is likely to be the result.

"7. The simplest and best form of apparatus is a short flexible tube, terminating in glass canulas, which is used to directly connect either a vein of the giver to a vein of the patient, or an artery of the giver to an artery of the patient.

"8. The amount of blood used may be measured by the time of flow. Enough blood would probably flow from vein to vein in three or four minutes ; from artery to artery (towards the heart) in half a minute or a minute.

"9. In ordinary cases in which transfusion is required, it will probably be found most convenient to employ the method of direct transfusion from vein

[1] This opinion is not universally accepted by the profession.

to vein, but in cases where death is imminent, transfusion from artery to artery towards the heart ought if possible to be carried out.

"10. Failing any person willing to submit to have a canula inserted into a blood-vessel, but, nevertheless, one being found ready to yield blood into a basin by the ordinary process of venesection, transfusion may yet be tried, although with greater risk to the patient, by means of a syringe or elastic pump.

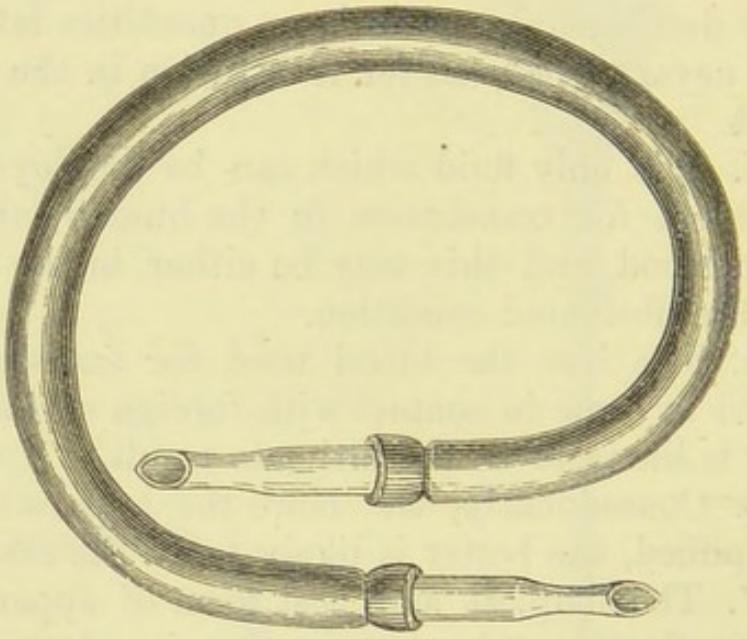


Fig. 160.—Professor Schäfer's Transfusion Tube.

The arm of the giver and the interior both of the basin and of the instrument ought to be washed thoroughly with hot water containing carbonate of soda in solution, and the blood injected quickly without defibrination, and with every precaution to prevent the introduction of air. Injection into an artery of the patient towards the heart, as recommended by Blundell, ought to be preferred to any other mode. If the injection is into a vein, a funnel with an india-rubber tube provided with a spring clip

and with the canula for the vein attached to the end of the tube is as simple and effectual an apparatus as could be devised."

If a transfusion apparatus be not at hand, it would be best to make use of *rectal injections* of plain hot water, or ·75 per cent sodium chloride solution, with or without added brandy, and the fluid should be injected as high up into the bowel as possible. Absorption takes place rapidly, the heart's action improves, and recovery may be thus promoted. The same object, *i.e.* giving the heart a sufficient quantity of fluid to work upon, may be achieved by large *subcutaneous injection* of saline fluid, even to the extent of a pint. Considerable rapid absorption is said to follow.

Finally, syncope may be warded off by elevating and "Esmarching" the limbs, beginning from the toes or fingers (auto-transfusion).

The after-treatment of severe hæmorrhage is of the greatest importance: absolute rest, warmth, brandy, and beef-tea (the brandy and beef-tea being given very frequently in small quantities). If vomiting be troublesome, rectal alimentation should be employed. When reaction has set in, opium is our mainstay. If there is much cephalalgia, ice and salines are useful. The cardinal point in the after-treatment is *not to allow the patient to assume the erect posture, even for an instant*, until the pulse indicates that the circulation has fairly recovered itself; in more than one case immediate death has followed violation of this rule.

CHAPTER XXIII

RUPTURES OF THE UTERUS, VAGINA, ETC.

Rupture of the uterus may take place either previous to or at the time of labour. The injury varies from small rents of the peritoneal, mucous, or muscular coats, to laceration of the entire uterine wall. When rupture takes place previous to parturition, the fundus is usually the seat of the injury. Atrophy of a part of the muscular wall; fatty, tubercular, or syphilitic degeneration; sudden fright, and mechanical injury, are some of the causes of this catastrophe. Rupture occurs more than twice as often in women pregnant with male children as compared with those pregnant with female children.

Rupture occurs once in about 4000 labours on the average, and is more common in multiparæ; only in about 1·2 per cent is it met with in primiparæ. The tear nearly always begins in that thinned-out lower segment of the uterus, below Bandl's ring, to which reference has been made at some length in considering the physiology of natural labour. Protracted obstructed labour, with undue retraction of the uterus, are the great factors in determining laceration.

The *causes* of rupture during parturition may be divided into mechanical obstruction to delivery, mechanical injury to, and disease of the uterine tissue.

In the first division are included pelvic contractions, occlusion or rigidity of the os uteri, and abnormal development of the fœtus, as hydrocephalus. Lateral obliquity of the uterus, and extreme antero-posterior obliquity due to pendulous belly, are predisposing causes leading to increased compression of the uterine tissue between the child and the pelvic brim.

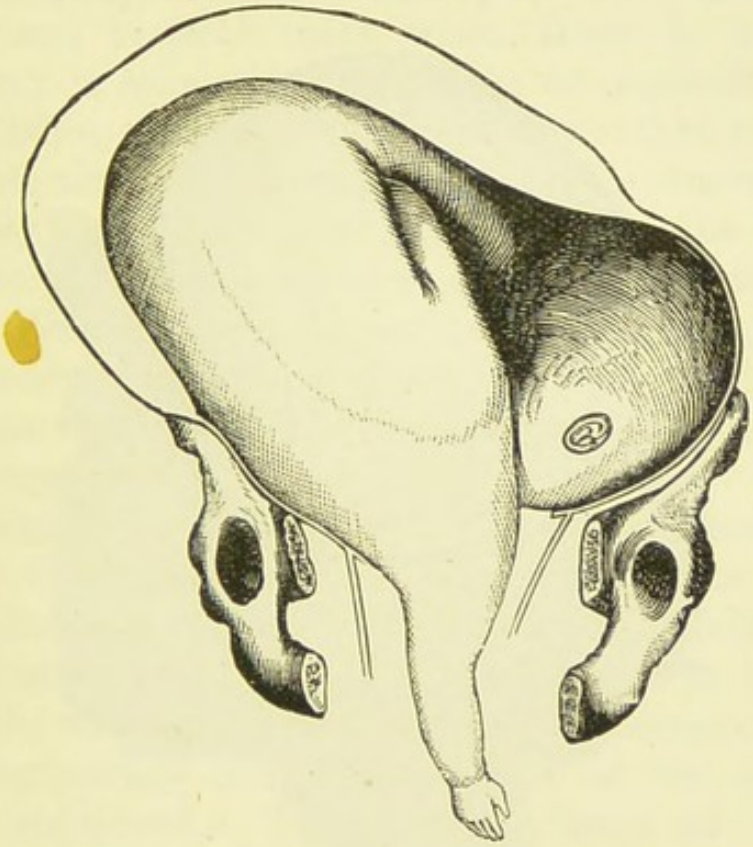


Fig. 161.—Retraction of the Uterus in Arm Presentation. (Lusk.)

Neglected arm presentations may be the cause of rupture when the uterus is allowed to contract upon the child in that malposition. The indiscreet performance of version is very liable to produce rupture, especially if the hand is forced into the uterus when the liquor amnii has long drained away; sudden uterine action also, as met with in hasty labour or after the administration of ergot, may, by its excessive

violence, lacerate the organ. Long-continued pressure of the cervix between the fœtal head and pelvic brim, especially if this is sharply defined at the promontory or elsewhere, has a tendency to cause rupture. I possess a pelvis with several sharp crests or spines developed along the linea ilio-pectinea, the patient having died from rupture of the cervix resulting apparently from the presence of these spiculæ.

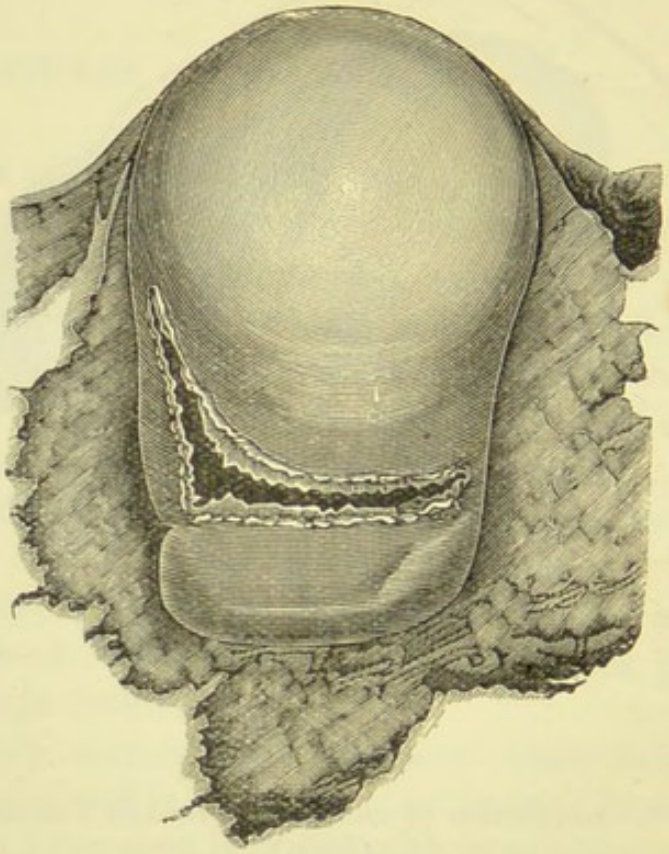


Fig. 162.—Ruptured Uterus: Anterior Surface. (Lusk.)

Mechanical injuries producing rupture may be the result of unskilled attempts to induce premature labour by puncturing the membranes. This is the frequent sequence of criminal attempts to procure abortion. Careless introduction of obstetric instruments during labour may perforate the uterus.

A diseased condition of the tissue of the uterus, by

rendering it friable, is apt to cause the organ to give way during labour; so also is the presence of cancer, or of interstitial fibroids, or of the cicatrix of a previous Cæsarian operation.

Lacerations vary in direction and position; they may be transverse or vertical, and situate at the front, back, or sides. Transverse tears are perhaps more common in cases of uniform contraction of the pelvis, and vertical tears when there is extreme flattening or when hydrocephalus or neglected arm presentation occurs. Complete tears—that is, those involving the peritoneum as well as the muscle—are generally at the front or back, usually the latter; tears not involving the peritoneum are commonly situated laterally, and the vaginal cervix is frequently implicated by downward extension of the laceration.

When rupture is the result of pelvic contraction, the injury usually takes place at the anterior or posterior aspect of the cervix, sometimes separating it entirely from the vagina. Dr. Gervis relates a case of annular laceration of the cervix where a strip of the uterine wall, about half or three-quarters of an inch in width, was detached laterally and posteriorly for about ten inches, leaving two inches at the anterior aspect uninjured. The detached band of uterine tissue was at first taken to be a loop of intestine protruding through a rupture in the uterus, but further examination showed its true nature. The lacerated portion was replaced, the torn surfaces united, and the patient recovered. When the injury commences with a rent at the margin of the os, it extends in a vertical direction, not unfrequently following the course of the muscular fibres. The cause of the womb's neck suffering most severely in pelvic contraction arises from its being jammed immovably between the fœtal head and maternal pelvis, and so rendered unable to yield

to the contraction of body and fundus, which, in attempting to force down the child, puts such a strain on the cervix that at last it gives way. Radford showed that rupture is more likely to take place when the brim is just large enough to allow the head surrounded with the cervix to enter, and there become arrested, than when the deformity is too great to permit the head to descend so far.

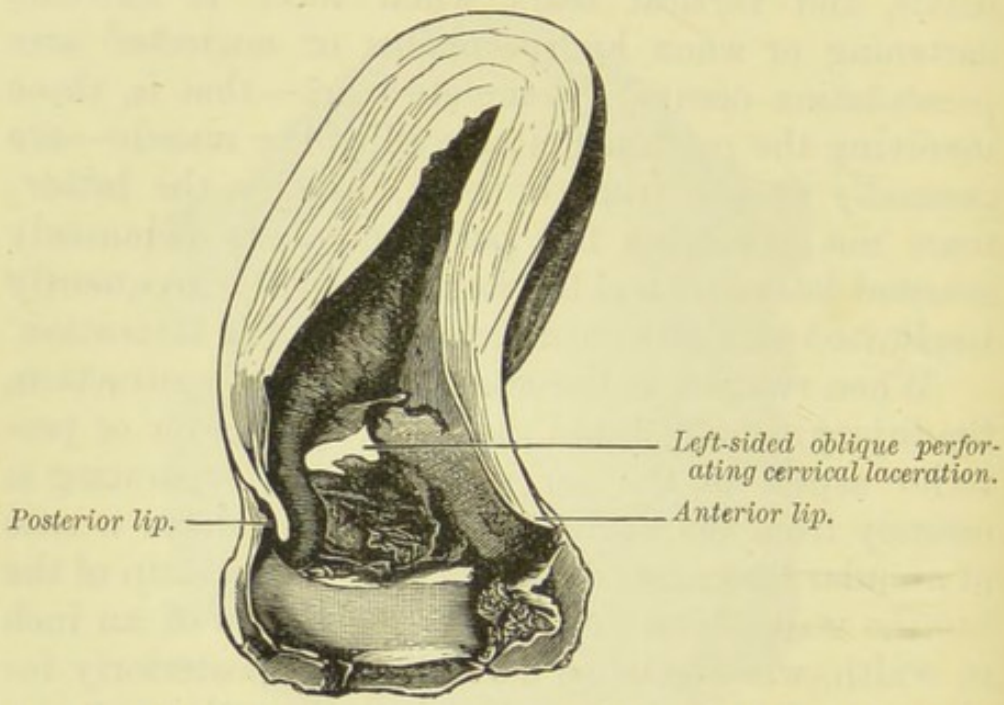


Fig. 163.—Cervix with Lacerations: A Left-Sided Oblique Perforating Tear through the Lower Uterine Segment. (Winckel.)

When partial laceration takes place at the cervix, leaving the peritoneum entire, blood is effused between it and the muscular walls, forming a peri-uterine hæmatocele, or, as some prefer to call it, a thrombus; this infiltration of blood may permeate the whole of the loose tissue between the uterus, bladder, and rectum. True hæmatocele takes place when the rupture extends through the peritoneal covering of the uterus, the blood being effused into the peritoneal cavity. Hæmatocele may also arise from the giving

way of varicose vessels in the neighbourhood of the uterus. On several occasions after difficult and tedious labours, I have found blood in the peritoneum, and have noticed *post-mortem* that in such cases the external uterine vessels were much dilated, a frequent condition in women who have borne many children. The effused blood varies in quantity, sometimes being scarcely appreciable, sometimes being sufficient to push the uterus upwards and forwards towards the pubes. In this displacement, by introducing a uterine sound and by its aid making the uterus move independently of the general swelling, the fundus may be detected through the abdominal walls; or preferably the same point may be made out on careful bi-manual examination under chloroform. The treatment of hæmatocele, in uncomplicated cases, is simply expectant. The effused blood is either absorbed or is discharged through the vagina, rectum, or abdominal wall. When it occurs before labour, and the tumour obstructs delivery, it should be punctured so as to evacuate its contents.

Symptoms.—The symptoms of rupture are sudden, acute abdominal pain, followed by immediate collapse, with or without external hæmorrhage. When rupture takes place during the early months of pregnancy it is not easy to distinguish it from rupture of the cyst in tubal or other form of extra-uterine gestation. Rupture during labour manifests itself by a sudden agonising pain, accompanied by a sensation as of something having given way, felt at the time of, or immediately after, a more than usually powerful uterine contraction. The muscular tissue may be *heard* to give way; the sound has been loud enough to be distinct at some distance from the patient, and she may possibly experience a sensation as of something warm—the blood—being poured into the peritoneal cavity. The

rapid setting-in of collapse, the scarcely perceptible pulse, vomiting, clammy sweats, rigors, hæmorrhage from the vulva, cessation of the uterine contractions, and recedence of the presenting part, with death of the fœtus from detachment of the placenta, and probably escape of the child into the abdominal cavity, are signs of the occurrence of this terrible accident. If the rent is small or incomplete, the symptoms at first are not so pronounced, hours sometimes elapsing ere the onset of the severer indications.

Rupture is generally fatal to both mother and child, either primarily, from shock and hæmorrhage, or secondarily, in the case of the mother, from peritonitis, metritis, pelvic cellulitis, or gangrene.

Treatment.—In *impending* rupture any conditions which may contribute to this result should, if possible, be removed; excessive uterine action is to be moderated by chloroform or opiates; rigidity of the os is to be obviated by the plans already discussed in the treatment of obstructed labour; pelvic contraction must be an indication for timely help by means of some operative measure; and if the deformity be known early enough, the induction of premature labour should not be forgotten as a preventive of possible rupture. When labour is going on, however, the main point is the early recognition of undue retraction of the uterus—Bandl's ring may possibly be made out a few inches over the pubes. In any case of protracted labour, when little or no advance has followed good bearing-down pains, when the pulse is quickened and the expression anxious, early assistance is the best prophylactic. In head presentation, forceps, symphyseotomy, craniotomy, and Cæsarian section are the measures at command; in transverse presentation, very careful version under anæsthesia

may first be attempted. In the latter case, if on cautiously inserting the hand into the uterus much thinning of the lower segment with well-marked retraction ring be noted, it may be advisable to consider the question of decapitation. Should the cord be flaccid and without pulsation, there can be little objection to this operation, and rupture of the uterus might not occur if delivery were effected in that way, whilst version might be difficult and risky.

The treatment of actual rupture, if the diagnosis be made before the child is born, involves the question of delivery as well as the consideration of proper surgical treatment of the tear itself. In the first instance, immediate completion of the labour affords the best chance to both mother and child, and the course of treatment varies according as the child remains in utero or has escaped wholly or partially into the peritoneal cavity. Should the child be still within the womb, delivery by forceps or version may be possible, if necessary the os being dilated by hand. Pelvic contraction or other barrier to the passage of the head demands craniotomy or cephalotripsy, and these measures may be undertaken without compunction, as the child is almost always dead from separation of the placenta.

If the child has partially escaped into the abdomen, it may be drawn back into the uterus, provided the head and a considerable portion of the body be still in that cavity. If the head or the head and shoulders have escaped, the child cannot be brought through the rent in the uterine wall without risk of considerably increasing the tear. The only resource then left is abdominal section, and indeed in all cases of *complete* tear, whether the child has escaped or not, the question of laparotomy demands grave consideration. If delivery of the child is possible by the

natural passages, the state of the mother must decide as to whether she could bear the extra shock of an abdominal operation. If the abdomen be opened, the tear may be treated by suture as in Cæsarian section; or where the neighbouring tissue is much bruised, and the rent very jagged, removal of the uterus as in Porro's operation may be preferable.

The management of the afterbirth demands a few words—for it must be understood that it is not to be expected that uterine action will expel the placenta. When the placenta is in utero it should always be removed through the vagina by hand. Should it have escaped into the abdominal cavity, which is unusual apart from its following the child, it may be drawn to the rent by traction on the cord, and then carefully pulled through by the fingers. Here again, however, laparotomy has to be considered. This operation must be performed where great difficulty is met with in extraction of the placenta; some operators would choose it in all cases, because when the abdomen is open the placenta could be easily and safely dealt with, and the clots and blood could be cleaned away, and the ruptured uterus itself be treated as before mentioned.

Besides the treatment of the tear by abdominal section, there remains to be briefly mentioned operation per vaginam, with suturing or plugging or both. If the tear be *incomplete*, not involving the peritoneum, this is almost always the plan to be adopted. In complete tears also, when delivery of the child and placenta has not necessitated abdominal section, some operators have trusted to plugging the rent in the uterine wall with iodoform gauze—all extravasated blood being removed from the peritoneum by douching through the uterus. In several cases the plan has been successful, and is certainly to be

adopted when the mother is too profoundly collapsed for a long operation; but when the patient can stand an operation, whilst admitting that good plugging has the advantage of forthwith placing her in a position to recuperate, I should hardly consider it as permanently reliable as treatment by laparotomy.

Laceration of the vaginal cervix has to some extent been discussed in the consideration of post-partum hæmorrhage. In almost every primipara some tear occurs, but it is usually of little moment. Serious rupture, however, sometimes happens in cases of obstructed labour, in malpresentations, and during the performance of operations with an insufficiently dilated os, especially when there has been previous laceration or inflammation leading to the presence of much unyielding scar tissue in the cervix. These tears are generally longitudinal, though, as mentioned, horizontal and even annular tears are reported; longitudinal tears are generally at one or other side of the pelvis, and may or may not involve the vaginal roof; sometimes they extend above the internal os. The minor cases are generally undiagnosed. The major ones may have been noticed at the time of their occurrence in cases of obstetric operation, or they may evince themselves by hæmorrhage with the uterus well contracted. The amount of loss may vary from a small continuous trickle to a rapid flow of blood, and this should always prompt an immediate examination: indeed perhaps it would be better in all cases of difficult delivery to make a point of examining the cervix for rupture as soon as the placenta is evacuated. It is not easy on the first attempt to make out a torn cervix, but once the fingers are accustomed to "the feel" of the lax cervix, it should not be a matter of great difficulty to trace

the os all round, and ascertain if there are any V-shaped breaches in the normal circular outline. An old tear may be diagnosed from a recent one, by its edges being rounded instead of being angular and irregular.

The *treatment* of laceration of the cervix consists in immediate suturing. In the absence of needles and chromicised gut, plugging with or without the use of perchloride of iron may answer as far as preventing hæmorrhage goes ; if hæmorrhage is slight, plugging may be dispensed with, as tending to interfere with healing.

To suture the cervix, the torn edges should be brought into view by means of vulsella with an assistant pressing down the uterus from above. Then chromicised gut sutures a quarter or a third of an inch apart are passed by means of a curved needle, and the sides of the tear brought together. In the after-treatment all that is required is the vaginal douche. Sutures of chromicised gut need not be removed.

Laceration of the vagina at the upper part is usually associated with rupture of the cervix, and the cause is mainly to be found in the increased tension of the upper portion of the vagina, which occurs when for instance either great retraction of the uterus has happened in transverse presentation, or when the uterus is very obliquely placed. Lacerations of the lower part are generally accompanied by ruptured perineum ; still, large or small tears may be found affecting the vagina alone, indeed the child has been delivered through the anus, after having reached the rectum by a large rent in the posterior vaginal wall. Small longitudinal rents in the mucous membrane not unfrequently occur, especially if the size of the fœtal head is disproportioned to that of the

passage; if the submucous tissue gives way and the membrane remains entire, thrombosis results; long-continued pressure of the head may cause a portion of the vaginal wall to slough away, giving rise to vesico-vaginal and other fistulæ.

Lacerations of the vulva and perineum.—The vulva generally undergoes slight laceration during the passage of the head, the fourchette being usually the part injured. Often also there may be found slight

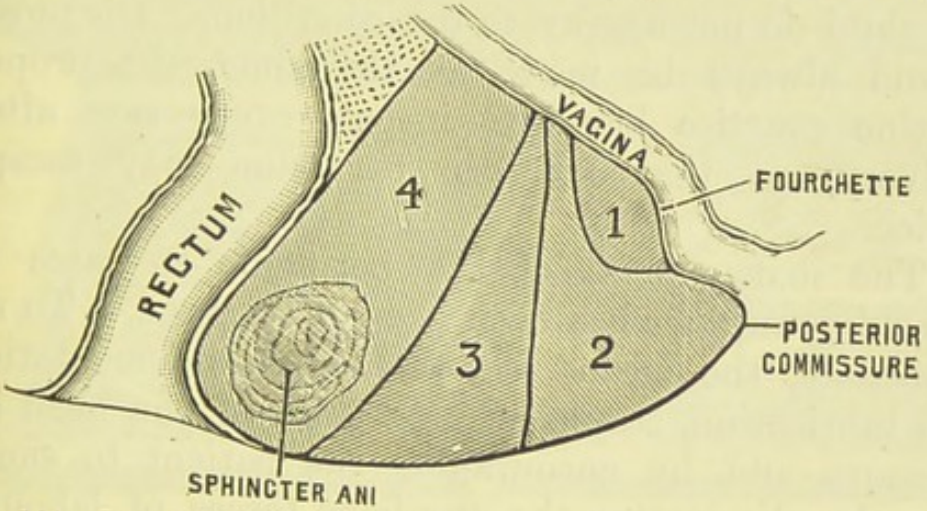


Fig. 164.—Diagrammatic Sagittal Section of the Perineal Body to illustrate various Lacerations.

1 indicates the small mucous laceration almost always occurring in primiparæ.

1 and 2 (together), a slight "incomplete" tear.

3 (alone), "central rupture."

1, 2, and 3 (together), a large "incomplete" tear; occasionally the tear in the lower aspect may extend even into the anus without involving the sphincter.

1, 2, 3, and 4 (together), a "complete" tear.

lacerations about the base of the vestibule. These are as a rule unimportant and merely require cleanliness to secure healing. More important are the cases of perineal tear.

Ruptured perineum is known as *partial* or *complete* according as the sphincter is involved or not. Generally the tear commences on the vaginal aspect of the perineal body, and extends from front to back

in the skin, but it may happen, through smallness of the pubic angle, that the head advancing too much in a posterior direction perforates the perineum, the child passing through a traumatic opening between anus and vulva, both these apertures remaining intact,—this constitutes *central* rupture of the perineum.

Nearly always the tear is commenced by the vertex in its passage through the vulva, consequently care must be taken that the chin and shoulders of the child do not aggravate the condition. Diagnosis should always be made at the time, the proper routine practice being to inspect every case after delivery, so that no torn perineum may escape notice.

The management of the perineum in cases of *impending* rupture has been previously given. To recapitulate, the means at command are fomentation and lubrication, staying the progress of the head by pressure and by encouraging the patient to shout (thereby eliminating the auxiliary forces of labour), and "supporting" the perineum so as to relax the anterior edge if possible. In the case of forceps delivery it is obviously important to work with a clear understanding of the axes of the parturient canal (*q.v.*)

As to *actual* rupture, the best treatment is immediate suturing, at any rate if the tear is more than half or three-quarters of an inch in length; the instrument used—a perineum needle—is one of the indispensable contents of the obstetric bag. The operation is one of little severity, and can usually be borne without an anæsthetic.

Partial lacerations, that is, not involving the sphincter, should have the edges brought together by transverse sutures a third or half an inch apart, each being passed through the skin at some little distance

from the tear. The hindmost should be buried all the way—the needle going through the tissue of the left ischio-rectal region, across in the recto-vaginal septum above the apex of the tear, then downwards in the tissue of the right ischio-rectal fossa to penetrate the skin from within outwards. The silk-worm gut or silver wire is then threaded in the eye of the needle, which is withdrawn, leaving the suture appear-

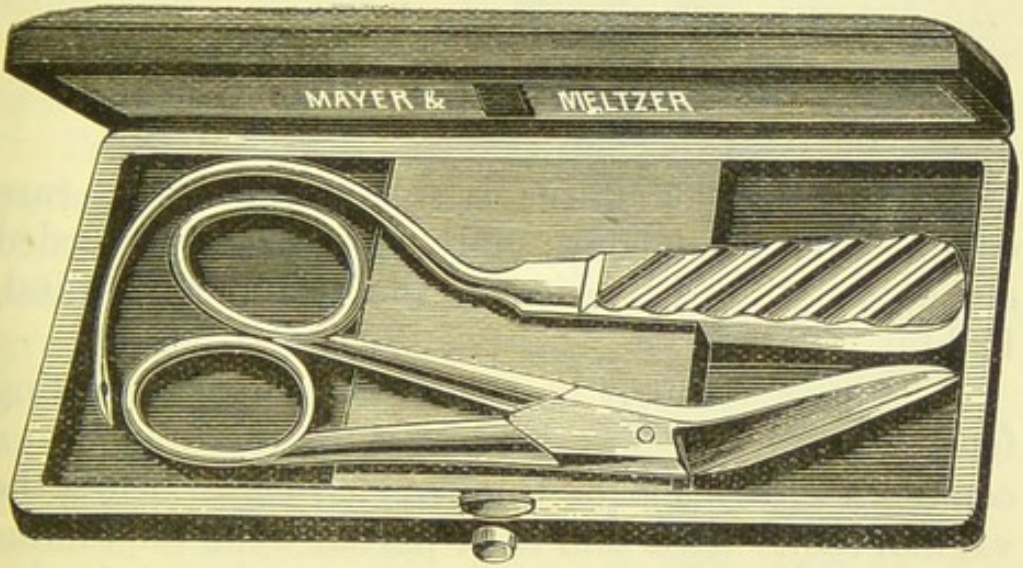


Fig. 165.—Perineum Needle and Scissors in Case.

ing neither in the rectum, vagina, nor the wound. The stitches in front of this should enter the vagina so that when tightened they close the vaginal aspect of the tear.

Complete ruptures require an additional series of sutures to bring together the rectal edges of the torn surfaces. Interrupted sutures of fine catgut should be inserted from above downwards and tied before the main stitches are put in,—in effect, by means of these rectal stitches, the tear is practically made into a partial laceration, and this is sutured in the manner previously directed.

CHAPTER XXIV

INVERSION OF THE UTERUS

INVERSION of the uterus is fortunately a very rare complication of labour; only one case is recorded among 190,000 deliveries in the Rotunda Hospital, Dublin.

The inversion may be partial or complete, varying from a small cup-like depression of the fundus to a complete protrusion of the inverted organ below the vaginal roof. It is said to be partial when the fundus remains above the os, and complete when the fundus protrudes into the vagina or through the vulva.

Usually it commences by depression of the uterine wall at the fundus, but it may originate at some point lower down nearer the cervix; commonly it occurs immediately after the birth of the child when it is generally quickly complete, or during the expulsion of the placenta, in which case it may either remain partial or may become complete.

Inversion may be caused by a sudden tug at the cord, as when delivery takes place unexpectedly in the erect position, and the child is suddenly expelled and falls to the ground; or when the cord is either actually short, or its available length is decreased by being coiled round the child's neck; by injudicious traction on the cord under certain conditions, as when the

uterus is in a state of inertia, or when a slight degree of inversion already exists; in other cases pressure upon the abdomen has led to its occurrence, or more rarely the muscular action of the abdominal wall has apparently been sufficient. In all cases, whether the exciting force has been applied from above or below, flaccidity of the womb is a constant factor.

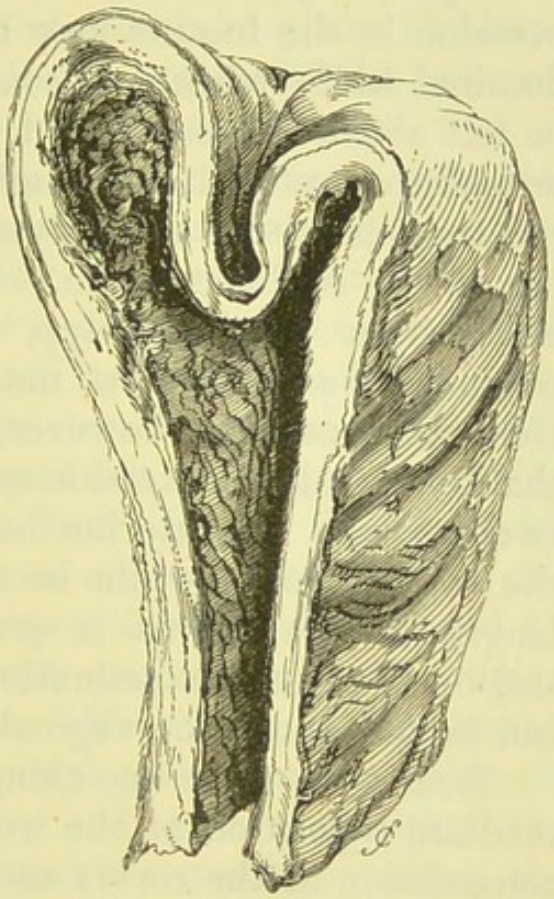


Fig. 166.—Commencing Inversion of the Uterus.

(From a preparation in the Museum of Guy's Hospital.)

Partial inversion is perhaps more common than is generally considered, at any rate in gynæcological practice it is not infrequently seen in cases of uterine polypi. Spiegelberg reports comparatively frequent instances of spontaneous rectification in cases where there has been a local depression; and he also records spontaneous reposition of a complete inversion by means, as he supposes, of retraction of the ligaments.

The *symptoms* vary according to the degree of inversion; dragging pains, restlessness, failing of the pulse, and consequent syncope, nausea, cold sweats, ghastly pallor, and the usual indications of shock and collapse are more or less manifest. When the placenta remains completely attached, there may be no immediate hæmorrhage; but as the relative changes in

position which take place between the placental and uterine surfaces in the act of inversion usually detach the placenta more or less, the hæmorrhage then becomes very copious.

Physical signs.—If the inversion is slight, the depression in the fundus may be felt through the abdominal wall; when it is complete, the uterus cannot be felt above the pubes, but is found on the vagina, or perhaps protruding through the vulva like a bright red tumour with a soft velvety surface, readily bleeding on the slightest touch. The diagnosis has to be made from uterine polyp, and the possibility of polypus *plus* inversion must be borne in mind. Generally speaking, however, in inversion there is a shallow circular depression round the pedicle of the swelling, and the uterine body cannot be felt above the vaginal roof; while in the case of a polyp the length of the uterus is scarcely if at all affected, and on bi-manual examination the body of the uterus can be felt above the vaginal roof.

Treatment.—The one thing to be done is the immediate reposition of the womb, for after a time the constriction at the cervix causes the organ to become tumefied — a condition which greatly increases the difficulty of replacement.

In a uterus recently inverted, with the placenta still attached, the question arises as to how to deal with the placenta. Should it be firmly adherent, it is perhaps best to try and replace the whole mass, but if it be only loosely connected to the uterine wall, or the mass be too bulky to pass through the contracted cervix, the placenta may be first carefully peeled off.

In partial inversion the uterus if inert should be compressed by the fingers, so as to empty its vessels, and then pressure is to be applied in the axis

of the pelvis. The sacral promontory must be avoided, and sometimes it is best to push in a slightly lateral direction, in all cases counter-pressure being employed from without. This manœuvre will generally succeed in producing a return of the uterus to its normal position; then, lest re-inversion take place, the hand should be retained within the uterus, whilst external stimulation is applied till contraction occurs.

In complete inversion much the same measures are to be taken, and cautiously continued for some time; if necessary they must be aided by an anæsthetic. The uterus is grasped in the hand, with the fingers extended round it, the fundus being in the palm. It is squeezed for some time, and then steady attempts are made at reposition, the upper part being pushed through the os first (Kilian, McClintock), sometimes pressure first on one side and then on the other is successful, or reposition may be effected by pushing in the fundus with the finger in the region of the Fallopian tube (Merriman, Noeggerath). Whatever means are employed, counter-pressure must not be forgotten; and after reposition the uterus must be stimulated to contract before the internal hand is withdrawn.

In inversion of some standing it is necessary first to reduce any inflammatory symptoms by hot fomentations, leeches, etc., and then to use air-pessaries or other contrivance to keep up sustained pressure for a considerable time. When the inversion has become chronic, *i.e.* as defined by Dr. Barnes, after involution has taken place, sustained pressure or the taxis should be tried; the length of time and the degree of force used must be left to the judgment and experience of the operator. A high authority, Marion Sims, limited the duration of the taxis to half an hour, and recommended the introduction of

an air-pessary, which is allowed to remain until the patient has rallied from the effects of the operation, when a second attempt may be made.

The best method of applying sustained pressure is undoubtedly by means of Aveling's repositor, or Dr. Galabin's modification thereof. Aveling's instrument comprises three different-sized vulcanite cups which can be screwed upon a sigmoid metal rod, the outer end of which affords attachment to four rubber bands. The cup of appropriate size is fitted to the inverted fundus, and by the elastic bands fastened to a waistband, pressure is transmitted through the curved stem in a direction corresponding with the axis of the pelvis. The instrument must be adjusted occasionally, and sedatives given to relieve the pain; in some cases it may be well to intermit the pressure for some hours and then to reapply it. Few cases withstand assiduous treatment by this means; generally the uterus will yield to pressure of twenty-four to forty-eight hours' duration. Galabin's modified repositor has for its head a cylindrical mass of vulcanite $1\frac{3}{4}$ inch long, with a concavity on the upper surface which receives the fundus; a perforation runs through the length of the instrument. These modifications serve to prevent the

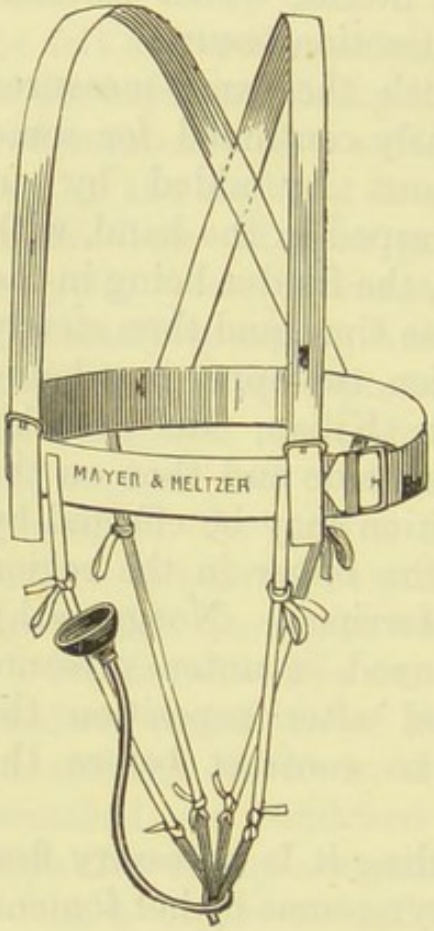


Fig. 167.—Inversion Repositor. (Aveling.)

repositor being retained in utero after the fundus is restored to the proper position :—the size of the instrument does not allow of its being wholly grasped within the womb, and the perforation assists withdrawal by eliminating atmospheric pressure.

Finally, in obstinate cases our last resource is to excise the uterus, a procedure which should scarcely ever be required.

CHAPTER XXV

INDUCTION OF PREMATURE LABOUR

UNDER certain circumstances, the full term of gestation cannot be arrived at without involving great peril, or even death, either to the mother, to the child, or to both. We therefore seek to anticipate the natural term by the induction of premature evacuation of the uterine contents, and thus to avert the threatened mischief. Before the child is viable, *i.e.* before the end of the seventh lunar month, the operation is styled "induction of abortion," and after that period the "induction of premature labour."

Conditions calling for the operation may arise in either mother or child. On the part of the mother there may be pelvic deformity, or some general or local condition rendering the continuance of pregnancy a danger to her life. Among the latter class of cases are to be mentioned uncontrollable vomiting, albuminuria, eclampsia, chorea, grave heart and lung disease—causing urgent dyspnœa,—abdominal and pelvic tumours (including malignant disease of the cervix), incarceration within the pelvis of the displaced womb, and complications of pregnancy, such as accidental and unavoidable hæmorrhage. On the other hand, repeated difficult labour, due to excessive

size of the fœtus or to advanced ossification of the cranium, or death of successive children within the last few weeks of pregnancy, may also be indications for the operation.

The fitting period for the induction of premature labour is determined by a due consideration of the urgency of the symptoms, and the prospective viability of the fœtus. For instance, if the patient suffers from excessive and persistent vomiting, and the strength is evidently becoming so far reduced as to imperil her life, the uterus must be relieved of its contents, irrespective of the age of the fœtus. On the other hand, if a moderate degree of contraction of the pelvis constitutes the difficulty, it will be our duty to wait until the child has reached a period of its existence sufficiently advanced as to ensure it a fair chance of surviving a preternaturally early expulsion.

The child can scarcely be said to be viable until the end of the seventh month. There is frequently some difficulty in calculating the exact age of the fœtus even when the time of the cessation of the menses is known; on the one hand there is the risk of procuring the expulsion of a non-viable child, and on the other of allowing development to proceed so far as to necessitate operative delivery or even craniotomy. In pelvic contractions the time chosen must depend upon the degree of distortion. In a flattened pelvis, if the conjugate diameter is above $2\frac{1}{2}$ inches, a viable child may be born; if under this measurement, labour must be induced at a period so early that the probability of the child's survival is but slight; of course the nearer the child is allowed to proceed to the full term, provided it can pass through the narrow canal, the greater the chance of its survival. Usually it is held that with a conjugate of

$2\frac{1}{2}$ inches, labour should be induced at the end of the seventh lunar month; of 3 inches, at eight lunar months; and of $3\frac{1}{2}$ inches, at nine lunar months of uterine gestation. These statements should be taken as referring to the purely flattened pelvis—any transverse contraction superadded will materially modify them.

Sometimes, as stated, from causes solely originating in the child, it is necessary to anticipate the natural period of delivery—as when the maternal pelvis being of normal size, dystocia is repeatedly produced in the same woman through excessive size of the fœtal head, or from advanced ossification having rendered it rigid and unyielding. Again, some women bring forth a series of dead children at the full time, the result usually of placental degeneration, which, by interfering with the nutrition of the fœtus, causes still-birth. In either case, if we shorten gestation by two or three weeks, we may generally obtain a successful result. In cases dependent upon degeneration of the placenta, it is well, during the last few weeks of pregnancy, to examine day by day the pulsations of the fœtal heart with the aid of the stethoscope, so that when any change takes place in its rapidity or regularity, we may be ready to proceed to immediate delivery.

Methods of inducing Premature Labour.—The agents used to effect the induction of premature labour have been classified into those which act on the uterus through the maternal system, and those which act directly on the organ itself. The more useful methods are given first, prefacing their consideration by stating that no one method is always the best; a combination of methods being often advisable. In all cases the most stringent antiseptic precautions should be adopted: the vagina should be well douched, and the

instruments and hands should be scrupulously cleansed before any operation is commenced.

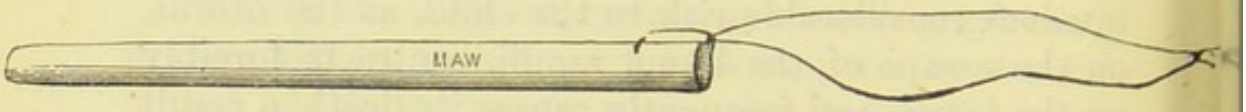
(*a*) *Rupture of the membranes* forms a plan of treatment well adapted to cases of eclampsia and accidental hæmorrhage. Denman advocated the plan of puncturing the membranes with a quill. The method, while very certain to induce labour, unfortunately involves considerable risk to the child, as the uterus, on the escape of the liquor amnii, contracts forcibly on the fœtus, and frequently causes its death, a result all the more likely to take place from the resistance offered by the undilated cervix because of the absence of its natural hydrostatic dilator, "the bag of waters." If the fœtus is dead or non-viable, or if an immediate reduction in the size of the uterus is desirable, the foregoing objections do not apply. Occasionally, after the first gush of liquor amnii, the child's head blocks up the aperture in the membranes, and so retards the escape of the remaining fluid, and the child in this case is placed under much more favourable circumstances than when the liquor amnii comes away *en masse*. Hopkins and Meissner proposed puncturing the membranes some distance from the os, and for this purpose devised special instruments; but the objections to this modification are the difficulty of its performance and the risk of injury to the uterus.

(*b*) *Passage of the intra-uterine bougie* (Krause).—This method depends on the separation of the membranes from the uterine wall, and the irritation due to the continued presence of the bougie within the womb.

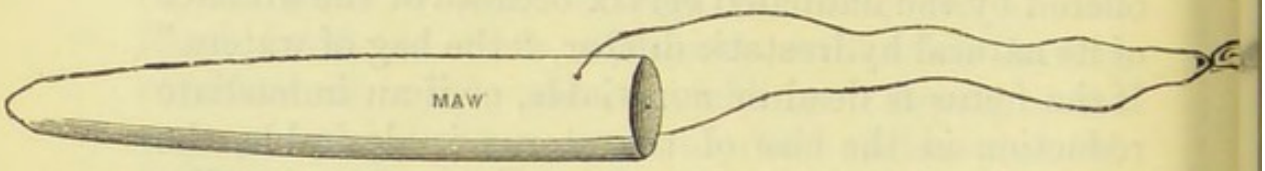
Hamilton advised separation of the membranes round the os by the finger or uterine sound, but the plan is uncertain and has given place to Krause's method of leaving *in situ* an elastic bougie which has been passed some six or seven inches between the mem-

branes and the uterine parietes—the outer end of the bougie being supported on the posterior vaginal wall.

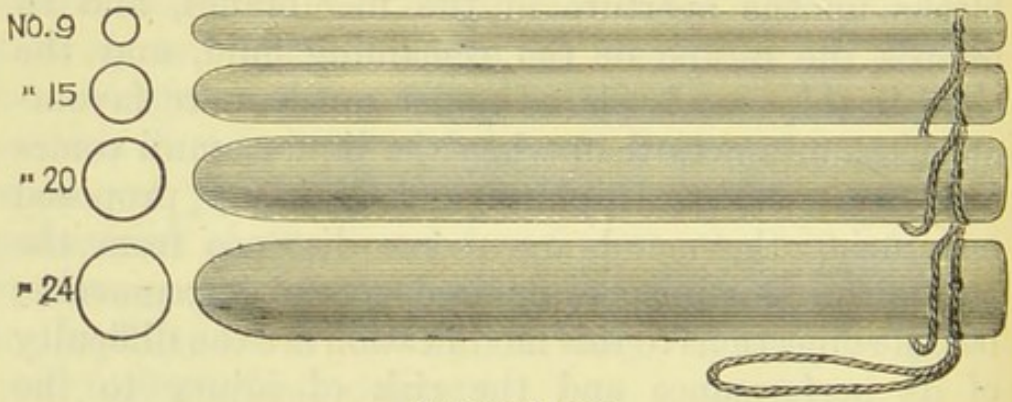
Labour induced by the bougie very closely imitates the natural process, the mechanism of the first stage not being interfered with by evacuation of the liquor amnii. It is on this account a favourite operation for



Laminaria (or Sea-Tangle) Tent.



Sponge Tent.



Tupelo Tents.

Fig. 168.

securing the birth of a living child. The disadvantages are the length of time taken—twenty-four to forty-eight hours—and the chance that the placenta may to some extent be separated. The late Sir James Simpson suggested that any risk of wounding the placenta may be avoided by ascertaining its position by means of the stethoscope, and then directing the bougie to another part of the uterus; given this pre-

caution, the operation is a safe and certain way of inducing premature labour.

(*c*) *Artificial dilatation of the cervix* has been frequently proposed as a means of exciting uterine action.

Metallic dilators, tents, and hydrostatic dilators have all been used for this purpose. Keiller of Edinburgh was the first to introduce an elastic dilator within the uterus, and afterwards Dr. Barnes developed this process to great perfection, his well-known

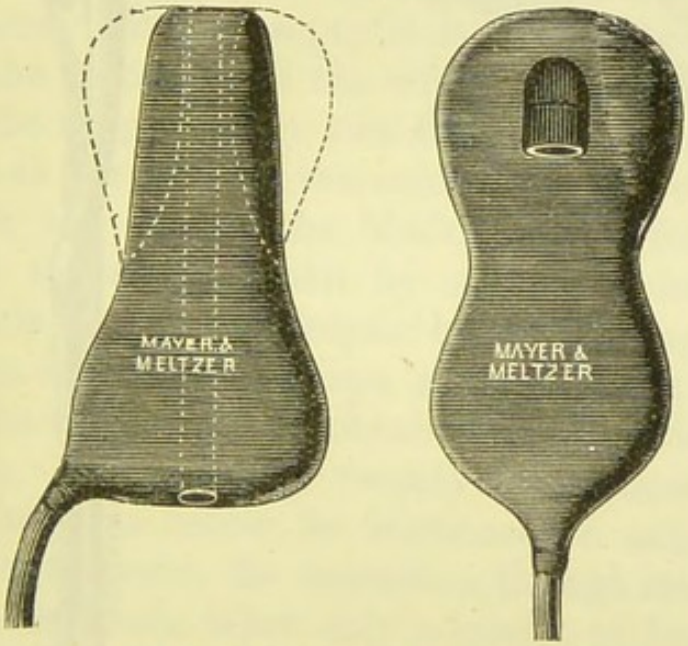


Fig. 169.—Barnes' Bag and Improved Form.

fiddle-shaped bags affording very satisfactory means of artificially dilating the os. Tarnier uses a modification of Barnes' bag in the form of an intra-uterine dilator of caoutchouc, which is introduced above the internal os, and distended with water. My late colleague Dr. Thorburn spoke approvingly of Tarnier's apparatus, and made some alterations and improvements in it. I, too, found it efficient in several cases.

Lately a form of hydrostatic dilator known as

Champetier de Ribes' bag has been much used. It consists of a silk bag covered with rubber, and, unlike

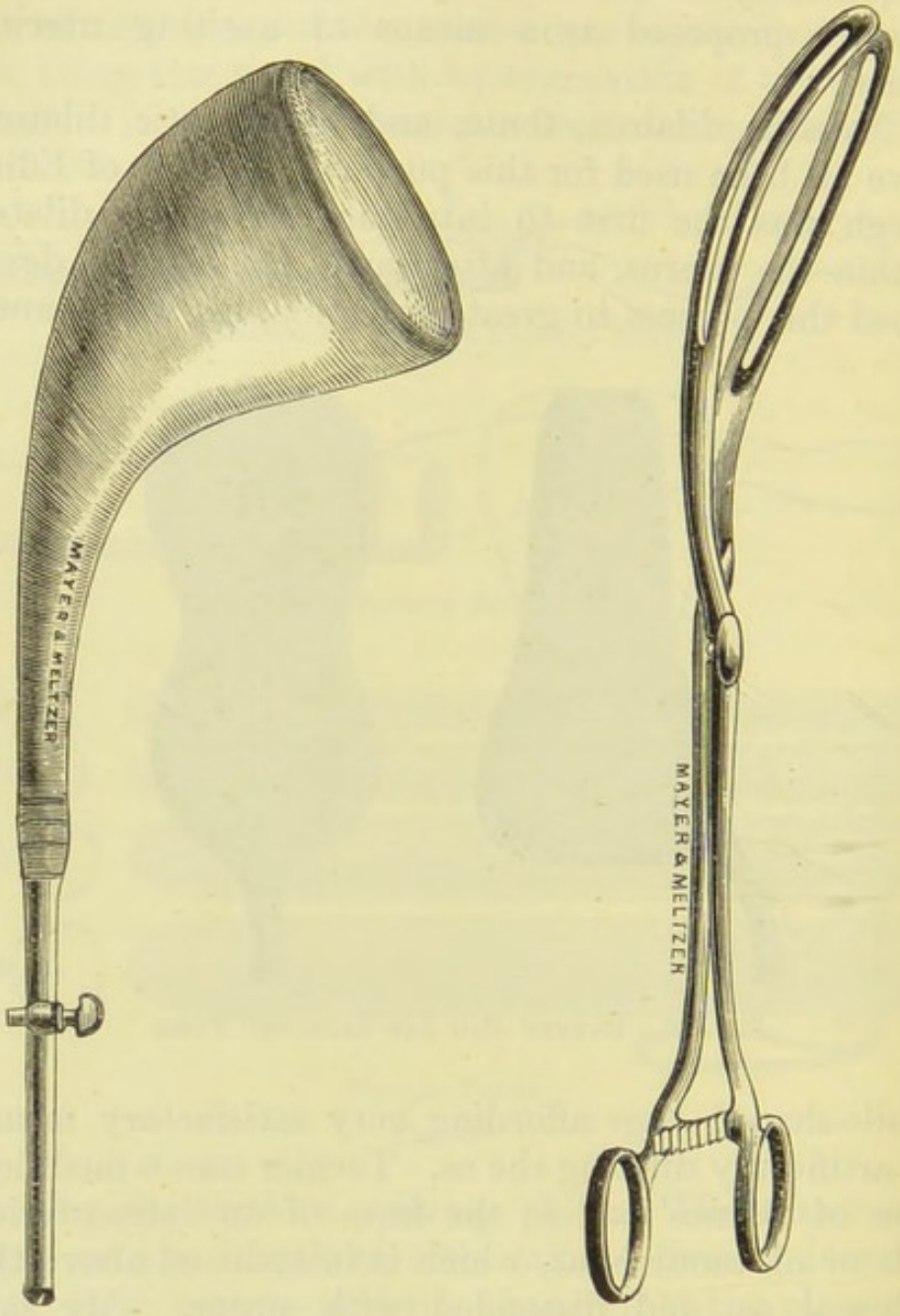


Fig. 170.—De Ribes' Bag and Forceps.

the pure rubber bags, when filled takes its own peculiar shape and size, being little if at all enlarged by pressure. As seen from Fig. 170, it is somewhat conical,

the diameter of the base being $3\frac{1}{2}$ inches. The advantage of this bag is that it leaves the os fully dilated, a second or third dilator not being necessary, but its introduction requires the os to be large enough to admit two fingers. Like Barnes' bags, it occasionally has the objection of causing alteration or complication of normal presentations, and the physician should therefore be at hand to treat any contingency that may arise.

The Champetier de Ribes' bag is introduced by means of special disarticulating forceps sold with the instrument. When empty it is folded and grasped within the forceps, and the whole is carefully passed within the os, guided by two fingers of the left hand. As soon as the bulk of the conical portion of the bag is within the uterus, the blades of the forceps are removed separately, then by a known number of syringefuls of warm antiseptic lotion the bag is made to assume its required shape, after which it is left *in situ*. The time taken to obtain full dilatation of the os varies. Occasionally twenty-four hours will be needed, but if a nurse be stationed to exert gentle traction on the tube, the operation, though rather more painful, commonly takes only a couple of hours.

It is better to use laminaria or tupelo rather than sponge tents, they are equally efficient, do not disintegrate, and therefore are not so prone to encourage septic changes. After the tent, one of the smaller Barnes' bags may be introduced, and when expelled replaced by a larger one; and so on until the requisite degree of dilatation is secured.

Finally, as a method of artificial dilatation of the cervix must be mentioned rapid digital dilatation under anæsthesia. With practice this can be done to the extent necessary to admit the fist within twenty or thirty minutes. First one finger is inserted, then

the tips of two, and so on; by separating the fingers and thumb, soon all the digits in a cone-like form can be introduced, and the whole hand follows in due course. The manipulation must be such as not to rupture the cervix; judiciously performed, the operation is the best when time is of great importance, as in cases of eclampsia, hæmorrhage, etc.

Several other plans of inducing labour remain to be noticed, but little need be said concerning them. Such are the vaginal douche, vaginal tampon, intra-uterine injections, and the use of drugs, electricity, and abdominal and mammary irritation.

The *vaginal douche* (Kiwisch) of hot water at 110° F. used thrice daily for fifteen minutes each time is in some respects satisfactory, but is an unreliable and a slow method. The stream from a douche-can, not from a syringe, should be continuously directed against the vaginal roof; after some time labour may be excited by the irritation of the cervix and the distension of the upper part of the vagina. This method is now replaced by the more certain means described above, and is only occasionally used as a preliminary to their adoption.

The *vaginal tampon* is only to be recommended in cases of hæmorrhage. Considered as an ordinary means of inducing labour, it is slow, painful, and apt to interfere with defæcation and micturition. The best material to make use of is antiseptic gauze. Braun devised the plan of introducing into the vagina a hollow india-rubber ball, which he called a colpeurynter, and then distending it with water, but the result is uncertain. The instrument causes a considerable amount of pain, and its use has been followed by violent inflammation.

Cohen recommended *intra-uterine injections*, a catheter being passed a few inches between the mem-

branes and the uterine wall and tepid water injected through it. Lazarewitch also advocated this measure, with the addition of insisting that the catheter be carried up as near the fundus as possible, as it is here that uterine action is initiated. Various fluids in varying amounts have been used as intra-uterine injections, but all are more or less dangerous, having, at any rate in former days, frequently produced fatal results from the admission of air into the uterine veins and from other causes.

The excitation of uterine action by *drugs*, such as ergot (Ramsbotham), quinine, and pilocarpine ; by *electricity* (Radford), *abdominal friction* (d'Outrepont), *mammary irritation* (Scanzoni), and by vaginal injection of carbonic acid gas (Scanzoni), has in each case proved so uncertain or even dangerous, that all these methods have now given place to the more successful and safe operations previously described.

Care of the Child.—The prematurely born baby requires very careful management to enable it to survive, and the earlier the premature delivery the more assiduous must be the attention. Its vitality must be kept up by warmth and suitable regular feeding. It should be wrapped in cotton-wool, and placed either near the fire, or in some form of incubator such as Tarnier's—or Credé's apparatus may be employed. The daily bath should be given with water at blood-heat; as regards food, mother's milk or the milk from a wet-nurse is best, but it may be necessary to resort to artificial feeding. In any case food must be administered by the spoon if the child has not strength to suck.

The induction of abortion is to be undertaken under such circumstances as render the continuance of pregnancy a danger to the mother's life (see premature labour); and in cases of extreme deformity,

when the patient will not consent to delivery by abdominal section at term. The methods of performing the operation are those just discussed. The most fitting periods are before the third month or about the fifth. In the former case, the placenta is not fully formed, and if the cervix be dilated the ovum is likely to be discharged *en masse;* in the latter, the placenta is not usually so difficult of expulsion as when the operation is undertaken sooner after its formation.

CHAPTER XXVI

THE FORCEPS

THE forceps is an instrument constructed for the purpose of affording to the accoucheur a means of grasping the child's head, making traction, and of altering its position whilst in the parturient canal. The forceps was known in ancient times, but the merit of re-inventing this instrument is due to Dr. Peter Chamberlen,[1] who lived about the year 1640. For a time the instrument was kept a secret, the Chamberlen family meanwhile acquiring great reputation in the treatment of difficult labours. By degrees the secret crept out, and the forceps, like many other useful inventions, had to stand the severe test of injudicious use; turning consequently fell into comparative neglect, the forceps being employed in season and out of season, until the inevitable reaction set in, which caused the instrument to be looked upon with unmerited disfavour and to be avoided except as a last resource. Happily a more logical appreciation of this instrument now exists, the forceps having its legitimate range of action, within which all unprejudiced operators use it without hesitation.

There are two kinds of obstetrical forceps, respectively called the long and the short forceps. The long

[1] Aveling.

forceps is adapted for use when the fœtal head is either above or below the brim; whilst the short forceps can be used only when the head is near the outlet. The *short forceps* consists of two curved, fenestrated blades, which, when placed in apposition, describe an

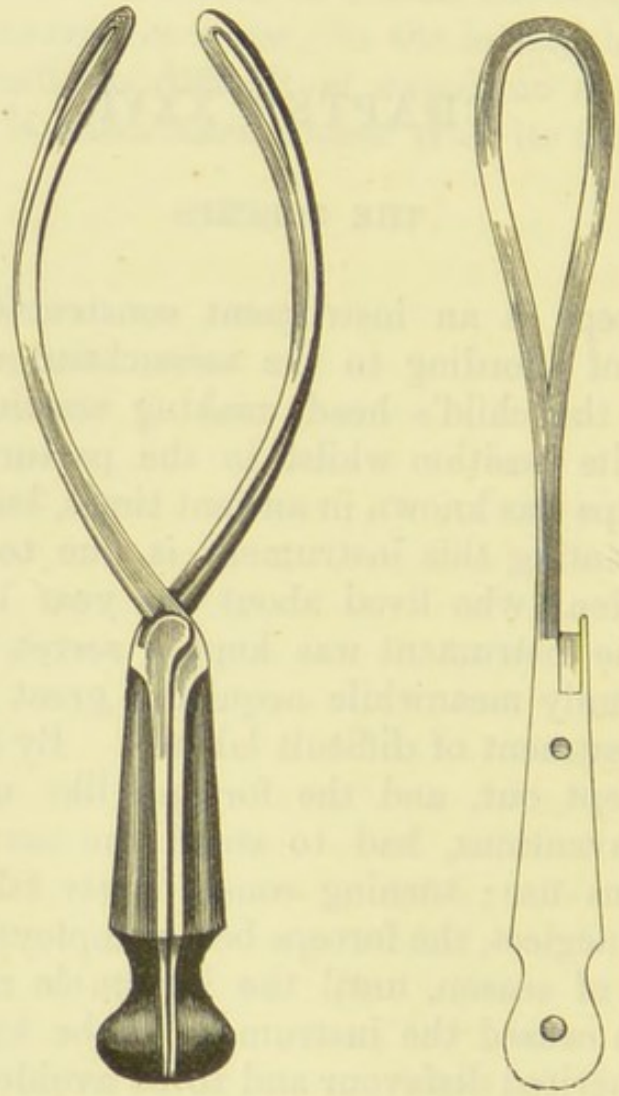


Fig. 171.—Short Straight Forceps.

ellipse about 7 inches in length, by $2\frac{7}{8}$ inches in its greatest diameter. The blades are usually furnished with wooden handles, and have an arrangement, called the lock, by which they can be united. The lock figured in the plate (Fig. 171) is known as the English

lock, and was invented by Smellie. It is quite satisfactory, and is considerably easier of manipulation than the pivot and slot locks found on the French and German instruments.

This instrument has undergone several modifications [1] from time to time, but still retains the general characteristics of Denman's forceps. The straight short forceps, owing to inadequate length and non-adaptability to the curve of the pelvic canal, is not applicable when the head is high up. The instrument has sometimes been lengthened by the addition of a straight shank between the curved portions of the blades and the handles; but such an instrument cannot be applied to a head high up in the pelvis without rendering the soft parts of the mother liable to severe contusion and laceration, owing to the great tendency which straight forceps have of slipping over that part of the fœtal head which lies nearest the mother's sacrum. To obviate this difficulty, a second or pelvic curve has been added at a right angle to the cranial curve, so that the fenestra, instead of being in a straight line with the handles, form a curve representing an angle of about 35°, which gives the handles a direction forwards from the perineum, however high the situation of the head. The instrument thus constructed by the addition of a shank and a pelvic curve is known as the *long forceps*. It is found practically that the long forceps with

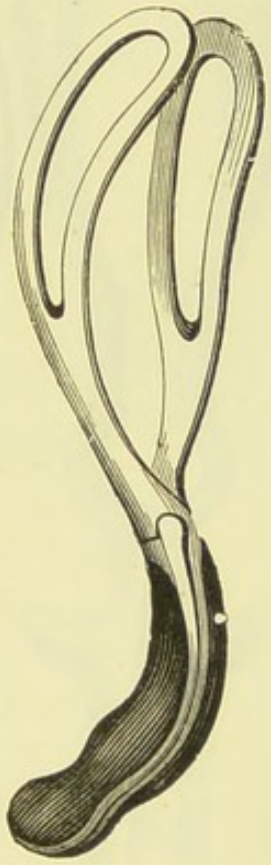


Fig. 172.—Aveling's Short Forceps.

[1] Those of Sir James Simpson, Dr. James Braithwaite, and Dr. James Aveling being the most useful and convenient.

the second curve adapts itself equally to the head whether it is high or low; and since it is convenient to have an instrument available for general use, the practitioner usually contents himself with a pair of long forceps as being suitable to all positions of the head. The straight forceps, however, have one

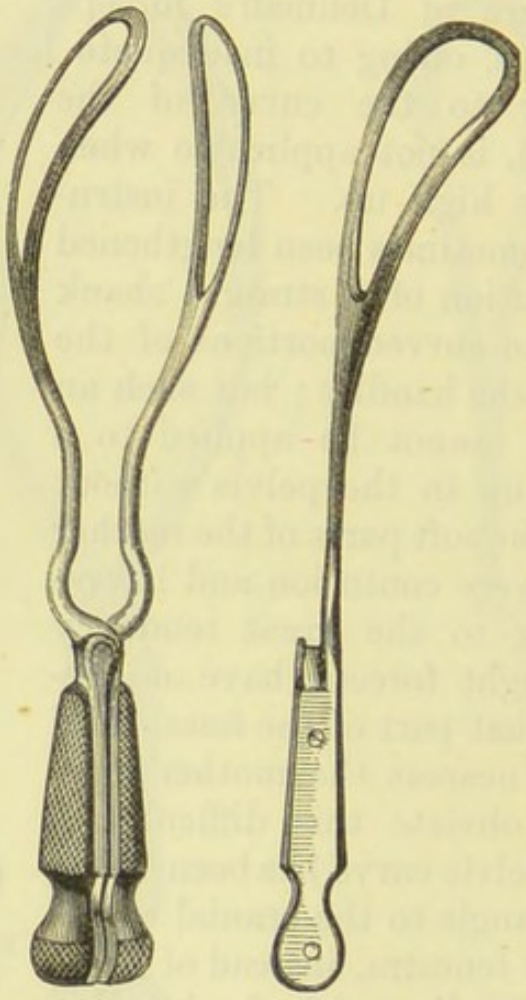


Fig. 173.—Lever's Long Forceps.

advantage, and that is their adaptability for use as a rotator of the head, say in mento-posterior positions. In these cases a similar manœuvre could not be attempted by means of instruments possessing a pelvic curve, without incurring considerable risk of injury to the walls of the pelvis by the tips of the blades.

There are numberless modifications of the long forceps, every accoucheur having his pet instrument, which, in most instances, differs from the ordinary form to so slight an extent that the designer himself is the only person able to appreciate the improvement. The instrument with which Roberton's name is associated is an excellent form of forceps; so also are the forceps of Barnes and of Simpson, which have the advantage of affording the opportunity of obtaining a purchase for the hand by hooking the fingers over the handles, and thus facilitating traction. Graily Hewitt devised a modified form of forceps for use when the fœtal head is unusually elongated by being forced along narrow or unyielding passages. Aveling proposed to curve the handles backwards, so as to increase the grasp and power of traction. Dr. Galabin has designed a long forceps with the shanks curved in such a manner as to enable the operator to make traction in the axis of the pelvis. The usual dimensions are—length of curved portion of blade, $6\frac{1}{4}$ inches; straight portion, $2\frac{1}{2}$ inches; fenestrum, $1\frac{1}{4}$ inch at the widest part; ends of blades, $\frac{7}{8}$ inch apart; widest part between them when the handles are closed, $2\frac{7}{8}$ inches; the pelvic curve being about $1\frac{1}{4}$ inch.

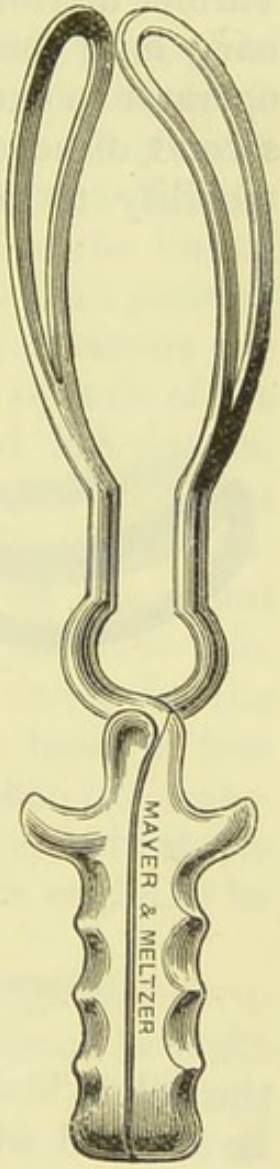


Fig. 174.
BARNES-SIMPSON FORCEPS.

Radford designed a pair of long forceps with blades of unequal length, the longer blade being in-

tended to go over the face, and the shorter blade over the occiput. The forceps bearing the name of Professor Tarnier of Paris possess certain distinguishing features evincing great mechanical ingenuity. M. Tarnier attributes the following defects to the ordinary long forceps: "First, of never allowing the operator to exercise traction in the axis of the pelvis; second, of never leaving to the fœtal head a sufficient mobility to enable it to follow truly the curve of

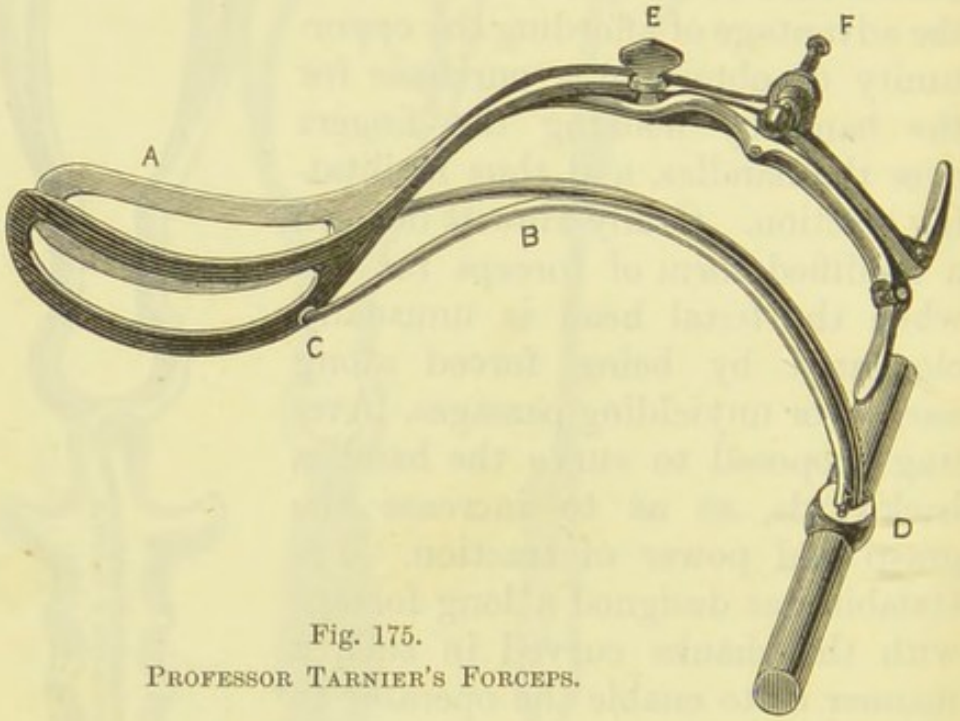


Fig. 175.
Professor Tarnier's Forceps.

the pelvis." The instrument about to be described he devised with a view of remedying these defects. AA (Fig. 175) are the blades which represent those of an ordinary pair of forceps; to these the tractors B are united by an articulation C, movable in all directions. The tractors are so curved that traction is made in a straight line from the centre of the fœtal head to the handle D, the result being that the head when above the pelvic brim is drawn backwards into the hollow of the sacrum, and not against

the pubic arch, as is the tendency with the ordinary long forceps. The blades cross and lock in the continental fashion with a screw E. A second screw F is affixed to the blades, by means of which they can be made to grasp the fœtal head with the requisite amount of pressure. The instrument is applied according to the ordinary rules: each blade is introduced along with its tractor, and is afterwards locked to the other blade with the screw E: the shanks of the blades act as an indicator to the line of traction, and if the tractors are maintained in a position parallel to them, separated by a space of about one *centimètre*, the operator draws exactly in the axis of the pelvic canal. The advantages claimed for this instrument are somewhat numerous. It is stated that less force is required, that there is no injurious compression on the maternal parts nor on the fœtal head, that the blades seize the head without projecting over it, that there is no tendency in the blades to slip off the head, that the head is free to follow the pelvic curve, and finally, that the transverse traction handle gives greater power, whilst the indicating handle shows how the power ought to be directed.

Many modifications of Tarnier's original instrument have been introduced. Tarnier himself brought out several, Fig. 175 representing a pair of forceps illustrated in Fig. 14 of his monograph. The axis traction instruments most commonly used in Britain are those of Dr. A. R. Simpson, Dr. Milne Murray, and Dr. Cullingworth.

The blades of forceps, whether long or short, should be smooth and highly polished, so as to reduce to a minimum the friction caused by passing them between the child's head and the pelvis. It is very convenient to have the steel electro-plated with nickel, which

resists the oxydising properties of animal fluids, and, when the instrument is not in use, obviates the

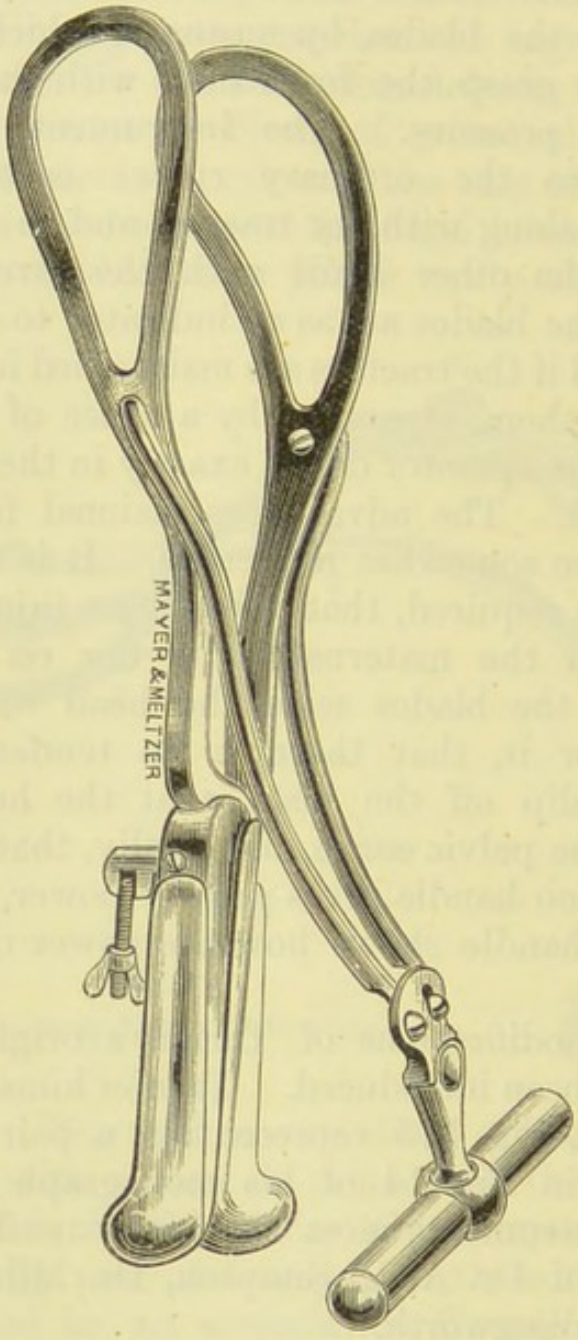


Fig. 176.—Dr. Simpson's Axis Traction Forceps.

necessity of keeping the blades coated with grease. The handles and lock should have no small crevices in which septic matter might be harboured. They

are better as plain as possible, and the so-called "aseptic" metal handles are advantageous, inasmuch as they admit of the whole instrument being boiled and rendered sterile.

The forceps is used principally as a means of traction, but it can bring to bear the two accessory forces of leverage and compression, both, however, to a slight extent as compared with the tractile force. It is as a lever we use the forceps when we impart to the handles an undulatory motion. What then occurs is as follows: when the instrument is kept well drawn down, and the handles are oscillated either from side to side or from front to back, the part of the head impinging on the pelvic brim on that side to which the handles are directed keeps its position, while on the opposite side some advance occurs. Dr. Galabin points out that the oscillatory movement is best made in the line of that pelvic diameter in which obstruction is greatest, *e.g.* if the pelvis is flattened an antero-posterior movement should be imparted to the handles, and a side-to-side motion given in cases of transverse contraction.

The cases demanding the use of the forceps may be arranged under three heads—uterine inertia, mechanical obstruction, and threatened danger to the life of mother or child. In inertia great care must be taken not to forcibly empty the uterus without allowing time for it to contract. Contraction may be generally induced by grasping the uterus externally with the hand, and exercising a fair amount of pressure. The perverted old adage that "meddlesome midwifery is bad," has long stood in the way of an early application of the forceps in uterine inertia; so has the observation, often urged, that as no mechanical obstruction existed, nature required only time to conclude her work unaided. In some instances, doubtless, it

may be true; but unfortunately this overweening trust in the abstraction called "nature" tends often to disastrous results, so that, whilst futilely waiting and hoping, the patient's ebbing powers too plainly show that life is in danger, and the over-cautious attendant is at last compelled to resort to the mechanical means he ought to have adopted before the woman had reached a condition unfavourable, both locally and generally, for operative interference. Rash and inconsiderate measures I would not be thought to encourage. On the contrary, care and caution should ever be the watchwords of the obstetrician; but we must not let our caution warp our judgment, and so delay a comparatively simple and harmless operation until it becomes one that is difficult and dangerous. The evils which result from procrastination—inflammation, sloughing, and vesical fistulæ—often wrongly put down to the use of the forceps, are more justly to be attributed to undue delay in resorting to it.

My colleague Mr. Hardie (*Edinburgh Medical Journal*, 1876) vigorously advocated timely resort to the forceps in place of the dilatory action usually recommended by the older obstetrical authorities. We may observe that as a rule it is inadvisable to interfere in simple cases of tedious labour or in difficult labour till the os is fully dilated or dilatable; but careful delivery by forceps is good treatment where the patient's powers are becoming exhausted after a prolonged first stage, due say to premature rupture of the membranes. Again, in cases of uterine inertia the forceps is to be preferred to ergot, and comparatively early assistance should be given, as in these cases mechanical aid is not to be regarded as a *dernier ressort*. If, however, the practitioner be summoned very late in one of these cases of inertia, it then be-

comes a question of forceps *versus* the administration of an opiate and food to the patient with a view of enabling the uterus to regain some of its lost tone. To complete delivery at once is often to risk *post-partum* hæmorrhage, therefore in labours where the pains have been slight and are "going," and the head is loose at the brim, it is frequently good to wait a little. Indeed it is sometimes surprising how soon a dose of laudanum serves to restore the uterus to an efficient degree of activity, with the gratifying result that the child is speedily expelled by the unaided natural powers. If, however, the head be within the pelvis, it is not usually well to put off delivery, and the forceps may then be cautiously applied. From what has been said before it will be seen that a correct interpretation of the cause of delay is exceedingly important, as temporising is to be very strongly condemned in prolonged labour, either when the pains are active or when the uterus has assumed a state of tonic contraction; then chloroform and very careful instrumental delivery—the forceps if the degree of obstruction is favourable—must be resorted to in order to avoid the risk of ruptured uterus. Finally, as a general rule, in cases where the head is firmly impacted within the pelvis, the forceps should not be employed when there is good reason to believe that the child is dead.

Mechanical obstruction is treated of in the sections on obstructed labour and deformities of the pelvis; the limits within which the forceps can be safely used are there indicated.

As delay in the second stage of labour may cause danger to the child, the practitioner should make a point of ascertaining, by auscultation, the actual state of the fœtal circulation; and, if it begins to flag, he is justified in using the forceps, provided it is not

contra-indicated. In prolapse of the cord, the child being in danger and other means failing, the forceps may be used.

The complications imperilling the life of the mother, and demanding, under certain conditions, the use of the forceps, are convulsions, rupture of the uterus, and hæmorrhage, which are all considered under their respective heads.

Application of the forceps.—Before applying the forceps it is necessary to ascertain whether the maternal structures are sufficiently relaxed and dilated. It is usually held that the os uteri should be so fully dilated that its margin is out of reach of the finger; but this rule is too hard and fast always to hold good, for sometimes the anterior lip descends below the head, and becomes compressed between it and the pubes, and ere it can be released the forceps may be required. Other exceptions are also met with. In the majority of cases, however, it is well to let the os dilate to the utmost before applying the forceps. The vagina and perineum should be relaxed so far as to accommodate themselves to the advancing head, plenty of time being allowed to permit them to yield without laceration—a rigid perineum demands the exercise of the greatest care.

The state of the rectum and bladder should be ascertained; the rectum should be palpated through the vaginal wall; if it is distended, an enema should be given, and even though the patient is said to have passed water but a short time before, a catheter should be passed—a precaution invariably to be taken.

The patient is now placed on her left side with her knees drawn up to the abdomen, the trunk lying across the bed, and the nates close to and even slightly overhanging its edge. The inexperienced practitioner will do well to make sure that the last direction is

fully carried out before he attempts to introduce the forceps, otherwise he will be compelled to desist until the proper position is assumed.

The next step is to ascertain the position of the fœtal head by feeling for the ear, or if this cannot be felt, by an examination of the sutures and fontanelles, as directed in the section on the mechanism of labour.

The application of the short and long forceps was formerly conducted on two different principles, the short being governed by the position of the child's head, and the long solely by the course of the pelvic canal, but this rule is not now generally adopted. The most favourable position in which the forceps can be applied to the head is that in which the blades pass over the parietal protuberances; and to accomplish this we may adapt the instrument to the position of the head when it is low down in the pelvis. When the head is above the brim, however, the bi-parietal diameter is in the antero-posterior diameter of the pelvis, and it would be impossible, both from want of space and from the curved direction of the pelvic canal, to apply the forceps so as to embrace the head laterally; we are therefore compelled to be governed by the maternal structures, and to seize the head in its long diameter, or nearly so. Most practitioners introduce the forceps always with regard to the pelvis, even when the head is low down. Ramsbotham favours this plan.

We will now suppose that the forceps is to be used with the head low, and the face in the hollow of the sacrum. Before introducing the instrument the blades should be raised to the temperature of the body by immersion in warm water, and then lubricated with some antiseptic cream. It matters little which blade, upper or lower, is first introduced; say the lower blade is selected. The distinction between the

blades is readily made. If the forceps are straight, there is no difference between the two, and either may be taken; if like the long forceps there is a pelvic curve, when the blades are put together and locked the

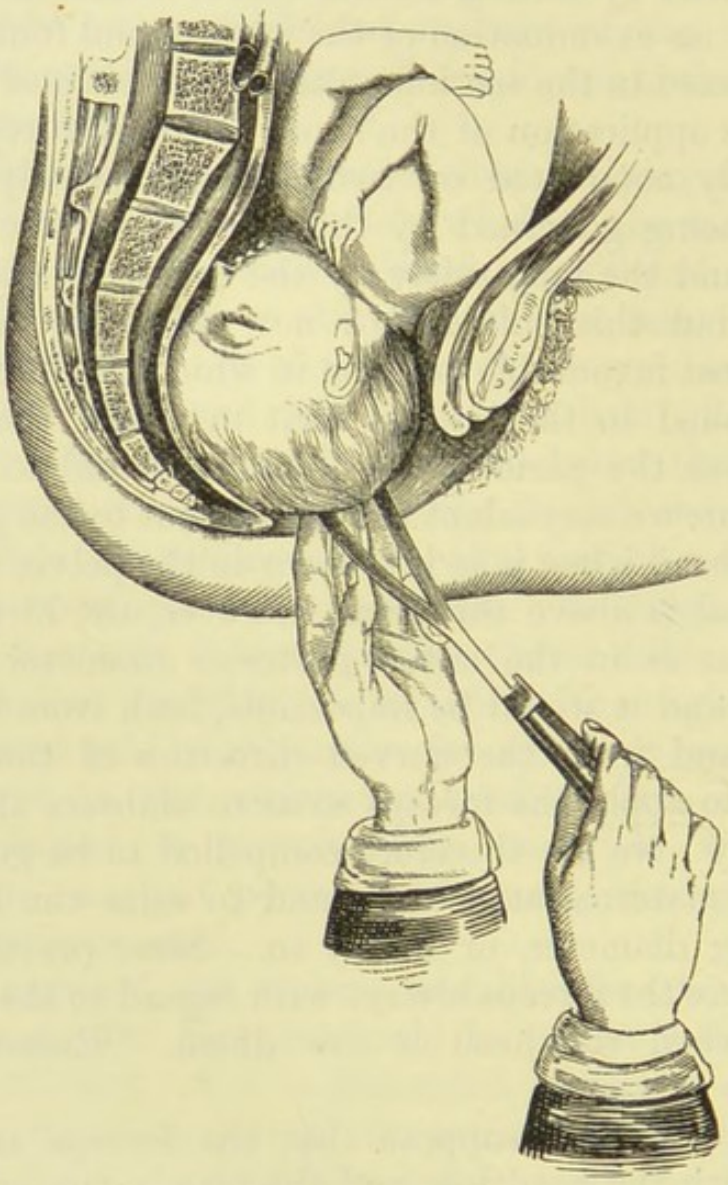


Fig. 177.—Introduction of the First Blade of the Straight Forceps.

concavity of this curve should look forwards, and this fact will be sufficient to indicate which is the upper or right blade, and which the lower or left. The instrument is held lightly in the right hand; the left hand is then

passed along the vagina, and the child's ear is sought for. The tips of the fingers now rest on the head, and help to guide the instrument, which is gently slipped between the fingers and the head, the handle

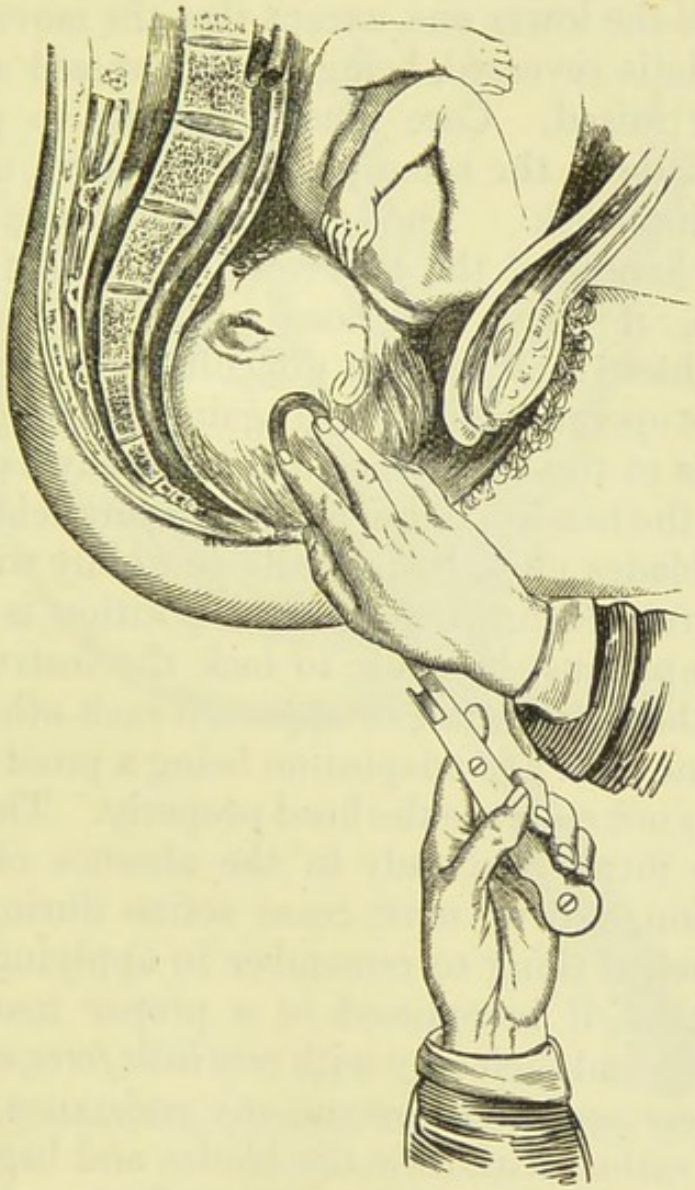


Fig. 178.—Introduction of the Second Blade of the Straight Forceps.

being first raised so as almost to touch the right thigh of the mother. Care must be taken to keep the end of the blade in contact with the head, as it glides round it. This gives a downward direction

to the handle, which is made to advance by slight lateral oscillations, very little pushing force being used, until at last it arrives in position. The handle is then moved backwards and given in charge of an assistant, whilst the upper blade is introduced in a similar manner to the lower one, except that the movement of the handle is reversed, being first depressed and then gradually raised. Care must be taken to pass the second blade in the same plane as the first, or else it will not interlock. The second blade being in position, the handle of the lower one is brought towards it, when, if they had been properly introduced, they ought to lock without difficulty. In locking the blades the operator must guard against injuring the soft structures of the mother, or including any hair in the lock. If the handles fail to meet with parallel faces, one or both blades must be partially or wholly withdrawn and rearranged until the proper position is secured. No attempt must be made to lock the instrument so long as the handles fail to approach each other in the same plane, this non-adaptation being a proof that the blades do not embrace the head properly. The forceps must be introduced only in the absence of uterine contraction, and we must cease action during a pain. The principal thing to remember in applying the forceps is that, if introduced in a proper manner, the blades will find their way with *very little force*, so that we must never seek to overcome any resistance by pushing, but rather withdraw the blades and begin again. The handles being satisfactorily locked, and not too firmly compressed, the extraction of the fœtus is now commenced by making traction, as far as possible in the axis of that part of the cavity in which the centre of the head appears to lie. To this is added a slight to-and-fro movement of the handles, whereby the leverage of the instrument is brought into play. If

uterine action is going on, traction must be made only during the pains. If the pains have entirely subsided, traction should be made intermittently, so as to imitate the natural course of events. During each remission

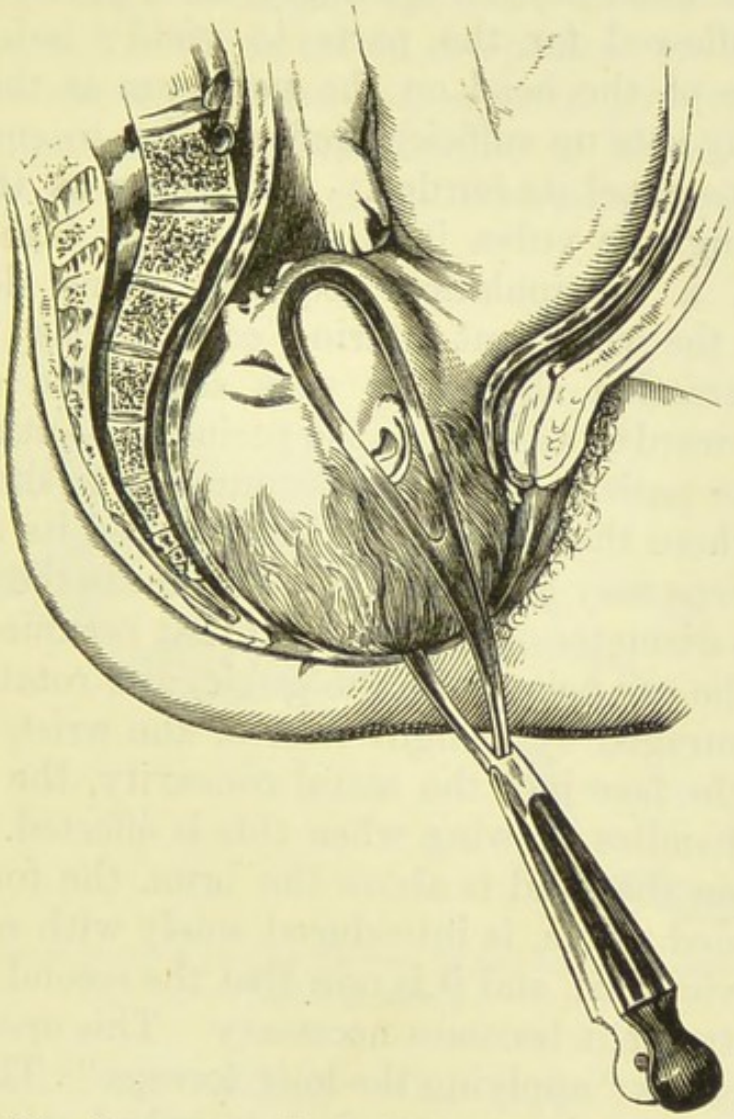


Fig. 179.—Delivery by Short Forceps in First Position.

the pressure must be taken off the handles, continuous compression of the child's head being injurious.

As the head descends the handles are carried more and more forwards, describing the segment of a circle whose centre is at the pubic symphysis, until, at the moment of extraction, they are close to the maternal abdomen. The downward progress of the head may

be estimated by the gradual distension of the perineum, to avoid rupturing which the handles must be carried well forward and the palm of the left hand so applied as to support the distended structures. Traction must now be sparingly used, plenty of time being allowed for the parts to yield; indeed, the pressure of the head on the perineum at this stage generally sets up sufficient reflex action to enable the uterus to expel its burden. Sometimes as the head is passing the vulva it is advisable to take off the forceps, a manipulation requiring some dexterity during the vehement uterine contractions; in any event, traction should be very slight and directed well forward so as to spare the perineum,—at the same time the patient should be encouraged to shout. In cases where the head has not completed its rotation, the forceps may be applied more or less in the opposite oblique diameter of the pelvis to that occupied by the head, the ear being still the guide, and rotation may be encouraged by a slight turn of the wrist, so as to direct the face into the sacral concavity, the position of the handles showing when this is effected.

When the head is above the brim, the forceps, as mentioned above, is introduced solely with regard to the pelvic canal, and it is now that the second curve in the instrument becomes necessary. This operation is spoken of as "applying the long forceps." The blades are passed in the manner first described, with, if possible, still more care and caution, since the head being so much farther out of reach, the danger and difficulty are greater; moreover the maternal structures are more liable to receive injury, as the uterus itself is in contact with the blades of the instrument. The left hand must be well introduced, so as to guard the cervix from being torn or crushed, the operator making quite sure that the blades pass *within* the cervix. After

being warmed and lubricated as previously directed, the lower (left) blade is introduced first, the upper (right) blade follows; the mode of introduction in each case is much as that described for the short forceps. The upper blade is usually the more difficult of insertion, and unless the nates of the patient are brought well over the edge of the bed, so as to give free space for manipulation, its introduction is hindered considerably by the handle of the instrument coming in

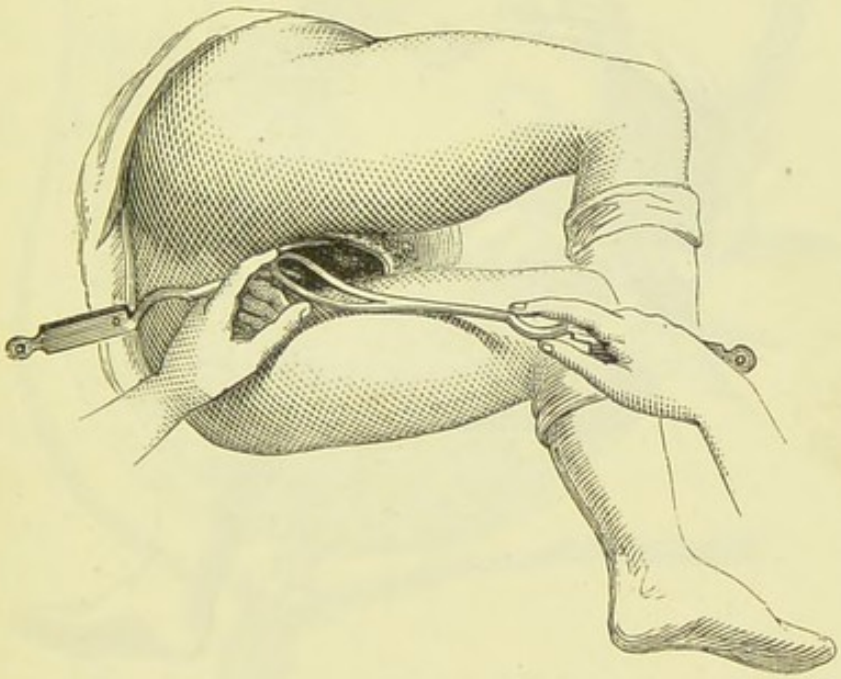


Fig. 180.—Introduction of the Second Blade of the Long Forceps (After Barnes.)

contact with the bedding. It is easier to commence the insertion of the upper blade as though its proper place were near the sacral promontory, and then as it reaches the head the blade is made to glide to the side of the pelvis, the handle being carried backwards and rotated a little until it arrives in apposition with that of the lower blade (*vide* Fig. 180). The caution previously given with regard to locking the instrument must be very rigorously observed, as incalculable mischief may be done by very slight movement

of the handles, the motion being multiplied at the extreme end of the blades in direct proportion to the length of the instrument.

The facility or otherwise of locking the blades after they have been properly introduced is an excellent guide as to the fitness of the case for delivery by the forceps. If, after a careful trial, the handles do not come into apposition, we may conclude that there is not room for the blades to occupy their proper posi-

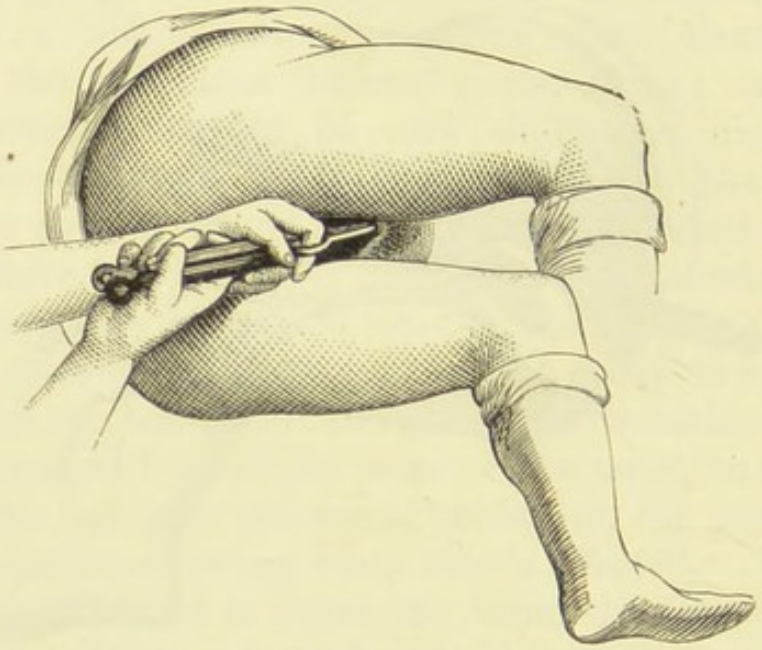


Fig. 181.—Extraction by the Long Forceps—the Head being at the Brim, Traction is backwards. (After Barnes.)

tion within the brim; if, on the contrary, they lock without difficulty, we are justified in attempting to deliver.

It is advisable, when possible, to place the patient under the influence of chloroform, especially when the head is above the brim, as any involuntary movement on her part may produce serious results.

Traction must at first be made in a backward direction, by keeping the handles well against the perineum, until the head descends into the cavity.

The efforts should be synchronous with the pains, or if they have ceased, should simulate them in a rhythmical manner. Considerable caution must attend delivery through an undilated os or past a rigid perineum, such cases requiring much time and patience. Apart from these conditions, a considerable

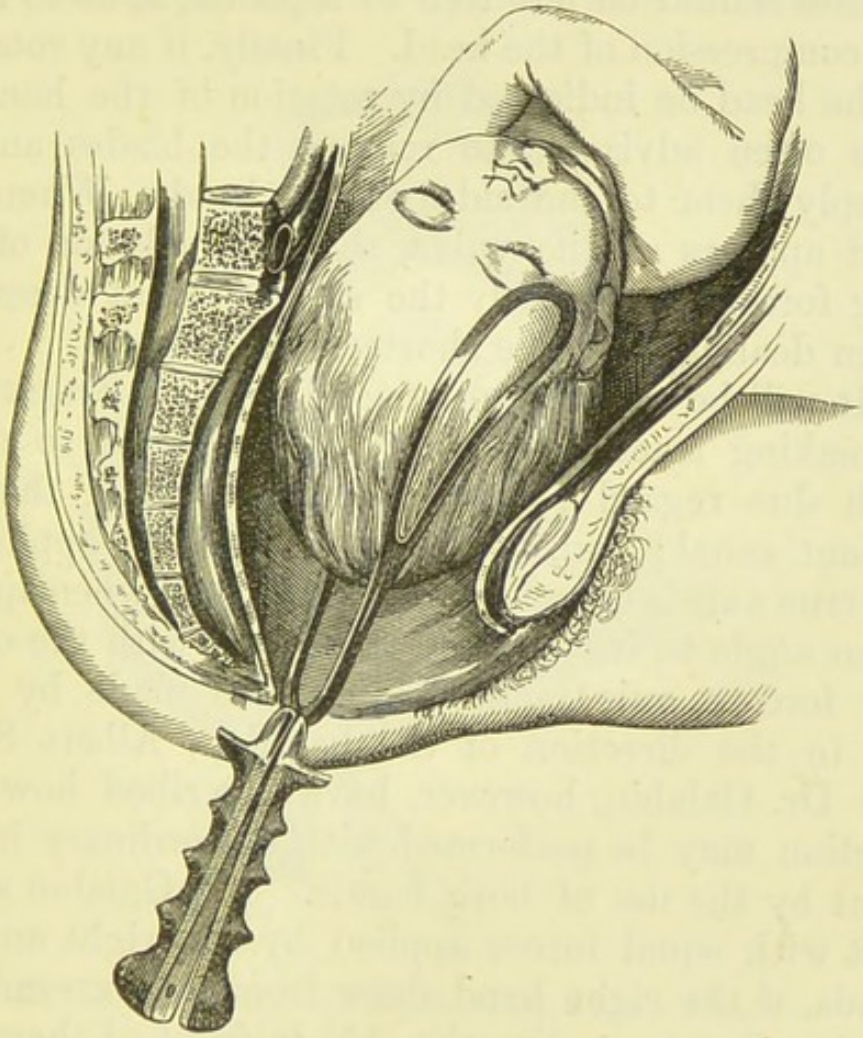


Fig. 182.—Delivery by Long Forceps in Contraction of the Brim of the Pelvis.

amount of force may be needed—probably in nearly all cases this, however, should be limited mainly to that which can be brought to bear by the arms without employing the body-weight or resorting to counter-pressure by placing the feet against a fixed object. The operator should have such control over

his efforts and his posture, that should the resistance suddenly give way he can immediately cease pulling, and at the same time maintain his balance. When the advancing head has passed the brim, traction must again be continued at intervals, and with due regard to the pelvic axis. Between the pains the handles should be left free to separate, so as to relax the compression of the head. Finally, if any rotation of the head be indicated by rotation of the handles, it is often advisable to remove the blades and to reapply them to the sides of the head. When the head appears at the vulva, the manipulation of the long forceps is precisely the same as that described when dealing with the shorter instrument.

It will be readily understood how important it is in making traction with the long forceps to do so with due regard for the varying axes of the parturient canal; and, further, that traction applied in the true axis is of much more value than when applied at an angle to it. It is obvious that with the ordinary forceps axis-traction cannot be made by pulling in the direction of the handles; Albert Smith and Dr. Galabin, however, have described how axis-traction may be performed with the ordinary instrument by the use of both hands. Dr. Galabin shows that with equal forces applied by the right and left hands, if the right hand draw from the extremity of the handles in a direction 15° in front of them, and if the force of the left hand be exerted at the lock in a backward direction at right angles to that of the other hand, the resultant of the two forces will be found in a power transmitted along the correct pelvic axis.

As regards the various axis-traction forceps with traction-rods, introduction of each blade must follow the general plan above indicated. If the rods are

fixed, it should be remembered that (the patient being in the ordinary semi-prone position) whilst the handle of the right blade goes below that of the left, its traction-rod must pass over the left (or upper) handle, otherwise it may interfere with the easy locking of the instrument. At the vulva, when directing rather than pulling efforts are required, it will usually be

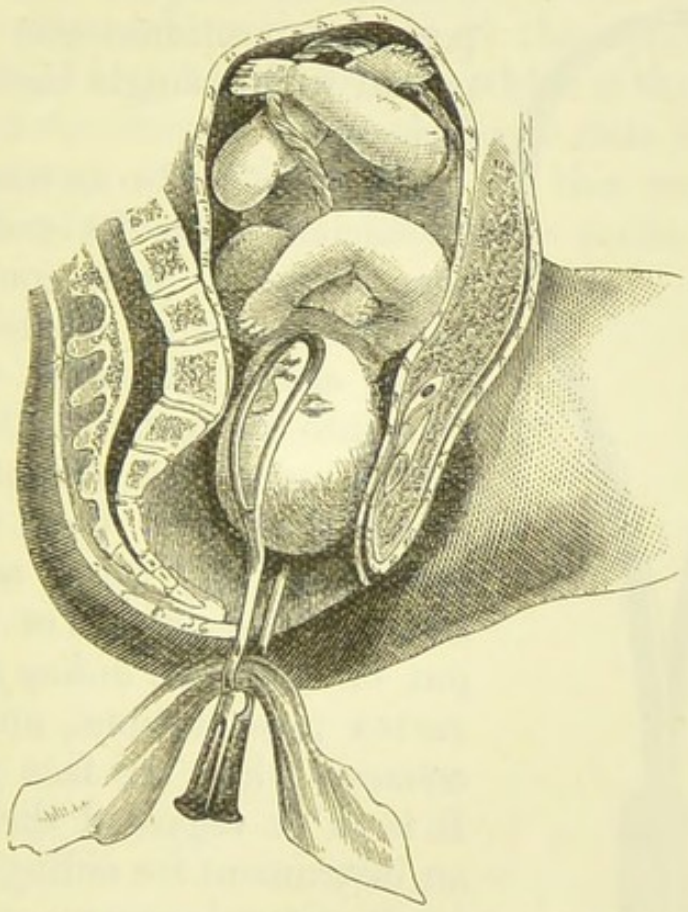


Fig. 183.—Delivery by Dr. Radford's Long Forceps.

found best to manipulate with the ordinary handles rather than with the cross-bar attached to the traction-rods.

The Vectis and Fillet.—The vectis or lever and the fillet have been used as substitutes for the forceps. The *vectis* or lever resembles a single blade of the straight short forceps, the curve and expansion of the fenestrum, however, being much more abrupt. The

action of the vectis is twofold—as a tractor and as a lever: as a tractor it is much inferior to the forceps, and as a lever it is capable of producing much mischief even in practised hands. Formerly a favourite instrument, it now rarely finds a place in the obstetric bag, as its principal and most useful functions —rectification of unnatural presentations, and *aiding rotation* in occipito- and mento-posterior positions—can be compassed with a single blade of the forceps.

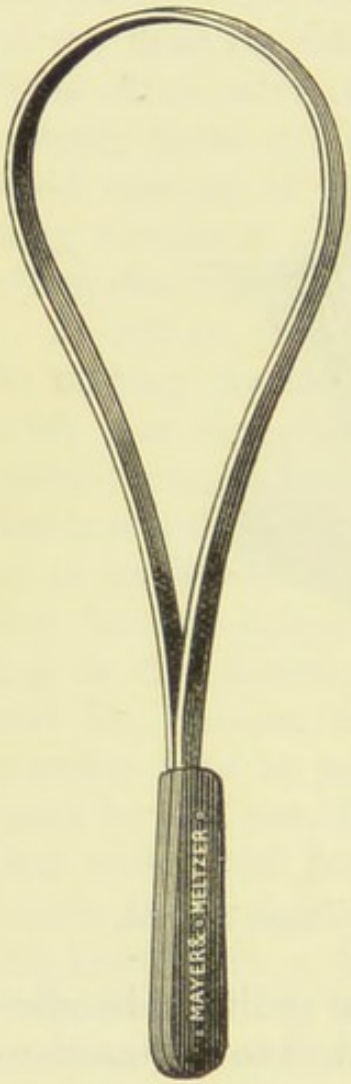


Fig. 184.—Fillet.

The *fillet* is also an instrument of ancient date, its use having been revived. It is constructed out of a slip of whalebone or other elastic material, which is bent into the form of a loop, and passed over the occiput or the chin of the child. Used with discretion, it may be of service in assisting the descent of the occiput or chin; *i.e. aiding flexion* in vertex presentations, and *aiding extension* when the face presents. It is to be regarded therefore as an instrument for aiding delivery by the natural powers; considered as an instrument for the actual accomplishment of delivery, its power is limited, and if much force is used, it is not free from danger. Its sole advantage is that it may be extemporaneously formed of materials to be found in almost every house, and so may prove serviceable should the practitioner be called upon unexpectedly to effect delivery when at a dis-

tance from home, his more trustworthy instruments not being accessible.

In breech cases, when considerable difficulty is experienced in bringing down a leg, the *soft fillet* may be employed as a tractor. It may consist of a silk handkerchief, which can be passed over one or both groins; or best of all, one end of it is passed over the groin from without inwards, the other end being similarly disposed on the groin of the opposite side. This leaves a loop hanging down, which is then pushed up behind the sacrum, whilst the loose ends are drawn down between the child's legs. In this way a very good and safe purchase for traction is made.

CHAPTER XXVII

VERSION

VERSION or turning is an operation by the aid of which an unfavourable presentation of the child is changed into a more favourable one. There are two varieties, *cephalic* and *podalic* (pelvic version is a subdivision of the latter); and in each operation the long axis of the fœtus is made to coincide with that of the pelvic canal—in the former the cephalic pole, in the latter the pelvic pole being the presenting part. We disregard here manipulations for altering a face into a vertex presentation.

The operation of turning itself is performed in three different ways, viz. by external and by internal manipulation, and by a combination of the two; after the required presentation is obtained, delivery remains to be accomplished either by the natural process or with artificial aid according to circumstances.

The cases which demand the performance of version include malpresentation of the child, pelvic contraction, hæmorrhage, convulsions, prolapse of the funis, and rupture of the uterus.

In the early days of obstetrics cephalic version was the favourite method. In the fifteenth century Ambroise Paré and his pupil Guillemeau advocated the podalic form, which continued to hold the chief

place in obstetric operations until the introduction of the forceps, when it fell into comparative disuse. Of late years it has been reinstated to its proper position amongst our means of artificial delivery, as one which, besides its other advantages, enables us, not unfrequently, to forgo the otherwise inevitable perforator.

Cephalic version is only applicable to cases of malposition. The object is to convert a faulty presentation into one of the vertex, after which labour may be allowed to take its ordinary course, or delivery may be effected by the forceps. The operation is done by external palpation with posturing, or by the combined external and internal methods. It is occasionally useful in transverse presentations where the child is freely movable. Pinard indeed advises early cephalic version by palpation in breech presentations, but this practice is not general. Cephalic version has the advantage of not interfering with the performance of podalic version, should this afterwards be deemed necessary, and as it is one of the most conservative of obstetric operations, it is to be commended. In this country it has not been very frequently resorted to, partly because it requires considerable practice, the opportunities for which are few, and partly because it is possible only at a comparative early stage of labour, before or soon after the evacuation of the liquor amnii.

It is best performed by Dr. Braxton Hicks' method of combined external and internal manipulation, or, as some have called it, bi-polar version. A portion or the whole of the left hand having been introduced into the vagina, and one or two fingers passed within the os, the right hand is placed on the abdomen, and, by the combined action of the two hands, the position of the fœtus is changed. If the shoulder presents it should be pushed up with the

fingers of the left hand whilst the head is depressed by the right; when the head is fairly over the os, it is best to rupture the membranes, so that the uterus may contract and prevent further movement of the child.

Wigand was the first to suggest version by external manipulation; his method consisting in first ascertaining the presentation and then in depressing that pole of the fœtus into the os which is nearest to it; this is done solely by external manipulation, the hand within the vagina taking no active part in the operation, but merely passively receiving the part brought down. This operation is limited to the rectification of malpresentations. Dr. Braxton Hicks greatly improved and modified this plan, and developed it into a very valuable obstetrical resource, by making use of the internal hand to assist in turning the child.

Pelvic version, or turning by the breech, is seldom performed, as all its supposed advantages are obtained by podalic version, one foot only being brought down, which further enables the operator to accelerate delivery in accordance with the requirements of the case.

Podalic version.—This method of turning, which is the one usually resorted to, has for its object the delivery of the child by the feet. There are two ways of performing the operation, either by passing the hand within the uterus and seizing the feet, or by combined external and internal manipulation with, at most, one or two fingers in the uterus.

In all varieties of turning chloroform renders the greatest assistance, and in many cases is absolutely necessary; it has entirely superseded general bleeding and the administration of tartar emetic in spastic rigidity of the uterus. Its full administration curbs

the ordinary uterine contractions, which often place considerable difficulty in the way of the operator; it prevents unexpected jerking movements on the part of the patient, which might lead to rupture of the uterus during the progress of the operation; and finally, it is of great service by relaxing the abdominal muscles to such an extent as to enable the accoucheur to ascertain by external examination the child's

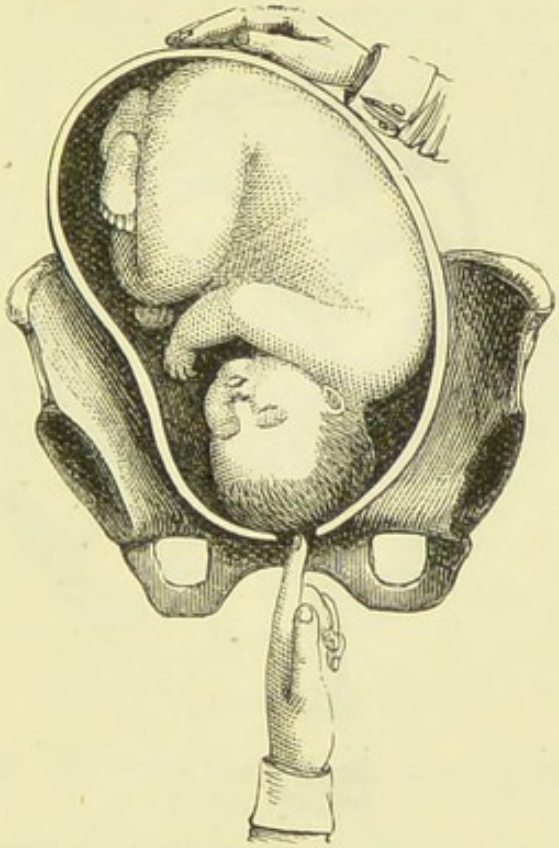


Fig. 185.—First Stage of Bi-polar Version.
(After Hicks.)

position, which otherwise would frequently prove impossible.

I will first describe Dr. Braxton Hicks' manner of performing the combined method of podalic version. The patient is placed on her left side, and the operator's left hand is introduced into the vagina as in cephalic version, the right being placed on the abdomen. It is well, before proceeding so far, to ascertain the

position of the breech by palpation, that of the head, if presenting, being recognised by the situation of the fontanelles. When the head is in the first or fourth position it should be pushed up to the left, the breech being simultaneously depressed to the right; this manipulation is continued until the head has passed out of reach; the shoulder then comes in contact with the fingers and is treated in the same manner until the

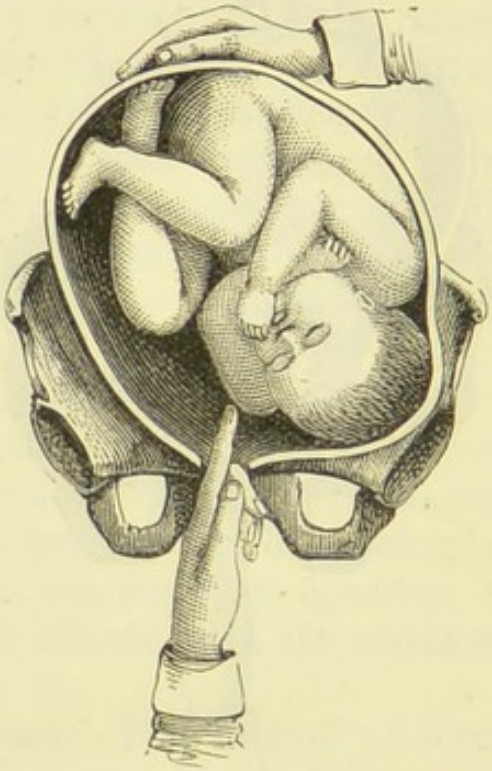


Fig. 186.—Second Stage of Bi-polar Version.
(After Hicks.)

knees are felt, when the membranes are ruptured and the legs brought down. In the second and third positions the head must be elevated to the right, the breech being depressed to the left. If the presentation is obscure it is best to treat it as if in the first position. Shoulder presentations are to be treated after the same plan; the shoulder being raised in the direction of the head, whilst the breech is depressed

in the other. Extra assistance may sometimes be given to the movement by making occasional use of the right hand externally to elevate the head. It need scarcely be observed that these various manipulations are to be carried on only in the intervals between the pains.

The two great advantages of Dr. Hicks' plan are that the operation can be performed at an early period, and in case of non-success we can at once

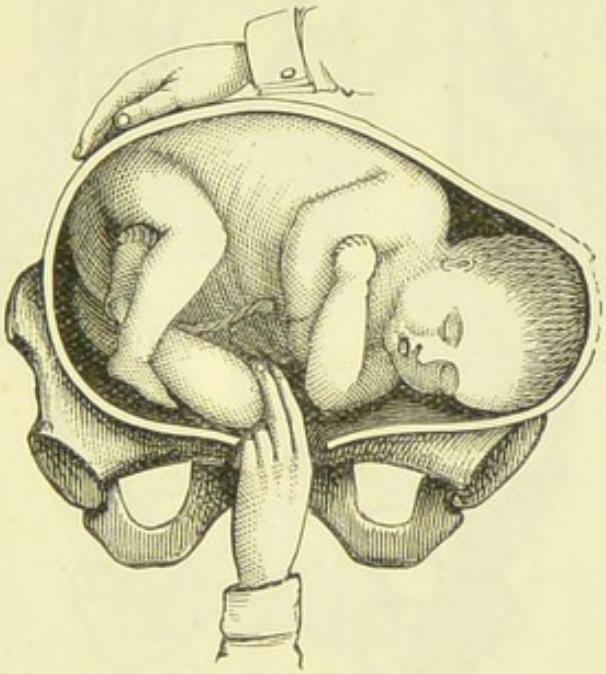


Fig. 187.—Bi-polar Version—Seizing the Knee.
(After Hicks.)

proceed to podalic version without having created any extra difficulties by our previous efforts.

In the common form of podalic version the hand within the uterus does the principal part of the work, but it must not be therefore inferred that the other hand is idle or useless; on the contrary, both hands are quite as necessary as in the combined plan. The operation is thus performed: The patient is placed on her left side, with the legs separated; the hand of the operator, after being lubricated on its dorsal aspect,

is then gently passed up the vagina, with the fingers gathered together at their tips, as previously directed. The choice of hand is a matter on which no absolute rule can be given, inasmuch as it depends upon the

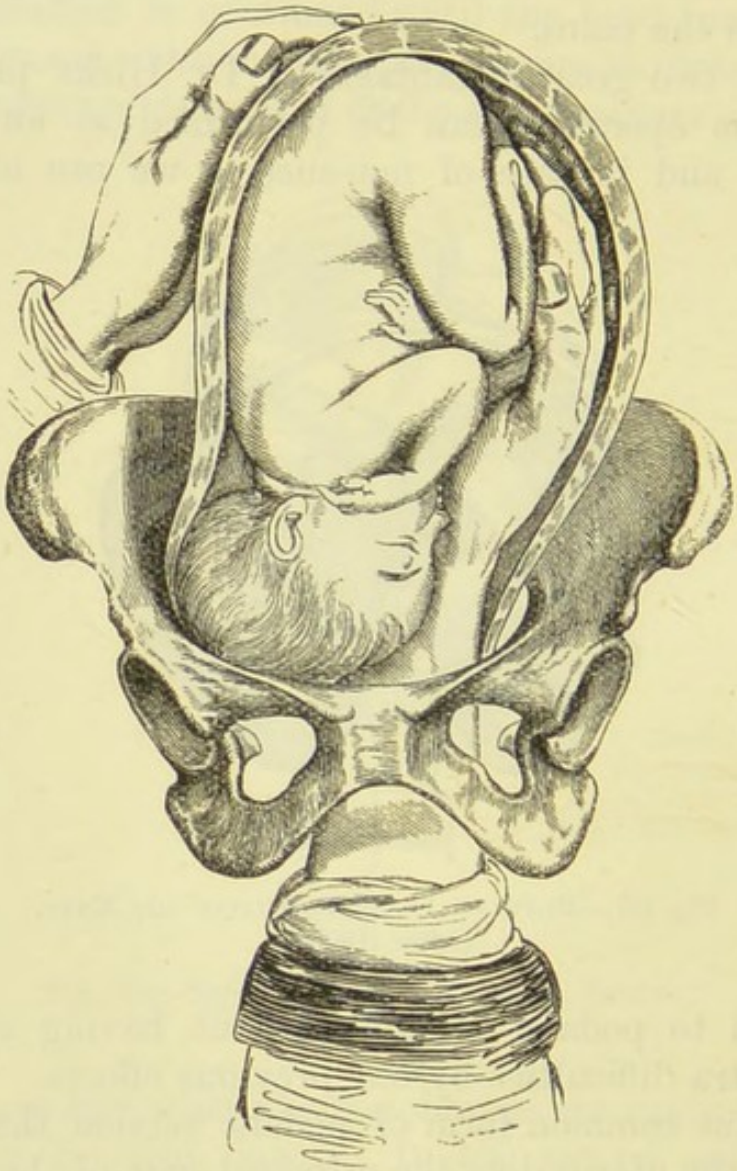


Fig. 188.—Podalic Version—Seizing the Feet.

nature of the case, and upon the degree of ambidexterity possessed by the operator; the left hand, however, adapts itself most readily to the curve of the pelvic axis, and if properly educated may attain

a degree of tactile power equal to that of the right. This adaptability, however, is, as a rule, more than counterbalanced by the fact that the right hand, from the habitual preference accorded to it in all the

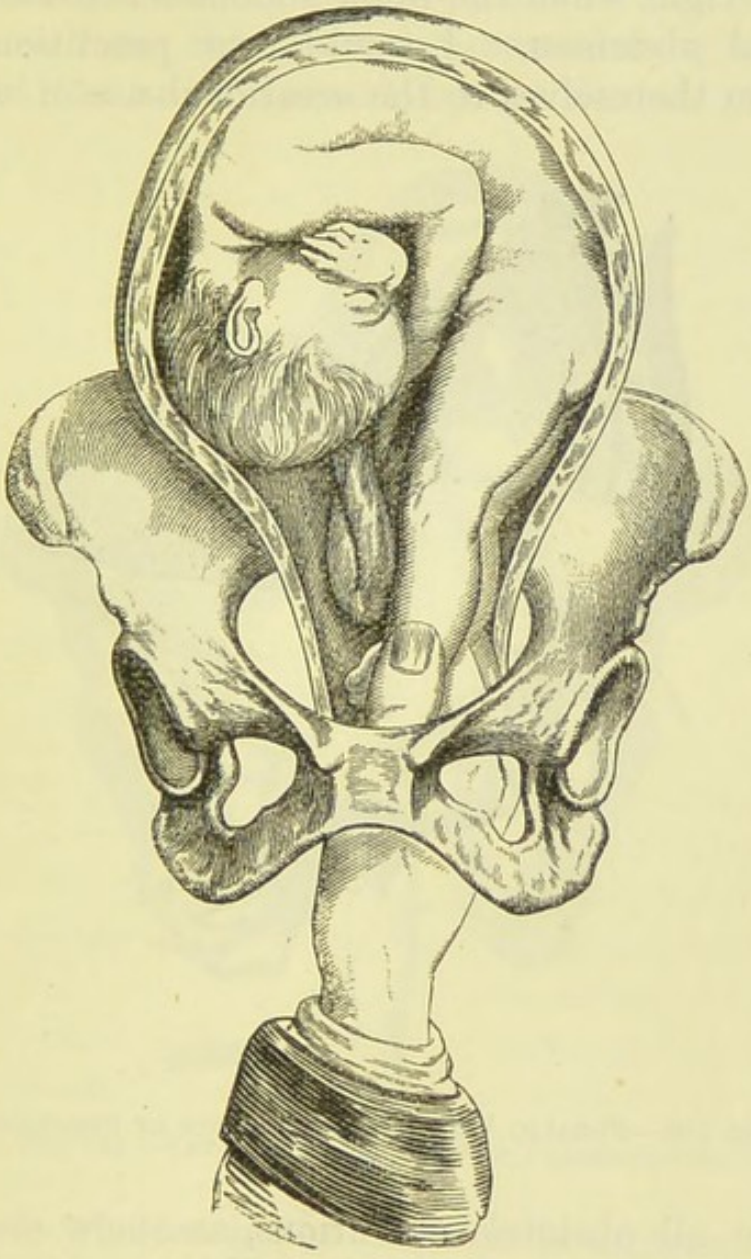


Fig. 189.—Podalic Version—Bringing down the Feet.

actions of daily life, attains not only a greater degree of digital strength, but is also much better able to endure the fatigue, sometimes ending in powerlessness, produced by pressure of the uterus. Some writers give

a series of rules to determine which hand shall be used in each particular case; the rational principle appears to be that the left hand should be used when the infant's back is towards the maternal abdomen, and the right when the fœtal abdomen is towards the maternal abdomen. I would urge practitioners to accustom themselves to the occasional use of the left

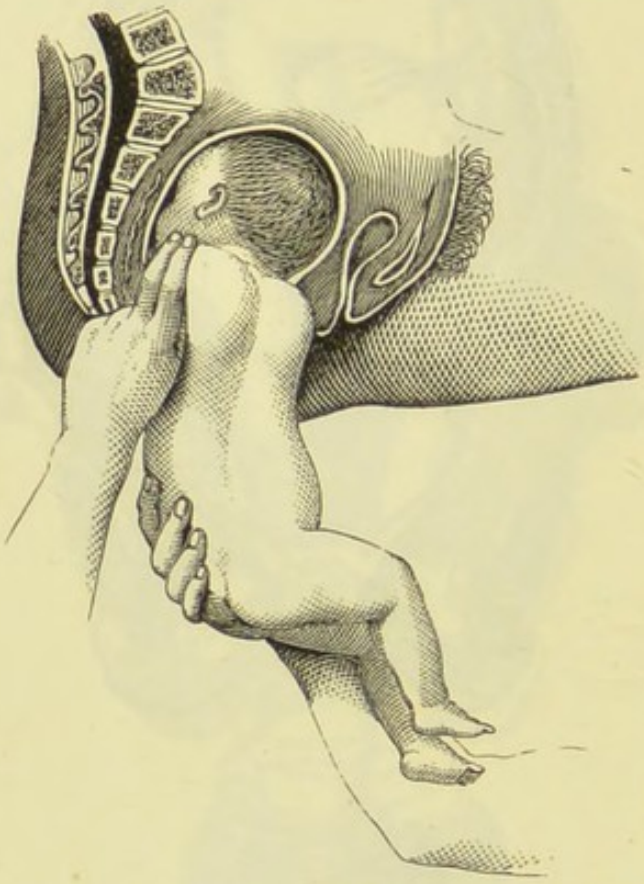


Fig. 190.—Podalic Version—Extraction of Shoulder.

hand in all obstetric operations, as there are times when its efficient assistance can ill be spared.

Whichever hand the operator elects to use, it should be passed up to the os, and then, whilst the uterus is steadied with the other hand, slowly insinuated with a semi-rotary movement during the interval between the pains, care being taken to follow

the curve of the genital canal. The hand is then passed along the abdomen of the child, and the feet or knees are seized and brought down in the absence of a pain. The foot is most readily discriminated from the hand by noticing the projection of the heel, and the knee from the elbow, by remembering that the apex of the angle formed by its flexion points to

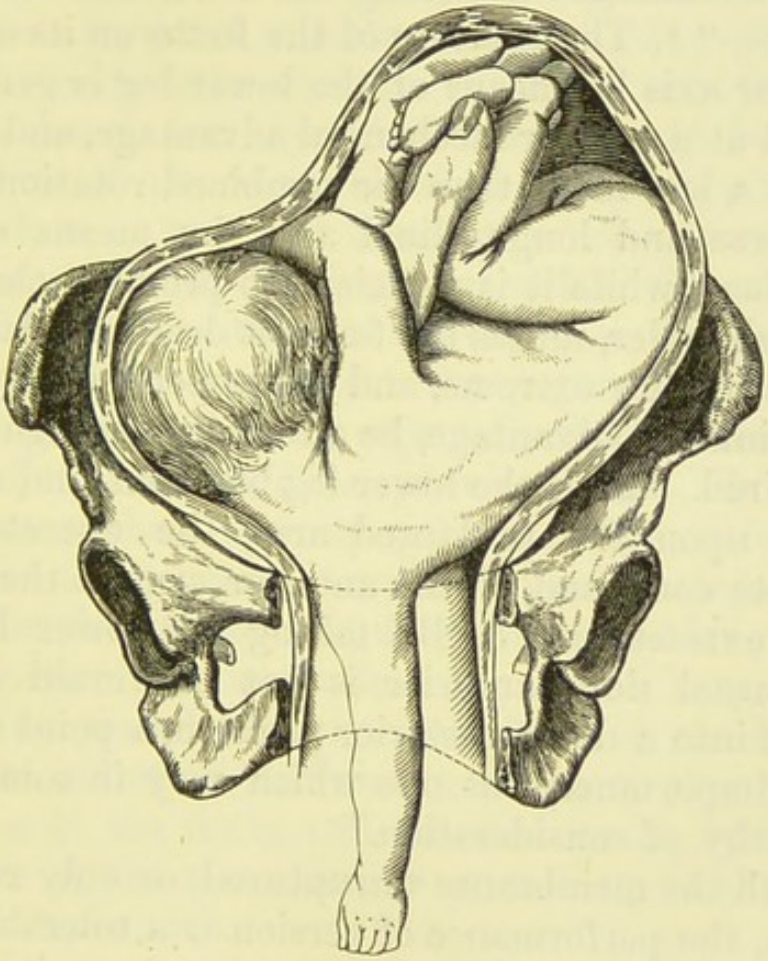


Fig. 191.—Version in Transverse Presentation.

the head, whereas in the elbow it is directed to the feet. It is sometimes advantageous to bring down one foot only, as the increased bulk of the child's trunk thus produced dilates the soft parts more fully, and so renders the head's passage easier. Tyler Smith, Simpson, Barnes, and others recommend that the foot opposite the presenting arm should be selected

and brought down, by passing the hand along the palmar aspect of the child's arm, diagonally across its abdomen to the opposite leg. Dr. Galabin, in an elaborate and most interesting paper published in the *Obstetrical Transactions*, vol. xix., defends the custom of bringing down the lower leg in preference to the one of the opposite side. Dr. Galabin sums up the advantages of seizing the lower knee in these words :—" 1. The rotation of the fœtus on its antero-posterior axis by means of the lower leg is generally effected at a greater mechanical advantage, and therefore by a less force, than the combined rotation on its transverse and longitudinal axis, by means of the upper leg; while it is sufficient to produce elevation of the shoulder, unless the fœtus is dead and flaccid or uterine rigidity extreme, and the upper leg may, with no diminished advantage, be afterwards brought down if required. 2. If the lower leg be taken, and a noose placed upon the prolapsed arm, the operator has complete command of the anterior arm in the subsequent extraction. 3. By taking the lower leg the more usual dorso-anterior is not converted by the version into a dorso-posterior position, a point of very minor importance, but one which may in some cases be worthy of consideration."

With the membranes unruptured, or only recently broken, the performance of version is a tolerably easy matter; but it is by no means easy when the liquor amnii has long drained away, and the uterus is firmly contracted upon and adapted to the shape of the child; the shoulder (if the presentation be transverse) is then jammed tight in the pelvis; the whole parturient canal is hot, tumid, and dry; the patient is restless, and worn out with fatigue; her spirits are depressed with the fruitlessness of her exertions, and she shrinks from the gentlest attempt at examination.

Cases such as these demonstrate the benefits of chloroform inhalation; not only is pain subdued, but the muscular tissue of the uterus becomes so far relaxed as to render feasible what otherwise would be a sheer impossibility. In this condition the precautions previously enjoined must be observed with tenfold minuteness; the hand, on reaching the os, must be introduced with the minimum amount of force, the great secret of success being to allow plenty of time for each little advance. This is very fatiguing to the hand, but occasional rests should be made, the elbow of the engaged hand being supported on the bed, so as to afford temporary relaxation of the muscles. Whilst the hand is within the uterus it should be kept as close to the child as possible, care being taken not to present the protruding knuckles to the uterine parietes, especially during the pains, when the hand should be spread out flat. By the observance of these precautions, and by the exercise of a due amount of patience, success is usually attained. If, when the foot is brought down, the shoulder remains fixed in the brim, and refuses to rise, a loop of tape should be passed over the foot, either by the hand or with the aid of an instrument similar to that used in prolapse of the funis, and traction made, whilst the shoulder at the same time is pushed up in the direction of the fundus.

In a case of placenta prævia, where version is resorted to, the hand should be passed through that side of the os to which the placenta is least adherent; when the membranes are reached they should be ruptured, and the foot sought for and brought down. Rupture of the membranes is not usually attended with a large discharge of the liquor amnii, as the arm of the operator plugs the os, hæmorrhage from the torn placental vessels being also checked

by the same means. Here, as when version is required from other causes, much assistance may be afforded externally, by pressing on the breech with the unengaged hand, and so bringing the lower extremities within reach of the hand which is inside the uterus.

Delivery after podalic version.—Turning being performed, nature may occasionally be left to complete the delivery, which is then effected by uterine contraction as in natural breech presentations. Generally speaking, however, artificial extraction is better both for mother and child; this is usually described in three stages—1st, the management of the legs and trunk; 2nd, of the arms; and 3rd, of the head.

(1) *Legs and trunk.*—To free the buttocks and trunk when the leg has passed through the os, traction must be made gently in the axis of the pelvic brim, and at the same time a trustworthy assistant should "follow down" the uterus from above in order to obviate any tendency for the child's arms to become extended. Usually little difficulty is experienced in this stage, but sometimes in cases where the cervix is not very widely dilated, considerable delay may be avoided by combining traction in the axis of the pelvic brim with some pulling towards the side of the leg brought down; in this way the line of descent of the other buttock may be more easily brought within the circle of the os. The legs and lower part of the trunk are then easily delivered from the vulva, and it will be noticed that the first buttock always goes to the front; the shoulder-blades should be disengaged by pulling again in the axis of the brim, and then before proceeding to the liberation of the arms, the funis should be drawn down a little, freed from tension, and placed at one side of the pelvis.

(2) Liberation of the *arms* forms the next step in

delivery. In many cases of widely-dilated os, where well-applied pressure has been employed from above, they may give no trouble, coming into sight as soon as the shoulders, and merely requiring hooking down from just within the vulva, but in others the operation is not so simple, and much valuable time may be lost, resulting in still-birth of the child. The *posterior* arm should be brought down first as it is easier to dislodge, and when once out of the way more room is afforded for the manipulation necessitated by the other arm. The fingers are to be passed up the child's back, hooked over the shoulder until they reach the humerus near the elbow, when the arm is readily drawn down over the child's face. The anterior arm is then to be dealt with in a similar manner, a change of hands being often convenient. The more difficult cases in which trouble is experienced in this stage are generally caused by injudicious traction on the legs, or by non-following down of the uterus, so that one or both arms are extended upwards alongside the head, or from some cause or other an arm may have become "dorsally displaced," the forearm being flexed but situated below the occiput. The following manœuvre may then be employed. If, say, the anterior arm is extended or dorsally displaced, put the hands flat, one in front the other behind the trunk, and rotate the child's body on its longitudinal axis, so that its anterior shoulder goes backwards along the side of the pelvis to which the shoulder-blades were directed. Then the arm, unable to follow in this rotation, will be found in front of the face or neck, and within easy reach after the manner previously described.

(3) Extraction of the *head* may be manual or instrumental. In any case it is well that there should be a combination of traction with flexion of the head;

and as we have already insisted upon, the application of pressure from above is of considerable service. The *Mauriceau* or *Smellie-Veit* method consists in securing flexion by means of putting two of the fingers of one hand in the mouth or on the superior maxilla, while

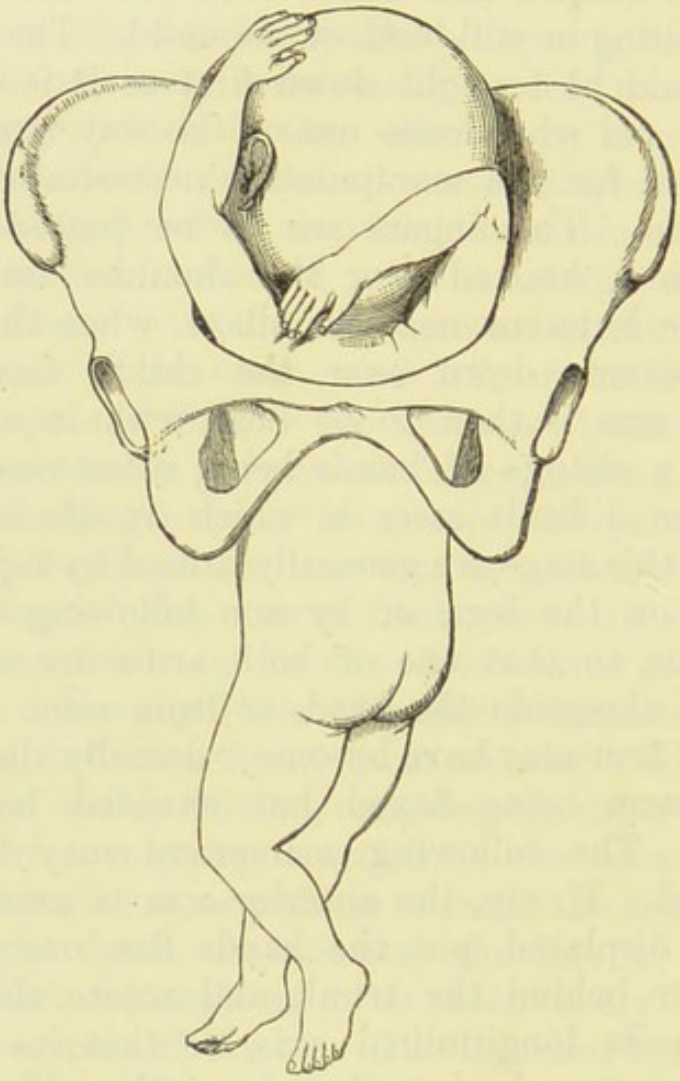


Fig. 192.—Dorsal Displacement of the Arm in Footling Presentation. (After Barnes.)

traction is performed by the other hand on the shoulders. In the *Prague* method traction on the legs is made between the mother's thighs, in a curved direction towards the abdomen, and the necessary flexion is obtained by pressure of the fingers of the

other hand on the occiput. It remains to mention the *Wigand-A. Martin* method of manual extraction. Here the occasionally injurious tension on the child's neck is done away with, but probably, as it appears to me, at the expense of some power. The operator, as in the Smellie-Veit method, brings down the chin by

Fig. 193.—The Mauriceau or Smellie-Veit Method of Extraction of the after-coming Head. (Farabeuf and Varnier.)

means of two fingers of his left hand placed in the mouth, and with the right hand on the maternal abdomen expels the flexed head by pressure transmitted to the uterus. It is maintained by Winckel that this method will "soon supersede all others."

In *forceps* delivery of the after-coming head, the

instrument should always be applied in *front* of the child's body, so as to enable both downward traction and also flexion on the head to be exerted.

The relative merits of version, long forceps, and craniotomy in cases of contracted pelvis have been made the subject of much discussion. Simpson advocated version on the grounds that the fœtal head

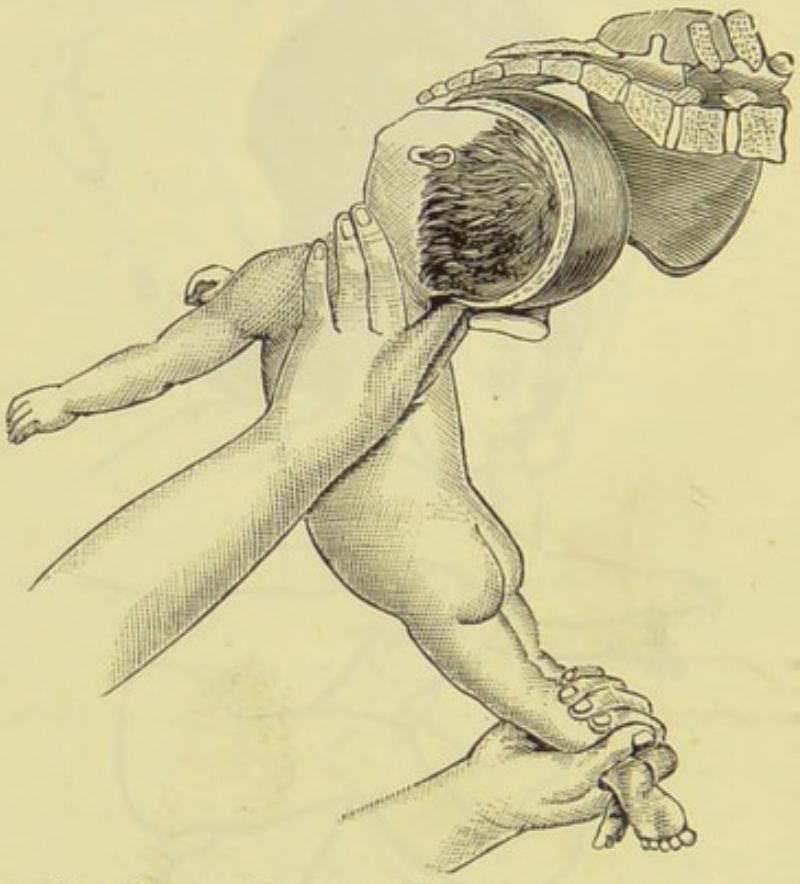


Fig. 194.—The Prague Method of Extraction of the after-coming Head. (Lusk.)

resembles a truncated cone, whereof the vault of the cranium forms the widest part; and when the head presents in the usual manner, the base of the cone is applied to the pelvic brim, and being too large to enter, becomes spread out by the pressure to which it is subjected from above, and is thus rendered still less adapted for passing through the contracted opening. On the other hand, in the case of the after-

coming head, the smaller end of the cone is first applied to the strait through which it passes, until the diverging walls of the cranium bind against the margin of the brim, and further progress is temporarily arrested. The advantage of the plan advocated now becomes apparent, for the sides, instead of the base of the cone, are subject to pressure from the

Fig. 195.—The Wigand-A. Martin Method of Extraction of the after-coming Head. (Winckel.)

pelvis, and, as a consequence, the diverging angle formed by the child's head is lessened, the head itself being elongated vertically, but diminished laterally, which is the converse of what previously took place. There is yet another point in favour of version in contracted conjugate; when the head presents, the chin is flexed on the sternum, and, as a consequence, the bi-parietal portion of the cranium first enters

the brim immediately in the diminished conjugate diameter; when version is performed, the head is extended, and the bi-temporal portion passes through the narrowest part, the bi-parietal coming through the lateral and wider portion of the brim; now the bi-parietal diameter exceeds that of the bi-temporal by half an inch.

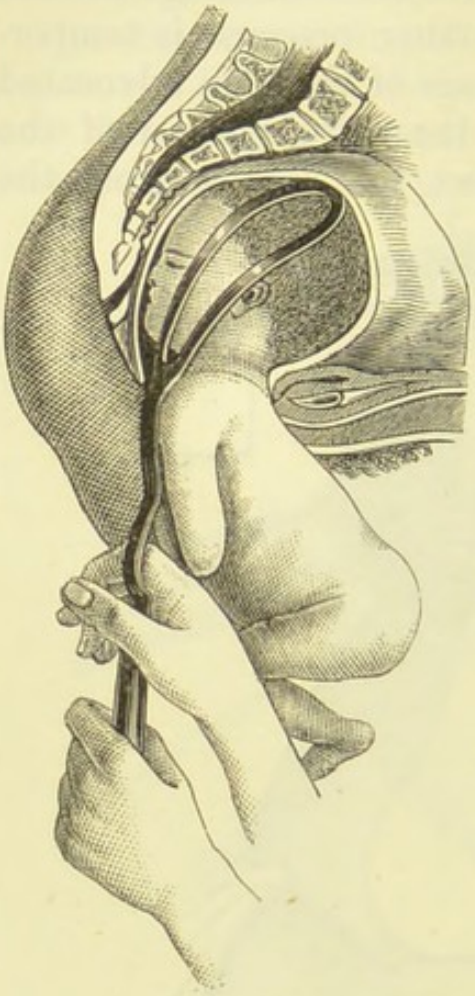


Fig. 196.—Forceps Delivery of the after-coming Head.

There can be no doubt that version may be frequently substituted with advantage as an alternative to craniotomy; for even if delivery cannot be accomplished by version, perforation can still be resorted to, and we have, at any rate, given the child a chance of life. This, of course, applies only to cases adapted to the performance of version, otherwise the risk to the mother counterbalances the possible benefit to the child.

It must not be understood, however, that version is better than forceps in all cases of deformed pelvis. This question has been discussed to some extent in the consideration of obstructed labour from pelvic deformity. It will be remembered that there it was stated that version might be successful in a flattened pelvis with a smaller conjugate than would admit of successful forceps delivery, but that in cases of

general or uniform contraction of the pelvic brim the advantages of version were not so evident. In these cases when the forceps is carefully used, with due regard to the varied direction of the pelvic axis, the danger to the mother is no greater than is the case in difficult delivery by version, and it appears to me that the child has certainly a better chance of life; for in version, whilst the head is being moulded to the requirements of the brim, the cord is undergoing compression. A prolonged degree of moulding in cephalic presentation may be undergone with impunity, as the circulation is not interfered with, and the child suffers little from the compression of the head; but in footling cases the condition of things is very different, as, in spite of all efforts, the cord can scarcely be preserved from fatal pressure during the delay which ensues when the head engages in a uniformly contracted pelvis; so that, except under peculiar circumstances, when the forceps is contra-indicated, I prefer the forceps to version in generally-contracted brim.

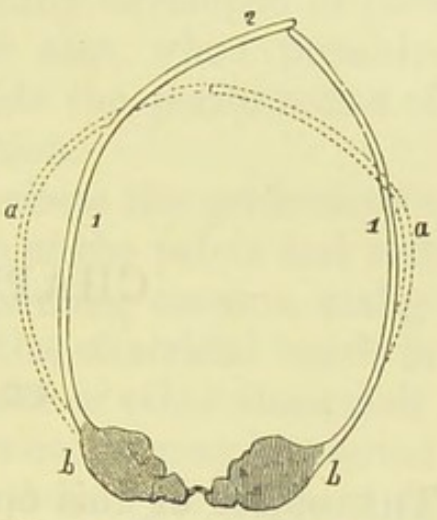


Fig. 197.—Section of Fœtal Skull.

a a, *b b*, Normal outline. 1 1, 2, Outline of skull, as compressed in turning.

When the fœtus is dead and firmly impacted in the pelvis, the mother being in an exhausted condition, version should not be attempted; in such cases the proper treatment is decapitation, or Dr. Barnes' operation described at page 437.

The employment of version in cases of prolapse of the funis and in rupture of the uterus is considered when treating on these subjects.

CHAPTER XXVIII

CRANIOTOMY

THE object of this operation is to reduce the size of the fœtal head by making an opening through which the brain may be evacuated; delivery is then accomplished either by the natural powers, when the head has become further moulded, or by traction made by means of various instruments constructed for the purpose. The profession of this country has the unenviable reputation of performing this operation more frequently than that of any other country in the world, in the proportion of about six or eight to one—a disparity partly owing to neglect of the timely use of version or the forceps, resulting in impaction or other condition which is only remediable by sacrificing the child; and partly to the difference in the relative value of fœtal and maternal life held respectively in Roman Catholic and Protestant countries. The Roman Catholic Church stigmatises as mortal sin the destruction of infantile life for any cause; it has therefore been the custom on the Continent to resort to Cæsarian section in many cases which, in this country, would have been delivered by craniotomy. In a case of difficult labour, ere he takes up the perforator the moral responsibility of the practitioner makes it an imperative duty to exhaust all

the resources of his art, and, in cases of known pelvic deformity, to insist upon the induction of premature labour before the fœtus is too fully developed to pass the portal alive. He should also, when possible, adhere to the rule which forbids the performance of craniotomy without a consultation.

The causes which may necessitate the performance of craniotomy are malformation of the pelvis and soft parts of the genital canal, including osseous, malignant, ovarian, and fibroid growths, cicatricial bands in the vagina, and also hydrocephalus or other abnormalities in the fœtus; moreover, craniotomy may be needed in certain cases in which speedy delivery is required on behalf of the mother, as in convulsions, hæmorrhage, ruptured uterus, etc., but these incidents are generally treated by other means. In pelvic deformity the limit within which craniotomy becomes necessary is reached when the conjugate diameter is less than $2\frac{7}{8}$ inches. It is generally admitted to be impossible for a living child at term to pass through a pelvis so far contracted. Between $3\frac{1}{2}$ inches and $2\frac{3}{4}$ inches the revived operation of symphyseotomy has its limits—but in many cases up to $3\frac{1}{4}$ inches there may be reasons for the performance of craniotomy; from $2\frac{7}{8}$ inches to $1\frac{3}{4}$ inch, if Cæsarian section be out of the question, craniotomy should be accepted as the proper method of delivery. Below $1\frac{3}{4}$ inch Cæsarian section must replace craniotomy.

The maternal mortality has been put down so high as one in every five cases; but really the mortality of the operation *per se* should only be a little greater than that of the application of the long forceps. The deaths are rather to be ascribed to undue protraction of labour, that is, to want of timely interference, to septicity, or to the complications necessitating the operation.

Various procedures for delivery after reduction of the size of the head will be referred to in this chapter, such as simple craniotomy, cranioclasm, and cephalotripsy, in all of which perforation forms the first step; the respective operations are named in accordance with the subsequent treatment of the case. In *craniotomy*, after perforation, delivery is accomplished by the natural powers or by means of a tractor, such as the craniotomy forceps, crotchet, or vertebral hook. *Cranioclasm*, introduced by the late Sir James Simpson, is an operation in which, after perforation and collapse of the vertex, the rigid base of the skull is fractured by wrenching or twisting when held within the blades of his improved craniotomy forceps or cranioclast. In *cephalotripsy* extraction is accomplished by means of the cephalotribe, a powerful crusher and tractor.

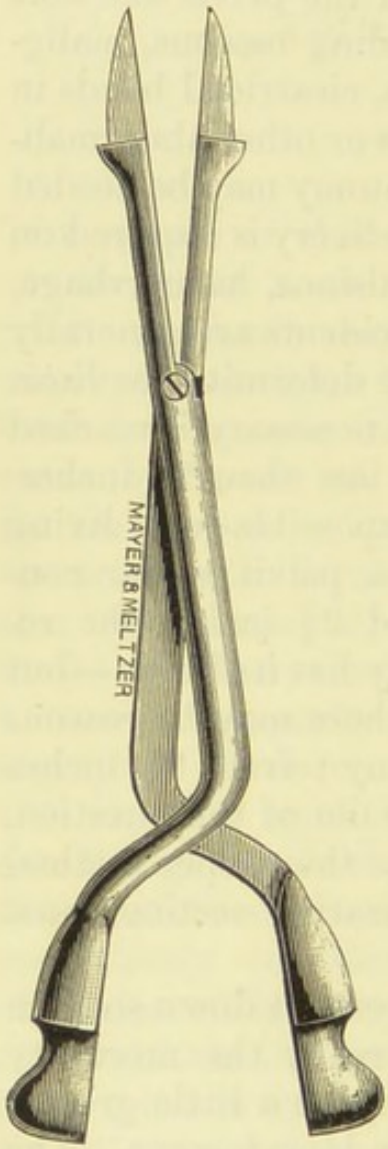


Fig. 198.—Oldham's Perforator.

The instruments to be described are the perforator, crotchet, vertebral hook, craniotomy forceps, with its modification the cranioclast, and the cephalotribe.

The *perforator*, the instrument for opening the fœtal head, is constructed in a variety of forms. Denman's perforator is inconvenient on account of its requiring the aid of an assistant to open the blades. Dr. Oldham has devised an excellent instrument, com-

bining strength and rigidity with ease of manipulation; the cutting edges open by compressing the handles, so that the operator himself has full command of its movements. A very convenient form of perforator is shown at Fig. 199. The handle and spear-point form a straight line; the lever which separates the cutting edges projects some distance from it, so as to be out of the way of the hand whilst the point is being bored through the skull. Another advantage possessed by this instrument is the spring which closes the blade when the lever is released, and so facilitates the movements of the operator in making the crucial incision.

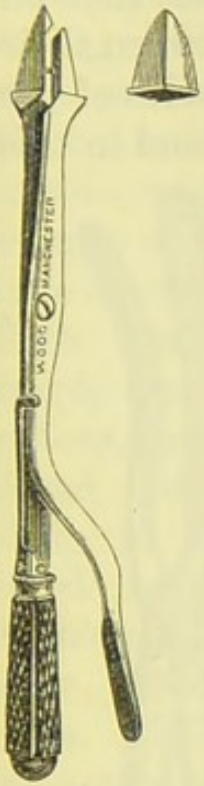


Fig. 199. PERFORATOR.

The *crotchet* (Fig. 200) consists of a metallic stem either straight or curved, with a sharp hook at one end. The instrument is used by affixing the hook, guarded by the fingers of the left hand, to some portion of the cranium, and so obtaining a means of traction. The great disadvantage of the crotchet is its liability to slip and to injure either the hand of the operator or the soft structures of the mother.

Fig. 200. CROTCHET.

Dr. Oldham's *vertebral hook* (Fig. 201) has a long straight stem of slender proportions, devised for the purpose of extracting the head after its separation from the trunk in breech presentations. The hook is passed up the canal of the vertebræ which remain attached to the skull, and there obtains a hold.

The *craniotomy forceps*, consisting of two blades with long handles, is used chiefly as a tractor and slightly

for its crushing power. One blade, which is somewhat smaller than the other, is inserted within the cranium, the larger blade passes outside the scalp, so that on closure they grip a portion of the skull between their serrated opposing surfaces. Usually the blades of the simple craniotomy forceps are inseparable, and in this

Fig. 201.—Dr. Oldham's Vertebral Hook.

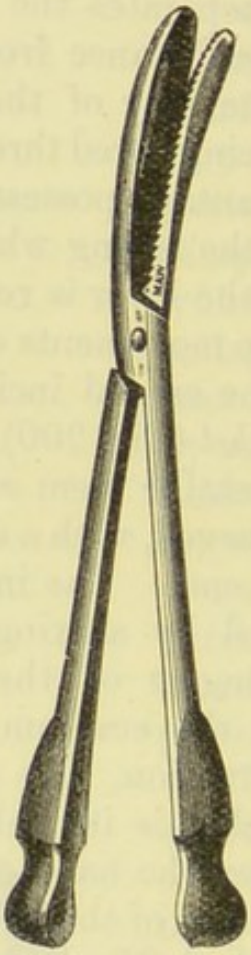


Fig. 202. Simple Craniotomy Forceps.

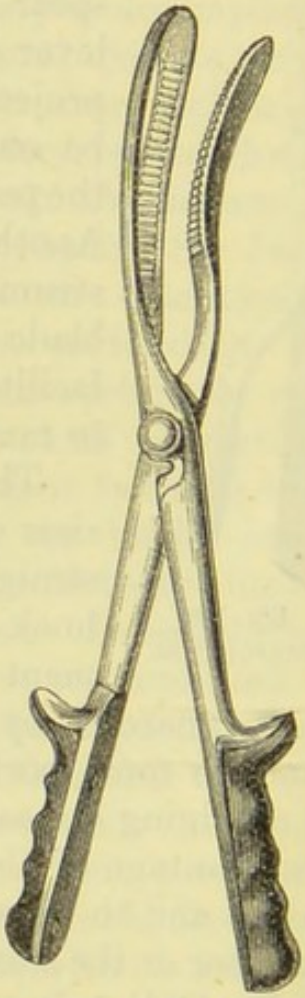


Fig. 203.—Sir James Simpson's Cranioclast, or Craniotomy Forceps.

form the instrument may be used for another purpose, *i.e.* to remove the vault of the skull piecemeal—the blades being disposed one within the cranium and the other outside the bone, but under the scalp.

Sir James Simpson's *cranioclast* is specially de-

signed for obtaining a very firm hold, with a view of facilitating disarticulation or fracture of the bones of the *basis cranii*—which is the essence of his operation of cranioclasm. Both blades have deeply-marked serrations, and when closed the inner blade is accommodated well within the concavity of the outer fenestrated blade. The blades are separable, thus aiding their introduction; the lock is of the pivot type, as shown in Fig. 203.

Roper's craniotomy forceps is an excellent powerful instrument provided with the English lock; the handles can be approximated by a screw, rendering crushing much more easy than when done only by manual power. The somewhat similar instru-

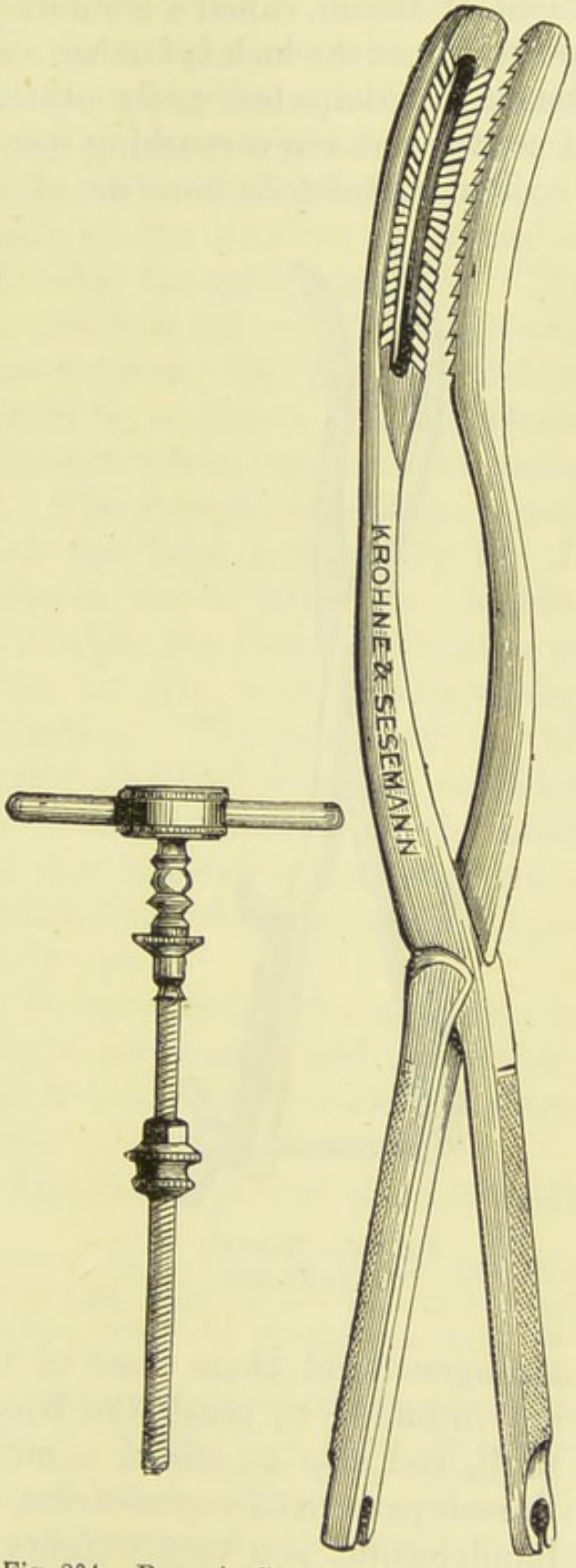


Fig. 204.—Roper's Craniotomy Forceps.

ment of Braun, called a cranioclast, is equally or more powerful, as the lock is farther away from the handles, but it is perhaps less easily adjusted. It also possesses a convenient screw-crushing mechanism.

The *cephalotribe* consists of two blades of much

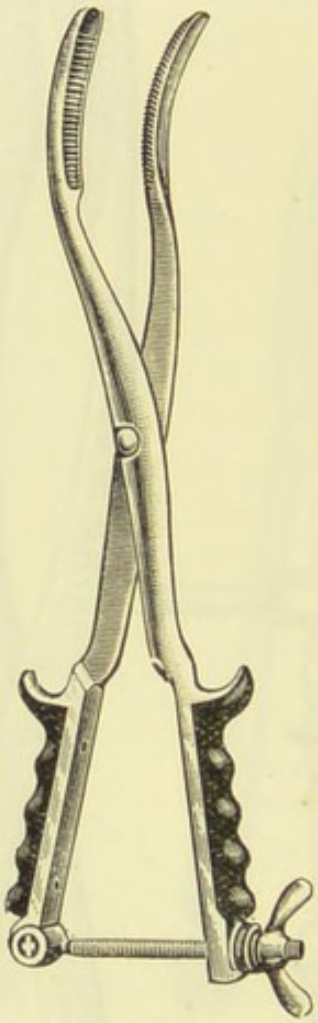


Fig. 205.—Braun's Cranioclast.

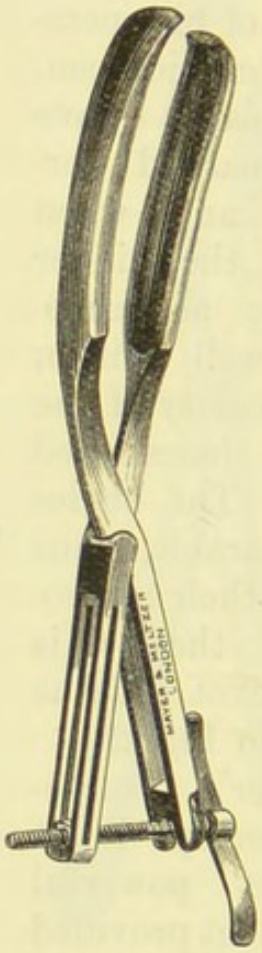


Fig. 206.—Improved Cephalotribe.

stronger build than those of the cranioclast, which are intended to crush the bones at the base of the skull, and also to afford a means of traction. The French pattern of cephalotribe, originally invented by Baudelocque, is a very weighty and powerful instrument, the great length of the handles giving great

leverage. Dr. J. Braxton Hicks' modification of Simpson's cephalotribe is a most convenient instrument; it consists of two strong blades having a slight curve, which can be applied separately, and afterwards locked in the same manner as the ordinary forceps; a screw is then applied to the handles, by means of which they can be forcibly brought together.[1] The question of the pelvic curve in the cephalotribe is one on which opinions are divided. Dr. Kidd of Dublin argues that there should be no curve, as it interferes with the rotation of the instrument, and makes it more difficult to introduce. The French pattern has a considerable curve, which has been reduced by Sir J. Simpson and Dr. Hicks to one of about two inches, which, they contend, renders the instrument easier of introduction and firmer in grip, without interfering with its power of rotation. The propriety of the curve must be generally admitted when we consider that the cephalotribe is usually applied to the head above the brim, and that therefore the same rules should govern its construction which govern the construction of the long forceps.

The performance of the operation.—The operation is divided into two stages, perforation and extraction; or, if the cephalotribe is used, an intermediate stage of compression is added.

Perforation.—The first two fingers of the left hand

[1] Messrs. Mayer and Meltzer have made for me an improved cephalotribe (Fig. 206). It is light, weighing two pounds two and a quarter ounces, and combines power and compactness with efficiency. The screw, instead of being separate and removable, is united to the handle of one blade, along which it moves in a slot, so that it can be placed out of the way of the hands during the introduction of the blades. When the blades are in position, the screw can be instantly brought into action by one movement of the hand, thus obviating the necessity of an assistant. I have repeatedly tested this instrument, and found it very handy and efficient.

are passed up the vagina, and with their aid the entire margin of the os uteri is carefully distinguished. The perforator is then introduced with the right hand, and is made to impinge on the most prominent part of the fœtal skull, over a parietal bone in preference to

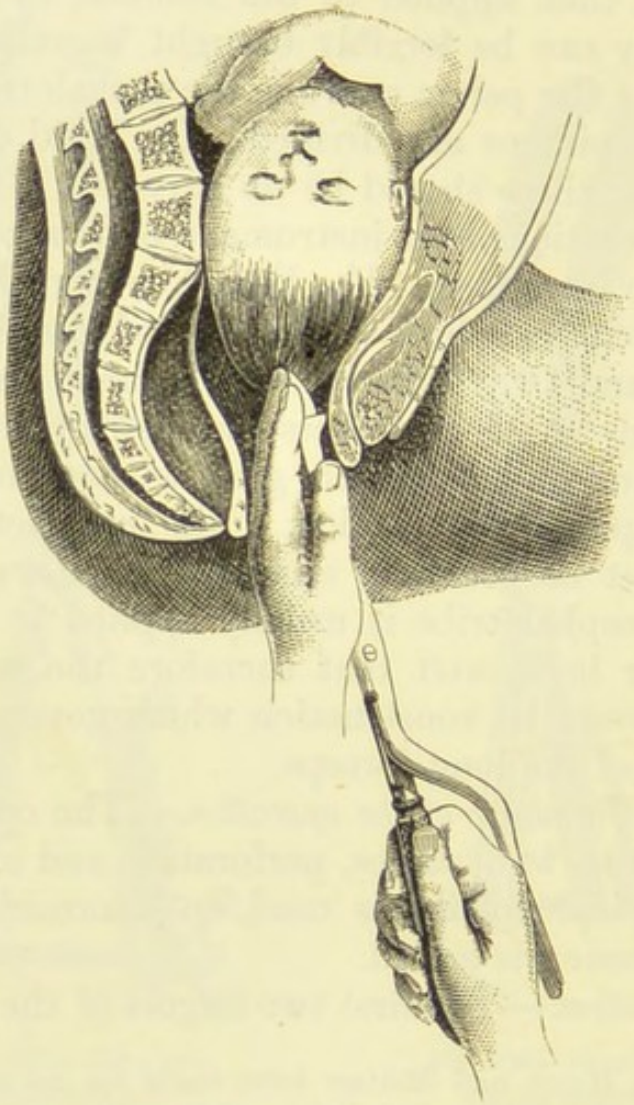


Fig. 207.—Perforation of the Head.

a suture. If the head is free, the fundus uteri should be carefully and firmly supported by an assistant, so as to steady the head and to prevent its receding from the perforator. The point of the instrument is cautiously bored through the bone with a

reciprocal motion of the wrist, when the blades of the instrument are thrust in as far as the shoulder-stops, and are then widely opened. They are again closed, and turned the quarter of a revolution, and are once more opened, thus making a crucial incision. The closed blades should then be passed well into the cranium down to the foramen magnum, and moved about in all directions, in order to break up the cerebral tissues, especially the medulla oblongata, and so to deprive the fœtus of life. Some operators prefer to use the crotchet for this purpose. Unless immediate delivery is urgently demanded, a pause of five or ten minutes may now be made, so as to enable the uterus to mould the collapsed head into the pelvis, and so to bring it more within reach.

Extraction with the crotchet is performed by passing the hook of the instrument within the cranium, so that its sharp end impinges on a portion of the bone, and then making traction, meanwhile carefully protecting the vagina with the left hand, in case the instrument should slip, or a piece of bone should become suddenly detached. The crotchet should take hold in such a manner as to bring the base of the skull down *edgewise*. The central region must therefore be avoided, and an endeavour made to attach the instrument inside to the lateral portions, or else externally to the orbit. If attached to the orbital region, the tendency is to bring down the uncollapsed portion of the skull *face foremost*. Long ago Hull of Manchester observed that the induction of a face presentation after perforation was the most advantageous method of delivery, for the distance from the root of the nose to the chin forms the smallest diameter of the mutilated remains of the head. If the instrument slips or brings away a portion of the cranium, fresh hold must be taken. During extraction the scalp should

be brought well over the jagged edges of the bones, to protect the soft parts of the mother.

The craniotomy forceps is a much safer instrument to use than the crotchet, and, as a rule, it is to be preferred. One blade is introduced into the opening made by the perforator, and the other passed outside the cranium, so as to grasp a portion of the bone and scalp, and traction is then made in the usual manner. Sometimes the whole of the calvarium becomes detached, piece by piece, each of which must be carefully removed, the vagina being protected from the sharp edges of the fractured bone either by the fingers or the blades of the craniotomy forceps. When the deformity is marked, it is well to seize hold of the occipital bone, so as to obtain flexion, and to bring down the *basis cranii* endwise; in other cases a face presentation may be induced before applying the craniotomy forceps, which then brings down the facial pole first. Dr. Braxton Hicks has devised an instrument, in the form of a firm blunt hook on a soft iron stem, for drawing down the face. The base is canted to the desired extent by means of the hook fixed in the orbit, the flexible stem enabling the instrument to be bent, so as to meet the requirements of individual cases.

The late Sir James Simpson's cranioclast forms an excellent improvement on the simple craniotomy forceps, and is well adapted for the purpose of disintegrating the *basis cranii* (cranioclasm) in the manner indicated in the description of the instrument. But these instruments and methods have largely given place to extraction by means of the forceps of Braun and Roper, or by the cephalotribe. The craniotomy forceps of Roper and the similar instrument of Braun (wrongly termed a cranioclast) are applied with much more facility and certainty; in screwing up the

blades the base is generally tilted edgewise, a face presentation being easily secured, and each instrument constitutes a most admirable tractor.

The cephalotribe is to be applied like the long forceps, so as to grasp the centre of the head and base between the blades. When screwed up, the basilar portion of the skull is well crushed or tilted

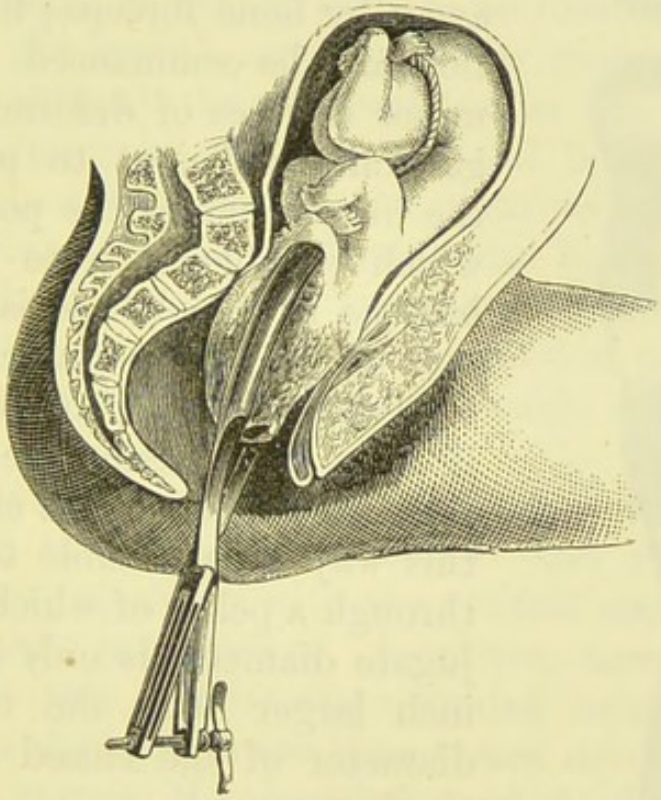


Fig. 208.—Delivery by the Cephalotribe in Contraction of the Brim of the Pelvis.

so as to bring it edgewise within the instrument, either condition being very favourable to delivery. If the pelvic deformity is very great, a second crushing may be necessary, in which case the instrument must be removed and reapplied as nearly as possible at a right angle to the former position. Care must be taken to compress the centre of the head—that is, in putting on the instrument the

handles must be held well backwards or the blades may simply glide over the posterior part of the head and slip on the slightest traction. An examination should then be made to ascertain if the fractured bones are well covered. It is not usual to find any jagged portions projecting from within the blades of the instrument, but if any sharp points are felt, they should be broken away by bone forceps; then traction may be commenced. For the minor degrees of deformity, it is generally sufficient to pull with the instrument in the position in which the blades were inserted, but the flattened head is brought into the most favourable position with regard to the contracted brim if the cephalotribe be rotated through a quarter of a circle. In this way it is possible to deliver through a pelvis of which the conjugate diameter is only a quarter inch larger than the transverse diameter of the closed blades of the instrument.

Fig. 209.—Fœtus after Extraction with Dr. Hicks' Cephalotribe.

In the *Obstetrical Transactions*, vol. xxxi. 1889, my colleague Dr. Donald contributed an interesting paper advocating the perforation of the after-coming head as an operation of election—that is, when craniotomy is decided upon he recommends a preliminary version even in cases of very considerable deformity. The advantages claimed for this method of craniotomy are, that the base of the skull is very effectually broken up, the head is well fixed during perforation

and crushing, and the position of the head is easily altered, thus allowing the cephalotribe to be applied in different directions, and the head to be brought down with its crushed base in the smallest diameter of the pelvis. Further, all jagged edges of bone are well covered, and consequently there is no risk of injury to the soft parts of the mother. In place of perforation behind the ear or through the occipital bone, he advises that the perforator be applied through the mouth, or it may be passed into the pharynx through the soft parts under the lower jaw. The basi-sphenoid and basi-occipital bones are then thoroughly disintegrated; the cephalotribe or craniotomy forceps (Roper or Braun) can be satisfactorily fixed without danger of slipping, and as the maximum of moulding is secured by the method of perforation, delivery may be accomplished through a very small pelvis.

The possibility of difficulty in version, and thereby increasing the duration of labour and risk to the mother, has interfered with the general acceptance of Dr. Donald's proposition. I believe, however, that the perforation of the after-coming head deserves rather a wider application than is now accorded to it, especially in cases of pelves deformed chiefly in regard to the conjugate, when this measures from about $2\frac{3}{4}$ to about 3 inches. Even if the forceps has been tried without success, I agree with Simpson and Barnes that a certain number of children may be saved by version. If unsuccessful in this design, and craniotomy be required after all, the operation on the after-coming head may then be easily and expeditiously performed after Dr. Donald's method.

Of the various instruments used for extraction after perforation, the cephalotribe is, in my opinion, greatly to be preferred. In cases of extreme diffi-

culty, which formerly occupied two or three hours, delivery is now accomplished with the cephalotribe in one-fourth the time. No obstetric bag is complete without this instrument; indeed, it is surprising that

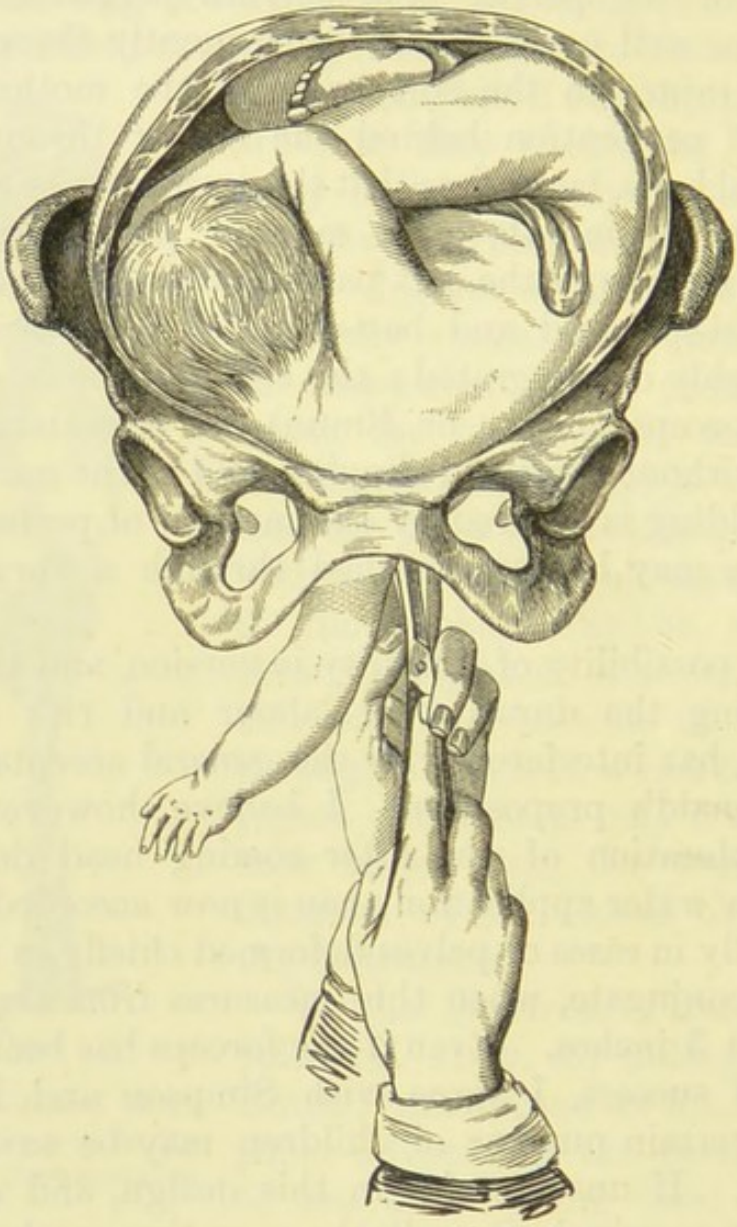


Fig. 210.—Embryulcia.

so efficient an aid to delivery has taken so long to obtain its legitimate position in British obstetrics.

Evisceration.—This operation is performed, when delivery cannot be otherwise accomplished, in cases

of transverse presentation, or in cases of obstruction from malformations of the fœtus. The chest is opened with the perforator, its contents are broken up with the crotchet, and are then evacuated. If necessary,

Fig. 211.
BLUNT HOOK.

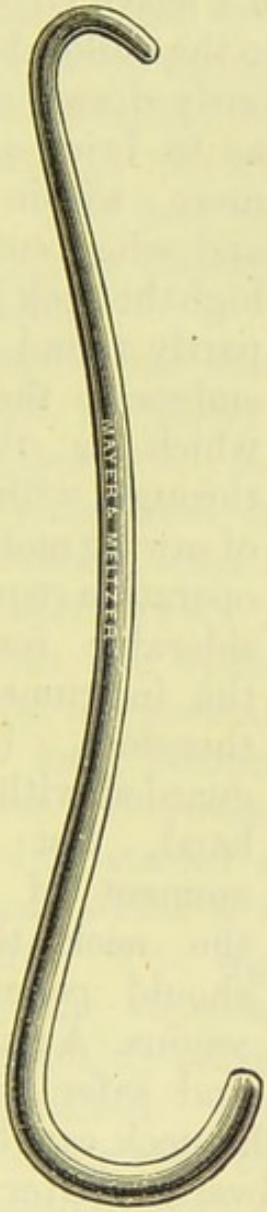


Fig. 212.
BLUNT HOOK.

Fig. 213.—CROTCHET AND BLUNT HOOK.

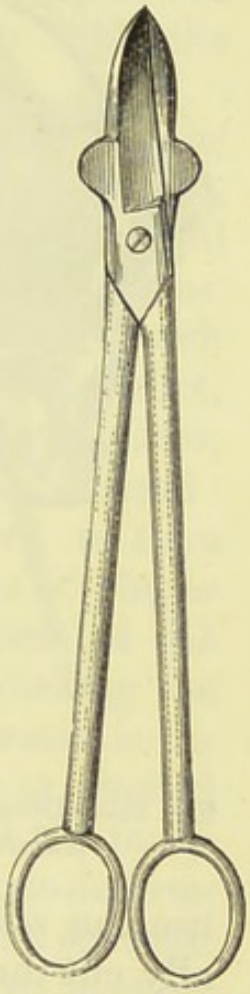


Fig. 214.—EMBRYOTOMY SCISSORS.

the diaphragm is ruptured, and the abdominal viscera removed; traction is then made at the breech with the fingers or the blunt hook (Fig. 211), so as to imitate the mechanism of spontaneous expulsion.

Decapitation may generally be substituted for evisceration. Decapitation is performed either with Ramsbotham's cutting hook, or with a pair of long straight scissors having powerful blades. The cutting hook resembles in shape the ordinary blunt hook, with the inner curve brought to a sharp edge. It is passed up with its flat surface to the child's body, the arm, if presenting, being previously drawn down, so as to bring the neck more within reach, and when sufficiently high the hook is turned partly round, so as to embrace the neck, which is then cut through with a kind of sawing motion. The operation requires considerable force, and the instrument must therefore be well guarded with the left hand, lest at the moment of severing the neck the hook should penetrate the vagina. A much easier and safer way is to use the scissors,[1] with which the neck can be gradually cut through from below upwards. After decapitation is effected, the trunk is drawn down by the arm without much difficulty, leaving the detached head

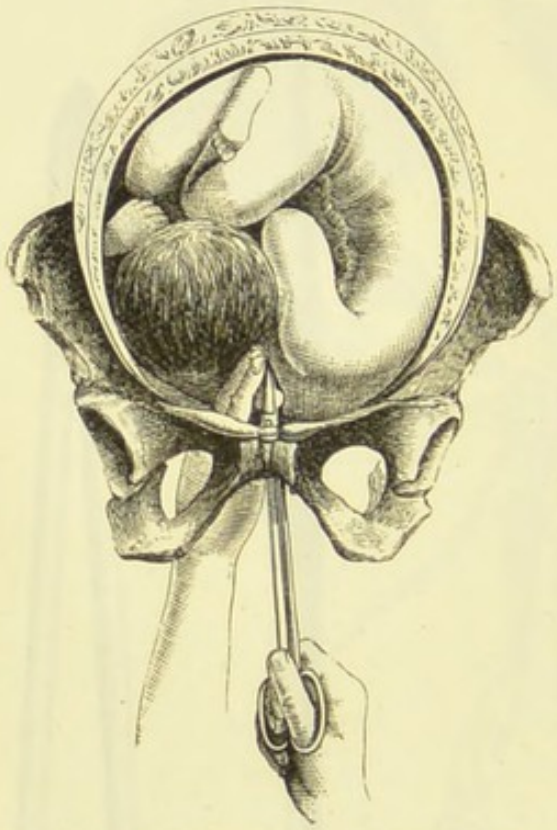


Fig. 215.—Decapitation of Fœtus with Embryotomy Scissors.

[1] The embryotomy scissors (Fig. 214) forms a very excellent addition to the obstetric bag—in decapitation and evisceration its usefulness is obvious, and being provided with shoulders, as in the figure, it can be used as a perforator.

within the uterus. If the uterus contracts well upon the head, the crotchet may be inserted into the mouth or Oldham's hook into the foramen magnum ; or the cephalotribe may be applied and the skull crushed and withdrawn. When the uterus, however, refuses to contract, and so to steady the head, it is often a very awkward matter to get it away. The application of the crotchet becomes dangerous, from the head being liable to slip suddenly round when traction is applied. The best plan is to have the uterus well steadied by an assistant, and cautiously to apply the cephalotribe.

Dr. Barnes has devised a method of reducing the fœtal head, in theory simple and efficacious, which, however, has not yet undergone adequate practical testing to establish it amongst obstetric operations. The instrument used is the écraseur, furnished with a loop of steel wire. After perforation, the crotchet, passed into the opening made by the perforator, is held by an assistant so as to steady the head : the wire loop, compressed by the fingers, is then passed over the crotchet to the right side of the os uteri, and is guided over the anterior part of the child's head, which is then separated by working the instrument. The segment after detachment is removed by the craniotomy forceps, which is applied to the remaining portion of the head, and the fœtus is then extracted. In cases of extreme pelvic deformity a second or even third application of the écraseur may be required, with repeated manipulations to effect the evisceration of the thorax and abdomen.

CHAPTER XXIX

SYMPHYSEOTOMY

Symphyseotomy.— About the middle of the last century (1768), Sigault, a French student of medicine, proposed the operation thus named as a substitute for Cæsarian section. It was performed first in 1774 by Ferrara in Naples, but after a comparatively short experience it ceased to be ranked among obstetric operations. Latterly, however, division of the symphysis has been brought forward again, being practised at present with great frequency on the Continent. Morisani of Naples drew special attention to it in 1863, and there has been a strong recent revival of the operation in Italy, Germany, and especially in France, where it is held in great favour. In England symphyseotomy is as yet only rarely practised, owing to the possibility of subsequent non-union of the bones, of hæmorrhage, and of the occurrence of vesico-vaginal or of urethro-vaginal fistulæ. Indeed, on account of the likelihood of tears of the vagina, it is almost a rule that the operation should *not* be performed in primiparæ, though, under favourable conditions, satisfactory preliminary dilatation of the vagina may be secured by the use of a Champetier de Ribes' bag. Usually hæmorrhage from the vascular tissue of the mons veneris or from the

post-pubic veins is not more than can be controlled by plugging, and any accidental tears heal well if sutured at once and if the parts are kept thoroughly clean.

In the *Annales de Gynécologie*, April 1893, Varnier recorded 112 cases with 12 maternal and 32 fœtal deaths, and among these there were several fatalities hardly to be ascribed to the operation. Pinard (*De l'Agrandissement Momentané du Bassin*, 1894) gives 36 more recent cases in the Baudelocque Clinique with 2 maternal and 4 fœtal deaths, and compares the operation very favourably with the induction of premature labour as performed in the same clinique. Of the two mothers who died, one, after having been in labour three days, died of septicæmia; the other died on the seventh day from intestinal obstruction, caused by a band which, although laparotomy was performed on the fifth day, remained undiscovered until after death.

The statistics as given by Pinard are as follows:

1890-1891.

64 cases of induced labour.
62 mothers living.
2 „ dead.
35 children living } one
30 „ dead } twin.
Total: 97 living and 32 dead.

1892-1893.

36 cases of symphyseotomy.
34 mothers living.
2 „ dead.
32 children living.
4 „ dead.
Total: 70 living and 6 dead.

Pinard's report shows that the present success of the operation is due to its early performance under strict antiseptic precautions. As regards the after-results, he states that in all cases the consolidation of the pelvis was such that the patients left their beds and walked about with ease in an average of twenty days. To show the complete recovery of the pelvis, Pinard mentions one patient remaining in the hospital as a nurse, one as a ward maid, and a third who is a bread-carrier and obliged to mount steps from morning to night. One of his patients became pregnant again three months after the symphyseotomy. No pathological relaxation of the symphysis arose during the pregnancy, and the patient was able to continue her work until the eighth month. Then premature rupture of the membranes occurred, and she was delivered spontaneously of a child weighing $7\frac{3}{4}$ lbs. She left the hospital completely recovered on the seventeenth day.

Farabeuf shows that the total gain in symphyseotomy is made up of two elements: (*a*) the increase in the sacro-pubic diameter, and (*b*) the fact that a certain bulk or segment of the head can be accommodated between the separated bones. There is at first little gain in this second particular, but it increases considerably as the separation progresses. Fig. 217 is designed to show the total benefit conferred in pelves of different sizes by various degrees of symmetrical separation of the symphysis. Thus in pelves of 60 mm. conjugata vera ($2\frac{2}{5}$ in.), 6 cm. ($2\frac{2}{5}$ in.) of separation yield 25 mm. (1 in.) extra available space in the direction of the conjugate; 7 cm. ($2\frac{4}{5}$ in.) yield 33 mm. ($1\frac{1}{3}$ in.). Or expressed in another way, the figure shows how a pelvis of 70 mm. ($2\frac{4}{5}$ in.) conjugata vera becomes with a separation of 7 cm. ($2\frac{4}{5}$ in.) equivalent to a pelvis of 102 mm. (4 in.); one

of 80 mm. ($3\frac{1}{5}$ in.) equivalent to one of 111 mm. ($4\frac{2}{5}$ in.).

The operation is performed in cases of contracted pelves with conjugates of $2\frac{2}{3}$ to $3\frac{1}{4}$ or even $3\frac{1}{2}$ inches, so that practically it is no substitute for Cæsarian section, except when the contraction of the conjugate to the above degree is accompanied by marked general contraction. Its object is mainly to spare

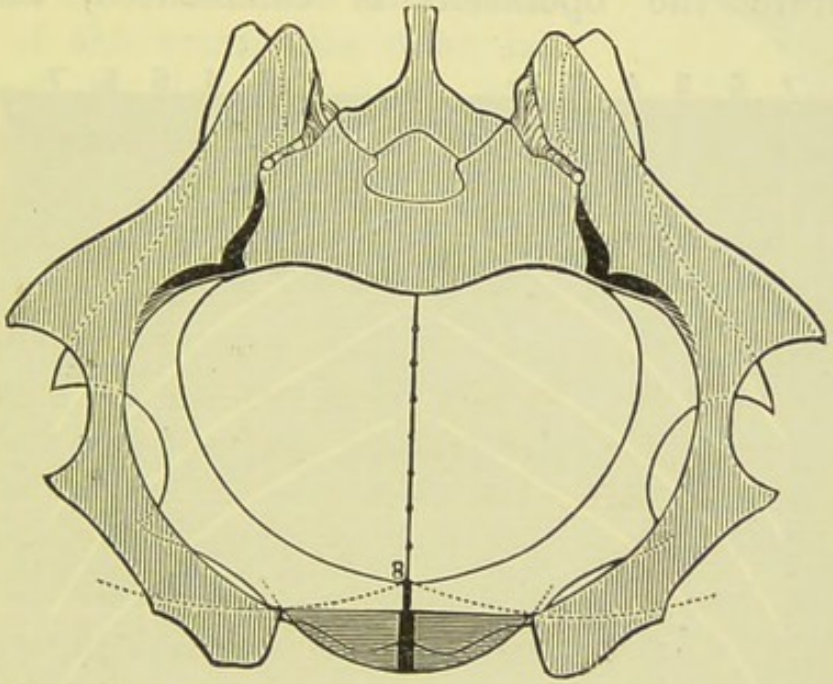


Fig. 216 (Pinard).—Diagram illustrating symmetrical separation of pubes—the total gain composed of two elements, (*a*) enlargement of the sacro-pubic diameter, rapid at first but soon ceasing, and (*b*) the thickness of the segment of the head engaged between the bones (illustrated by horizontal shading); at first this is slight, but later on it is much greater. The engagement of the head between the bones is the larger factor, and for this reason a separation of 5-7 centimetres is always needed in the operation. A separation of 7 cm. increases the available antero-posterior diameter by more than 30 mm.—say 10 mm. by the pubic displacement and 20 mm. by accommodating the anterior parietal bone between the pubes. Comparison of these two factors is indicated by the two little black columns under the figure 8.

the children from the almost invariably fatal injuries suffered during difficult forceps deliveries, and from the necessity for craniotomy following unsuccessful attempts at delivery by forceps, or by turning within

the above-named limits. The operation is only admissible when the child lives, and should not be done if there are evidences of the child's death; and in this connection we may advise that when the patient is under chloroform the fœtal heart-sounds should be listened for; if not heard, it might be well to pass the hand into the uterus and feel for pulsation in the cord.

Before the operation is commenced, the os

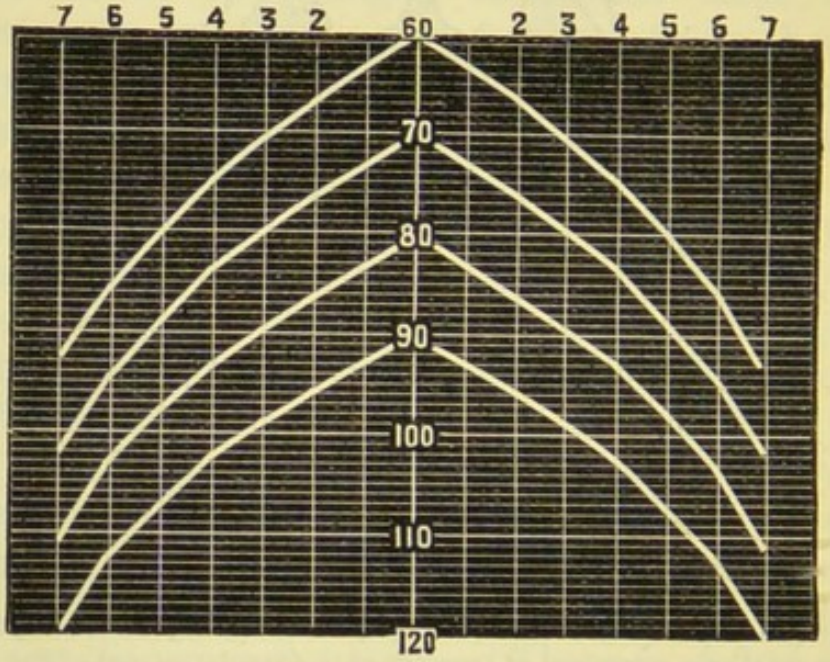


Fig. 217.—Pinard's Diagram.

Curves showing the progressive total gain that may be expected by symmetrical separation of the reduced symphysis from natural size. The central scale shows the gain to different brims from various degrees of separation of the symphysis. To brims of 60 mm. (2⅜ in.) antero-posterior diameter, a separation of 6 cm. (2⅜ in.) would give 25 mm. (1 in.), 7 cm. (2¾ in.) would give 33 mm. (1 5/6 in.). A brim of 70 mm. (2¾ in.) antero-posterior diameter might be increased to 102 mm. (4 in.); one of 80 mm. (3⅛ in.) to 111 mm. (4⅜ in.); one of 90 mm. (3½ in.) to 120 mm. (4¾ in.).

should be fully dilated, if necessary artificially, by means of the de Ribes' bag, the bowels and bladder attended to, the parts shaved and rendered aseptic. At the same time, the instruments and

dressings, as well as the operator's hands, must be sterilised. The patient being under an anæsthetic, and a catheter or bladder-sound inserted if deemed necessary, an incision about 3 inches long is made, exposing the symphysis. By some the cut is made to terminate just to the left of the clitoris, others commencing rather higher make it end in the mons veneris, in which case the lower edge of the symphysis must be exposed by drawing down the skin-wound by retractors. Probably the latter procedure gives a little more support to the tissues about the vestibule that are liable to be torn. All bleeding having been controlled, the upper edge and face of the joint is cleared. Above it the recti muscles are separated or slightly incised, so that the index finger can be passed behind the symphysis into the prevesical areolar tissue. Then the lower edge of the symphysis is defined by the finger-tip being exposed. Now, on the finger or on some hard metallic director, the division of the symphysis is accomplished with a scalpel or a Galbiati's knife. Some operators cut from above downwards, some from below upwards. Usually there is little difficulty, but cases are recorded in which it has been necessary to use a saw. The important point is that the sub-pubic ligament must be completely divided; when this is done the bones usually separate spontaneously to the extent

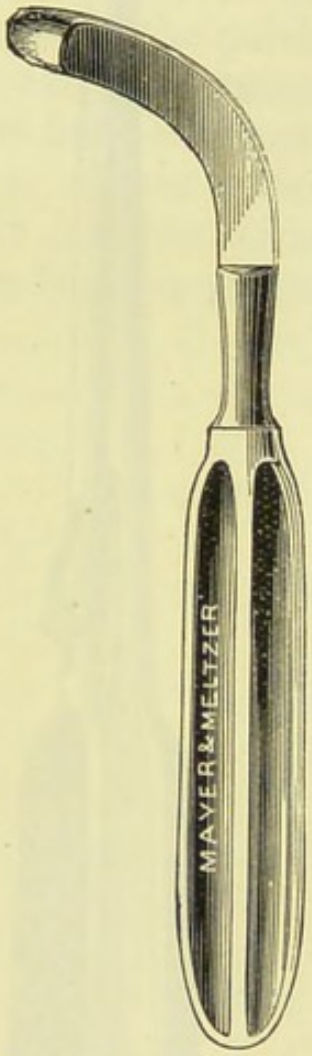


Fig. 218.—Galbiati's Knife.

of three-quarters of an inch, and the assistant supporting the iliac bones can with ease double this amount of separation. A little gauze or a strip of lint is placed behind the edges of the bones, so as to protect the bladder, and then, if after examination the head is found in a favourable condition as regards position and degree of flexion, the axis traction forceps is applied. During delivery the bones may separate to the extent of $2\frac{1}{2}$ inches, but at this degree the assistant should give strong support laterally, so that $2\frac{4}{5}$ in. (7 cm.) may not be exceeded, for this is about the greatest degree of separation consistent with safety to the soft parts and to the sacro-iliac synchondroses. To avoid tears about the urethra, traction should be made well backwards, as injury to the perineum is far less important—indeed in some cases it may be advisable to incise it laterally and so relieve the tension on the parts in front. Once the child is born, it is quickly separated, and the assistant who "follows down" the uterus should complete the third stage as soon as possible. Then the packing behind the pubic bones is removed, and they are approximated, care being taken to avoid nipping the bladder or urethra, which if necessary may be depressed by the bladder-sound. The bones being held in position, the periosteum and fascia are brought together by three or four buried sutures of silk or

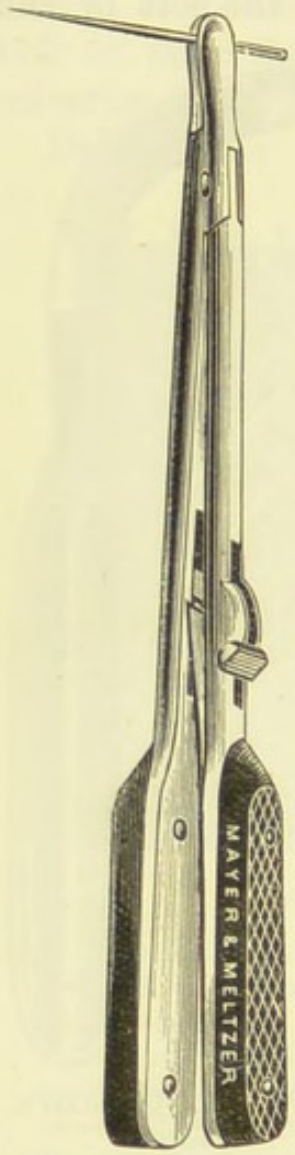


Fig. 219.—Improved Needle-Holder.

silver wire, and the wound is closed in the ordinary way by deep and superficial sutures. The dressing is applied, and the support up to this time accorded by the assistants at the sides is continued by means of strapping. One of the simplest ways of doing this is to take a broad strip of plaister, at least 4 feet long, fix its centre to the back of the sacrum, and draw the two ends simultaneously over the front of the pelvis. The vagina may then be douched and the patient put to bed between sandbags. Apart from the dressing, which will require attending to within a few days, the after-conduct of the case is just that of an ordinary forceps delivery, the catheter being employed if necessary.

CHAPTER XXX

CÆSARIAN SECTION AND PORRO'S OPERATION

THIS operation, the forlorn hope of the obstetric art, dates from the earliest times, and for centuries has been the theme of strenuous argument for and against. *Laudatur ab his, culpatur ab illis.* It has been eulogised in glowing strains as a means of salvation to mother and child; it has been anathematised in unmeasured terms as certain death to both. The Cæsarian section is indeed the most formidable of obstetric operations. Ascending in relative gravity, first we have the forceps, next version, then craniotomy and symphyseotomy, and finally the operation under discussion. It is of course wrong to resort to it so long as other and less objectionable means are available; but it is culpable to allow a patient to be lost for want of the timely performance of an operation which, though greatly to be dreaded, yet has saved many lives.

In order that Cæsarian section may not prove a forlorn hope, it should not be deferred until, as too often happens, the patient's powers are reduced to the lowest ebb. It is greatly to be feared that in many cases the operation has been performed as a sort of obstetric absolution, in deference to the rule that a woman in travail should not be allowed to die

undelivered. The conditions which render the operation necessary are pelvic deformity, pelvic tumours, or any other absolute barrier to parturition. The kind of pelvic distortion most frequently encountered in cases requiring Cæsarian section is that produced by osteomalacia; more rarely, rickets produces a degree of deformity sufficient to demand the operation. The rare form of spinal malposition known as spondylolisthesis may render it necessary. It may be required also in occlusion of the pelvic canal by osseous or malignant tumours, or when malignant disease of the lower segment of the uterus has rendered the cervix undilatable. Alonso reports an extraordinary case of Cæsarian operation for the extraction of a fœtus, which was retained in utero for twenty-two months through rigidity of the os.

Cæsarian section has been performed immediately after the death of the mother with the view of saving the infant's life, but unless the operation takes place within a quarter of an hour after death, it is not likely to be successful; the difficulty of obtaining surgical aid at the exact time of decease makes the post-mortem operation one of rare occurrence.

The degree of pelvic contraction which on the Continent is held to necessitate Cæsarian section is estimated at from 2 to $2\frac{1}{2}$ inches; but in this country, with so much space at his command, the practitioner might not feel justified in resorting to this formidable operation, the general rule in England being that hysterotomy is only admissible when delivery *per vaginam*, by any means, is either impossible or likely to be attended with as much risk as abdominal section. Delivery has been effected by craniotomy through an antero-posterior diameter of $1\frac{1}{2}$ inch, or even less: it is a question, however, whether, when the space is so limited, the severe bruising which the

maternal soft structures must necessarily undergo is not productive of as much danger as Cæsarian section. If the conjugate diameter of the brim exceeds $1\frac{3}{4}$ inch, without contraction in other directions, craniotomy ought to have the preference; if the measurement is less, hysterotomy is the only alternative, and indeed should be chosen even in pelves with a conjugate slightly exceeding $1\frac{3}{4}$ inch, if the transverse diameter be contracted to 3 inches or less.

The maternal mortality is very great, but, as before pointed out, a large part of this is owing to delay in operating. Till recently, in this country only about 15 per cent survived; but on the Continent, where the operation is not looked upon with such disfavour, and is consequently not delayed, the recoveries averaged about 57 per cent, this glaring discrepancy proving that by prompt measures the death-rate may be largely reduced. Lately, however, both in England and on the Continent, the mortality has been considerably lessened; our enlarged experience in abdominal surgery, derived of late years from the frequent successful performance of ovariotomy, and of the various operations on the intestinal canal, has aided greatly in the treatment of Cæsarian section, and tends to encourage the hope that the future percentage of deaths will place Cæsarian section in a far more favourable position than it even now occupies. With the care and attention to detail such as are devoted to ovariotomies, and the improved method of suturing the uterine incision introduced by Sänger, the mortality should not exceed 20 to 25 per cent in cases where no undue delay has prejudiced the chances of the operation. The causes of death include shock to the system, hæmorrhage, and peritonitis. Shock is the

inevitable result of an operation of this magnitude, and the question is—How may the shock be reduced to the minimum? The answer is obvious—Operate before the patient has lost her reserve of nerve force, and give chloroform or ether. Hæmorrhage, though often extremely copious, is not very frequently a direct cause of death; celerity on the part of the operator, together with manual or other compression of the uterus, will limit the flow. A large dose of ergot before operating might have some restraining effect. Septic peritonitis, including metritis, a great source of danger, may supervene within twenty-four hours from the operation, or after an interval of several days. The exposure and handling of the peritoneum are theoretically sufficient to account for inflammation, but when in addition to this we consider the primary escape of blood and liquor amnii into its cavity, with the liability to after-oozing from the divided coats of the uterus, it becomes a matter of no surprise that inflammation after hysterotomy is of frequent occurrence. Here, however, ovariotomy affords an instructive lesson. In performing that operation I have frequently been compelled, after the accidental rupture of the cyst and extravasation of its contents, or because of hæmorrhage from adhesions, carefully to sponge and even to wash out the peritoneal cavity, a procedure taking up a considerable time, and which of necessity has involved much exposure and handling, yet the result has been favourable. I am inclined to think that the muscular coats of the uterus at term being in a state of incipient degeneration are consequently not in a good condition to take on the healing process; and that this state, with exhaustion of the systemic powers, and want of attention to the peritoneal toilet, are to be taken as the special factors in

the causation of asthenic inflammatory action and in the development of septicæmia. The maternal mortality appears to be greater in cases of osteomalacia than in rickets. The infantile mortality is slightly greater than in natural labour, though there is little risk to the child from the operation itself. Radford stated the percentage of deaths as only half per cent greater than in ordinary births.

The Operation.—The first point to consider is the period when the operation should be performed. Is it better to wait until the uterus has begun to act from physiological impulse, or to anticipate the action by artificial means? As regards securing contraction of the womb after the operation, the old idea is no longer tenable that operating before pains come on tends to the production of hæmorrhage from inertia. The fact is that uterine action is found almost invariably to follow evacuation of the child and secundines, even when the operation is undertaken before the onset of any pains. Still it is undoubtedly better to have the os uteri patent, and as spontaneous uterine action may occur at a time unfavourable for the performance of the operation, Barnes recommends the artificial induction of labour within the last fortnight of gestation. This as a matter of course can only be done in cases where the condition of the pelvis is known beforehand; if the deformity is discovered after the commencement of labour, all we can do is to determine without loss of time whether the operation is necessary, and if so, forthwith to perform it. Winckel is of opinion that the end of the first stage is the best time to operate; I strongly urge its performance before the rupture of the membranes.

Once the operation is decided upon there should be no unnecessary delay, no preliminary trial of

the forceps, etc. The room should be warmed to a temperature of 70° to 75° F., a point long ago insisted upon by my late colleague Charles Clay in cases of ovariotomy. The bowels and the bladder are to be attended to, and the vagina should be thoroughly douched with 1 in 4000 perchloride solution. When the patient has been warmly clothed in flannel, the anæsthetic may be administered, after which she may be placed on the operating table. Then the pubic and vulval hair is removed by a razor, the skin of the abdomen is scrubbed with soap and water, washed with ether, and finally well sponged with 1 in 1000 corrosive lotion. An incision is now made along the linea alba—it is presumed that the operator's hands and the instruments have been duly prepared with regard to surgical cleanliness—from just above the umbilicus to within two inches of the pubes. The tissues are divided seriatim until the peritoneum is reached, through which a small opening is made so as to admit one or two fingers of the left hand to act as a director for the knife; all bleeding being stopped as it arises. The peritoneum is then divided to the full extent of the primary incision, the abdominal wall being carefully supported by assistants on each side. At this period it is a good practice to pass three or four loose temporary sutures at the upper part of the incision. The untied ends should be grasped in a pair of clip-forceps, on which traction may be made at a later time so as to obviate too much exposure of the abdominal contents. As regards the uterine incision, it has been recommended to determine the position of the placenta by auscultation, but as the so-called placental bruit does not indicate the placental attachment with any certainty, the endeavour will most likely be futile; and, indeed, if we know that the

placenta is attached to the front wall of the uterus, we cannot alter the line of incision sufficiently to avoid it. The uterus is now opened longitudinally along the middle line, avoiding the fundus and cervix where the circular fibres are most abundant, lest the wound should afterwards gape. When the uterine cavity is reached, Winckel advises that an assistant should pass his forefingers, the one to the top and the other to the bottom of the opening, and lift up the uterus so as to bring it into close contact with the abdominal walls, and thus, at the same time, prevent protrusion of the intestines, and the escape of blood and liquor amnii into the peritoneal cavity. If the placenta lies immediately in front, the hand must be passed between it and the uterine wall until the membranes are reached; they must then be ruptured and the child extracted, care being taken that the uterus does not by a sudden contraction close upon the head and grasp it so firmly as to necessitate—as has happened—a second incision ere it can be liberated; it is well, therefore, to draw the child out head first, bearing in mind that, in some cases, there is a special irritability of the uterus exciting it to sudden and powerful contraction. The placenta is then removed, when, in favourable cases, the uterus contracts, checking hæmorrhage and closing the wound. At this stage considerable difficulty has occasionally arisen in securing sufficient uterine contraction to arrest the hæmorrhage; in two such instances in my practice we at last succeeded by the aid of Faradisation, a procedure I strongly recommend in similar cases. Ordinarily excessive hæmorrhage may be avoided either by an assistant manually pressing the walls of the incision together, or by means of a temporary elastic ligature of rubber cord clamped round the cervix. Müller meets the diffi-

culty of hæmorrhage by making the abdominal incision large enough to admit of the gravid uterus being lifted outside the abdomen; the uterus is then kept warm by a succession of towels wrung out of hot carbolic lotion, which also protect the abdomen from the admission of fluid. The rubber cord is applied *before* the uterus is opened.

Dr. Murdoch Cameron advises, with the object of lessening hæmorrhage, that the uterine incision should be made within a flattened-out Hodge pessary, which is pressed on the surface of the womb. A small cut down to the membranes sufficient to admit the finger is first made, and then the opening is very rapidly enlarged to the required size.

Now, after evacuation of the contents of the uterus, comes the improvement introduced by Sänger, to which, along with asepsis, the recent successful results are mainly to be ascribed. Formerly the uterine wound was left unsutured, or if sutured, with its edges so insufficiently brought together as to permit of escape of the lochia into the peritoneal cavity. Sänger insists on the accurate apposition of the cut edges of the muscle and peritoneum. He uses two rows of stitches, one row deeply and the other row superficially inserted, after the manner of the Lembert intestinal suture. Ten or twelve deep interrupted sutures of silk or of silver wire are placed at intervals of $\frac{1}{3}$ or $\frac{1}{2}$ an inch, so as to include peritoneum and muscle, but not the decidua. Between these a dozen or fifteen superficial sutures of fine silk are inserted *à la* Lembert, so as to infold the peritoneal edges and secure their proper adaptation. When the uterine wound has been closed and the uterus is well contracted, ergotine having been injected if necessary, two things yet remain to be done before closing the abdominal wound: first, by means of new soft aseptic sponges

wrung out of weak warm lotion, the peritoneal cavity should be carefully freed from the blood and liquor amnii which may have escaped into it; and second, an assistant should ascertain that the os uteri is open, any clots likely to prevent or retard the exit of the lochial discharge being cleared away. The incision in the abdominal parietes is now closed with interrupted sutures passed through the entire structures, so as to bring the divided edges of the parietal peritoneum into apposition; the wound is then covered with a light dressing. For the first few days the catheter should be passed when required, the sutures being removed on the fourth or fifth day, unless there is great tympanitic distension, in which case they must be allowed to remain some days longer. The general treatment is regulated by the exigencies of each case.

Porro's Operation.—The great fatality attending the performance of Cæsarian section has led to the suggestion that the uterus, after being emptied by abdominal section, should be removed; the risk of leaving in the abdomen a wounded organ with a communication between its cavity and that of the peritoneum is thus avoided. The merit of first suggesting the operation is due to Cavallini (1769). Blundell (1823-8) performed a series of comparative experiments on pregnant rabbits, in some performing ordinary Cæsarian section, in others removing the uterus as a subsequent step, with results in favour of the latter operation. In 1869 Dr. Hover of Boston first performed the operation on a woman, on account of obstruction to delivery caused by a uterine fibroid; the patient died. In 1874 Professor Porro of Pavia repeated the experiments with rabbits without knowledge of Blundell's prior observations, or those of Dr. Fogliata of Pisa, which were also made in

1874. To Dr. Porro belongs the credit of establishing the operation Laparo-hysterectomy—now known by his name—on a practical footing. The earlier steps of the operation are identical with those of the ordinary Cæsarian section. After removal of the fœtus and placenta, the uterus is lifted out of the abdomen and secured just above the os internum either with the

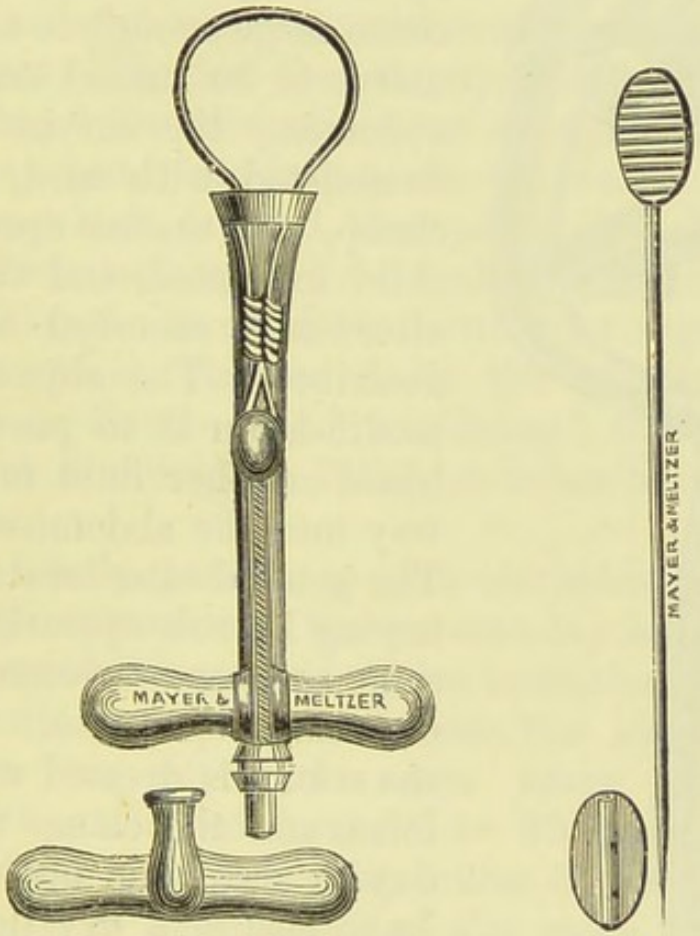


Fig. 220.—Koeberlé's Serre-nœud and Pins.

wire girdle (*serre-nœud* of Cintrat), chain écraseur, or clamp. The organ is then amputated above the constriction, the stump being fixed in the lower angle of the wound; the peritoneum below the constrictive wire should be sutured to the cut edges of the parietal peritoneum, so as to secure accurate closure of the abdominal cavity. Two long firm

guarded pins passed through the stump at right angles to one another are useful in preventing the stump slipping. The operation is performed with antiseptic precautions, and a drainage-tube is used if necessary. The operation has been modified (Müller) by making the abdominal incision large enough to allow the uterus to be turned out of the abdomen; the cervix is then constricted with cord, wire, or clamp, the uterus opened, the child extracted, and the organ afterwards removed as above described. The object of this modification is to prevent any blood or other fluid finding its way into the abdominal cavity. The general after-treatment following Porro's operation is the same as after ovariotomy or the Cæsarian operation. Locally the stump is dressed with iodoform, and the clamp tightened day by day; the object should be to ensure a dry decomposition of the sphacelated material, of which portions are cut away every now and then. Usually the serre-nœud or clamp can be dispensed with in ten to fourteen days; the granulating hollow which remains takes three or four weeks to fill up.

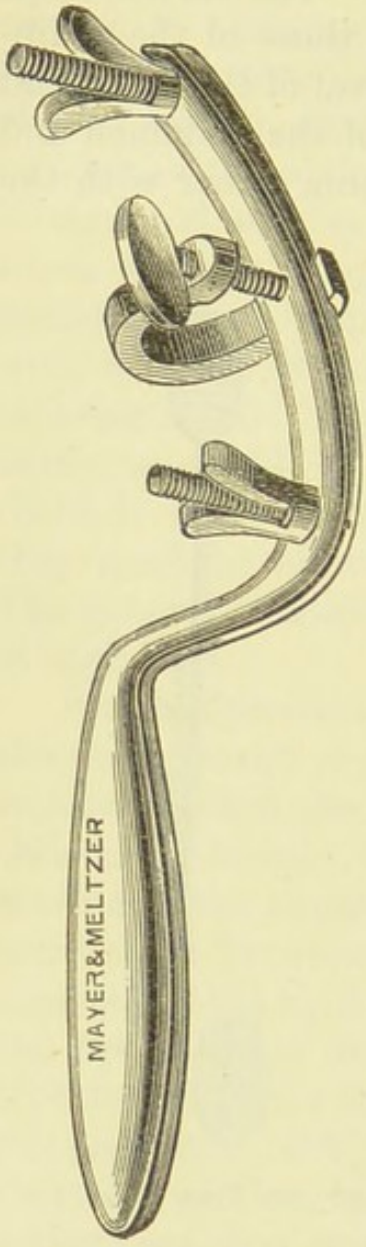


Fig. 221.—Improved Clamp.

Dr. Harris of Philadelphia some time ago tabulated thirty-six cases of Porro's operation, and considered

the operation could lay claim to two advantages over ordinary Cæsarian section.

1. The wound originally within the abdomen is treated virtually without the body, where it can be observed and dressed to the best advantage.

2. There is no bleeding or gaping uterine wound; no lochial discharge; no escape of fluids into the abdominal cavity from the uterus; and no uterine sinuses to absorb noxious matters and set up phlebitis or metritis. The fact that the operation unsexes the patient has been advanced as an objection to its performance; but, considering the nature of many of the cases which demand the operation, I should, on the contrary, look upon this result as a distinct gain; and further, the force of the mutilation argument is to some extent discounted by the practice which has held in England of "sterilising" the Cæsarian patient by dividing the Fallopian tubes between two ligatures.

It is hardly possible to give statistics accurately and fairly representing the present-day mortality of the improved Sänger and Porro operations. Under approximately similar conditions the *old* Cæsarian operation was attended some years ago by a maternal mortality of from 50 to 85 per cent, that of the Porro operation was under 30 per cent, so that the latter *then* presented the more favourable results. Nowadays, under like surroundings, the risk of the improved Sänger operation is believed to be somewhat less than that of the Porro operation, both perhaps having, roughly speaking, a mortality of from 20 to 25 per cent. On this account, and also because it does not of necessity terminate child-bearing, together with the fact that the risk lessens if the operation be performed a second or third time on the same patient, the Sänger operation would seem likely to

materially displace Laparo-hysterectomy. The latter (Porro) would still, however, possess a large field in cases for which it is peculiarly fitted, such as septic cases, advancing cases of malacosteon (especially having regard to the good effect of oöphorectomy in that disease), cases of uterine tumours and pregnancy in which it is desirable to remove the growth as well as the child, ruptured uterus, uterine atony following the Sänger operation, and in cases of obstruction to drainage on account of extreme cicatrization of the os uteri.

Gastro-Elytrotomy, a substitute for Cæsarian section, was proposed some years ago, but received little attention until Professor Thomas, of New York, quite recently revived the operation under the name *Laparo-Elytrotomy*, from λαπάρα, the flank, ἔλυτρον, the vagina, and τομή, a cut. In this operation the peritoneum is not opened, and consequently the danger of peritonitis, one of the great evils of Cæsarian section, is considerably reduced. The operation is thus described by Dr. Thomas: The patient having been etherised, is placed upon a firm table, and the os fully dilated with Barnes' bags. An incision down to the peritoneum is made from the symphysis pubis to the anterior superior spine of the ilium; the peritoneum is lifted up by the fingers, or by metallic retractors, until the junction of the uterus with the vagina is reached. By means of a metallic sound passed through the vulva the vagina is made to protrude in the wound, and is divided at its juncture with the cervix, which is then drawn into the iliac fossa. The child is now extracted through the dilated os by version, the placenta removed, and the uterus made to contract firmly. The iliac fossa is then washed out by a stream of warm water introduced through the abdominal wound and

allowed to escape through the vagina, after which the abdominal wound is closed by interrupted sutures. The vagina is syringed out every five hours with carbolised water, the nozzle of the syringe being carried through the vaginal opening, and the fluid forced through that in the abdomen. In this operation the great danger to be apprehended is hæmorrhage from the vaginal arteries, though it has not occurred in the cases hitherto operated upon. Dr. Thomas thinks that hæmorrhage could be controlled by means of ligatures, the actual cautery, or styptics.

CHAPTER XXXI

EXTRA-UTERINE PREGNANCY OR ECTOPIC GESTATION

THE fecundation and development of an ovule external to the cavity of the uterus is an accident fortunately of somewhat rare occurrence, and, as might

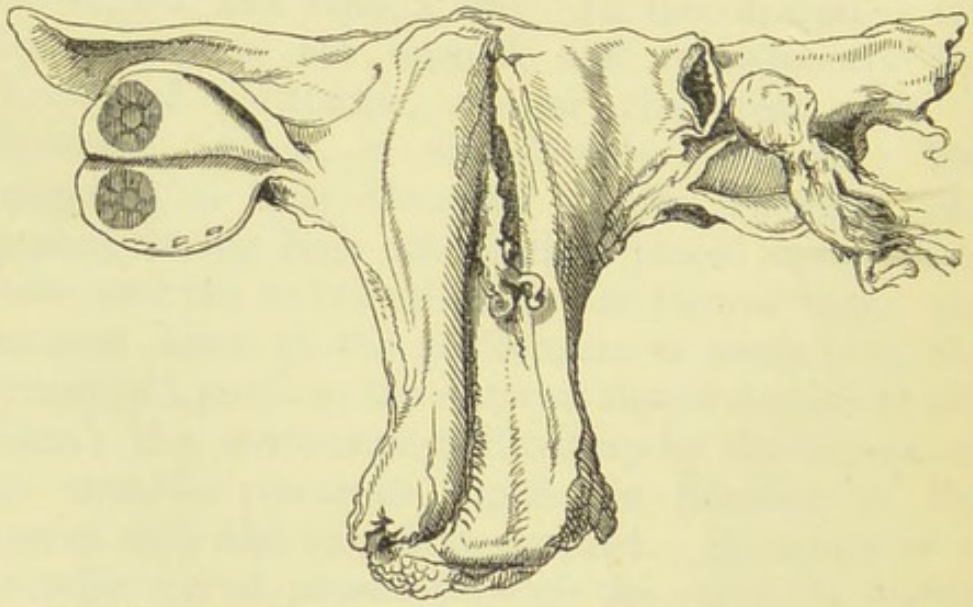


Fig. 222.—TUBAL PREGNANCY, WITH THE CORPUS LUTEUM IN THE OVARY OF THE OPPOSITE SIDE. (After Tyler Smith.)
The Decidua is represented in process of detachment from the uterine cavity.

be supposed, is necessarily very serious in its result. The ovule may be fecundated and arrested at any point of its transit from the ovary to the junction of

the Fallopian tube with the uterus. Cases of this kind are divided into *ovarian*, *abdominal*, and *tubal* pregnancy, and are further subdivided according to the exact position where the development of the ovum takes place.

The rarity of this form of pregnancy may be accounted for by the malplaced ovum becoming absorbed when the site to which it adheres is unable to afford the requisite amount of nourishment for its development. On the other hand, many cases of undoubted ectopic pregnancy, as shown by micro-

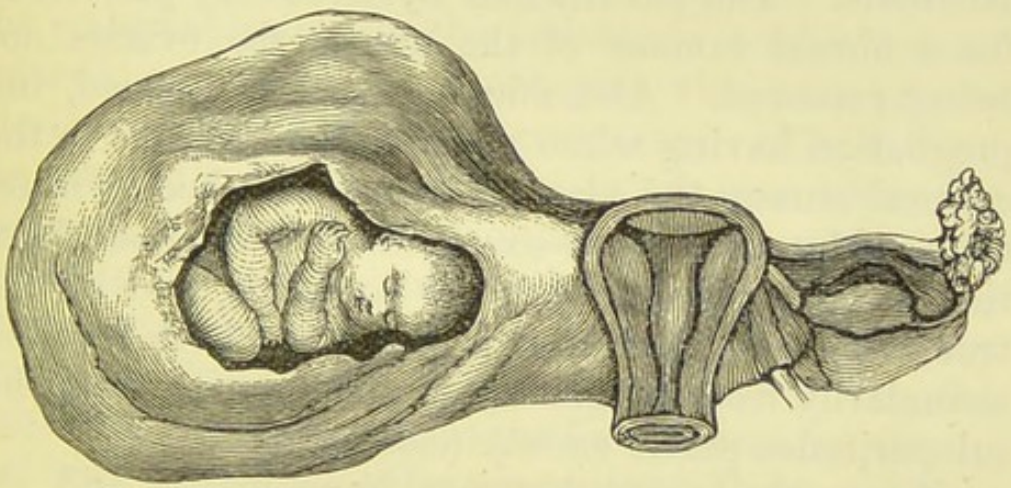


Fig. 223.—Case of Tubal Gestation.
(From a preparation in my own Collection.)

scopic evidence, were formerly overlooked, being styled simply hæmatocele, etc., their relation to conception not having been made clear. Had a section been made of many of them, chorionic villi would probably have been seen, and their true nature revealed.

The *ovarian* variety is exceedingly rare. Its occurrence involves impregnation prior to rupture of the Graafian follicle, or, what is more probable, rupture without discharge of the ovule, which becomes fecundated, the aperture in the follicular wall closing on the now developing embryo. The existence of such pure and primary cases of ovarian pregnancy is

doubted by some, since careful examination of reputed specimens has shown that the connection between the developing ovum and the ovary was only of a secondary character, as will be mentioned afterwards.

When the fertilised ovum enters the peritoneal cavity, and attaches itself to some of the abdominal organs, *abdominal* pregnancy is the result. This variety is also very rarely met with, although cases are recorded in which both ovaries and tubes were distinct from the fœtal sac; its possibility is put beyond doubt by the remarkable case recorded by Koeberlé. The patient had hysterectomy performed for a fibroid tumour of the uterus, the ovaries not being removed. Abdominal pregnancy ensued, impregnation having taken place through a sinus in the cervical stump, the placenta being attached to intestine. Many supposed examples of abdominal fœtation are, however, incorrectly so called, and of the true cases several are not primary, but have resulted secondarily from pregnancy in the tube or from the sub-peritoneo-pelvic variety (*vide infra*).

When the ovum becomes impregnated and arrested in the tube, or when an already fertilised ovule acquires an attachment to the Fallopian mucous membrane, the most frequent form of extra-uterine gestation, *i.e. tubal* pregnancy, results. Its frequency is very great compared with the others, and by some writers it is the only form of *primary* ectopic pregnancy regarded as proved.

We must now briefly allude to certain allied sub-varieties :—

(1) *Tubo-uterine* or *interstitial* pregnancy, when the ovum is attached to and develops in that part of the lumen of the tube which is traversing the uterine wall.

(2) Pregnancy in a rudimentary horn, or *cornual* pregnancy.

(3) *Tubo-ovarian* pregnancy, where the gestation sac comprises both ovarian and tubal tissue, development probably having proceeded in the "ovarian sac," closed by adhesions; and

(4) *Broad ligament* pregnancy, otherwise described as *sub-peritoneo-pelvic*, which is never primary, but results from rupture of the gravid tube into the tissue of the broad ligament.

In whatever position the ovum becomes adherent, the maternal vessels in the immediate neighbourhood enlarge, and to some extent play the part of the uterine vessels in ordinary pregnancy. The villi of the chorion engraft themselves on the spot where the ovum is located, but the attachment is precarious, owing to the absence of tubular glands, such as the true uterine decidua presents, in which the villi may obtain a firm hold. This fact accounts for the attacks of hæmorrhage into the fœtal sac so frequently met with in extra-uterine pregnancy. Corresponding with this local vascular hypertrophy there is sympathetic thickening of the mucous membrane and enlargement of the whole uterus, but owing to the absence of the stimulation afforded by the presence of the ovum, the organ, after a certain degree of development, either remains stationary or resumes its ordinary condition. Generally the decidua is cast off and, either whole or in several portions, is expelled *per vaginam*, accompanied by irregular hæmorrhages.

A gravid Fallopian tube undergoes little hypertrophy—its enlargement is mainly by thinning of its walls; and as a rule, the tubal contents are evacuated before or about the third month, either by rupture,

or through the peritoneal opening of the tube. Generally, in these cases, the abdominal ostium becomes closed early, but should this not have happened, the developing ovum may be displaced through it, and

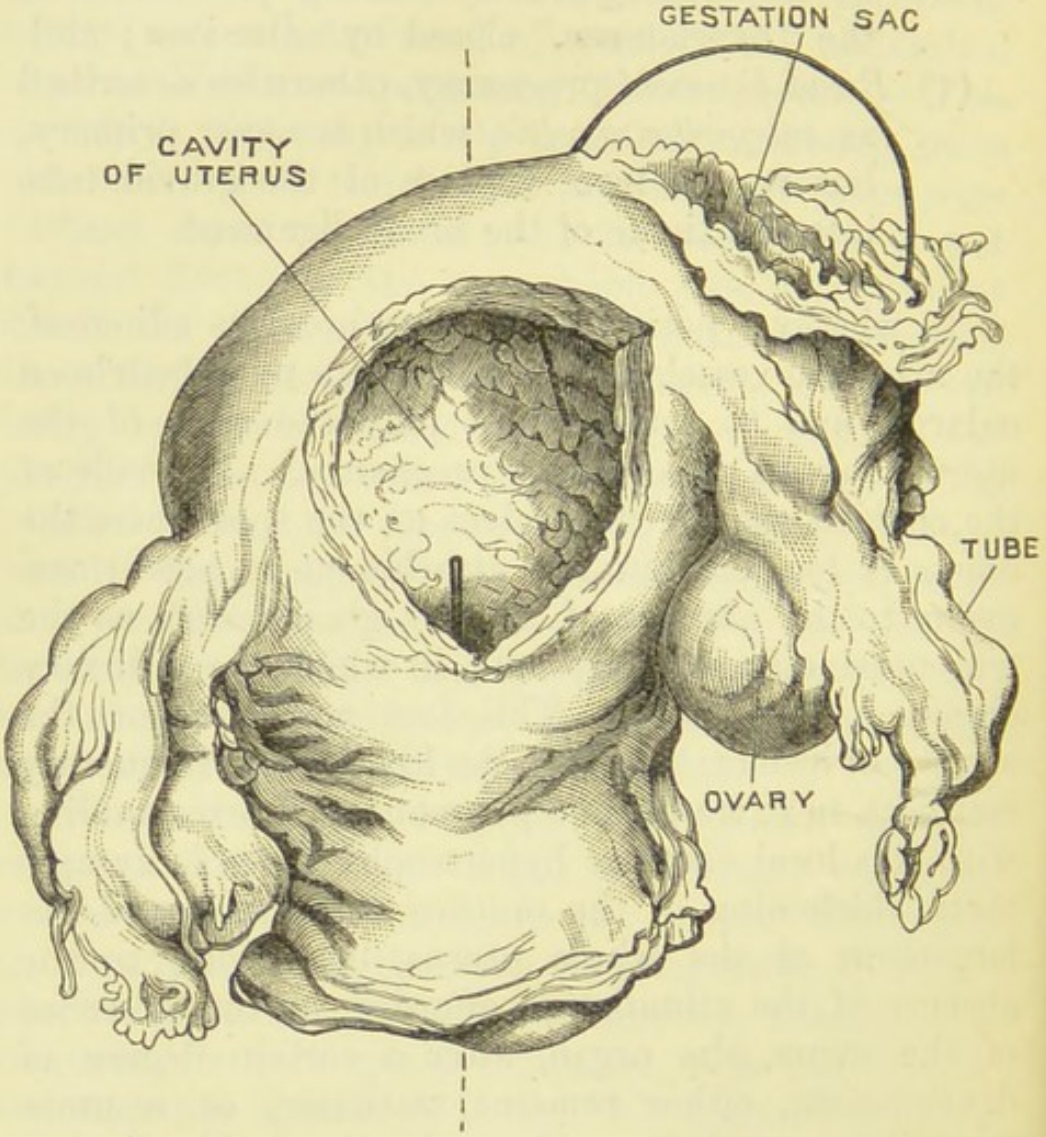


Fig. 224.—Tubo-Uterine Pregnancy: the Gestation Sac ruptured at the Mouth. (Bland Sutton.)

becoming attached elsewhere, may give rise either to *secondary abdominal* or to tubo-ovarian pregnancy. If the embryo be dead, say from hæmorrhage, and the mole be discharged through the unclosed mouth of the tube, *tubal abortion* is said to occur, and a form of peri-

toneal hæmatocele results. If the fimbriated opening of the tube be closed, rupture occurs, and the ovum is discharged (1) into the peritoneum, forming a hæmatocele, or rarely, giving rise to secondary abdominal pregnancy; or (2) into the cellular tissue of the broad ligament as an extra-peritoneal hæmatocele, or if development still goes on, as a broad ligament (sub-peritoneo-pelvic) pregnancy. This latter may in process of development so alter its peritoneal relations as to present the characters of an abdominal pregnancy except to the closest observation; or by secondary rupture of the peritoneum of the broad ligament a true secondary abdominal pregnancy may result. The causes which determine rupture of the tubal cyst are over-distension from simple development or from detachment of the ovum with or in consequence of hæmorrhage into the sac.

In all varieties of ectopic gestation the fœtus is surrounded by its own proper membranes—that is, by those derived from the ovum itself, viz. the amnion and the chorion. In the tubal form the maternal membranes are represented by a kind of spurious decidua produced from the mucous membrane lining the Fallopian tube, but in abdominal pregnancy there is no structure from which this covering can be derived, so that the chorion forms the sole external envelope.

The *causes* of extra-uterine pregnancy are somewhat obscure, being arrived at by deduction rather than by observation. Cases have been recorded in which fright, sudden shocks, or blows on the abdomen, at or about the time of conception, have been the only assignable reasons. Obstructions of a passively mechanical nature are probably more frequent factors. Amongst these may be enumerated inflammation of the uterus and its appendages, or of the tissues in

their immediate neighbourhood, producing thickening of the walls of the Fallopian tubes, which, by encroaching on their internal diameter, impedes the passage of the ovule without preventing the transmission of the spermatozoa, or inflammatory adhesions may result, which, by interfering with the free movement of the Fallopian tubes, prevent perfect apposition of their fimbriæ to the ovaries, and thus the fecundated ovum is allowed to escape into the abdominal cavity. Instances are recorded where a fœtus has been found in one of the Fallopian tubes, the concomitant corpus luteum being contained in the ovary of the opposite side. Various attempts have been made to account for this extraordinary circumstance; some believe that by action of the uterine cilia, or by spasmodic contraction of the womb itself, the ovum was propelled across the cavity of the uterus into the opposite Fallopian tube; others think that the Fallopian tube of one side twisted itself over to the ovary of the opposite side, and received the ovum directly into its fimbriæ but failed to transfer it to the uterus.

Previous salpingitis is now generally regarded as the commonest cause, and though a number of cases of ectopic gestation occur in primiparæ, the majority occur in multiparæ who have been sterile for some time before the abnormal pregnancy began. In these cases the history often warrants the supposition that during the sterile period either postpartum or gonorrhœal salpingitis occurred. Inflammatory conditions of the Fallopian mucous lining are supposed to conduce to tubal pregnancy by permanently arresting the ciliary action which helps the ovum onward in its progress to the uterine cavity.

None of the causes above given meets the objections that have been raised. One of the most recent

workers at the subject, Dr. Clarence Webster,[1] states that, in the development of the human female, there is such a functional specialisation of portions of the Müllerian ducts, in addition to their structural differentiation, that only the uterine mucosa is usually capable of decidual formation in reponse to the genetic influence of the fertilised ovum; that a fertilised ovum can only develop in connection with tissue in which there is the possibility that such formation may occur; and that cases of ectopic pregnancy can only happen when exceptionally some non-uterine area of the Müllerian ducts presents a mucosa possessing this power of "decidual reaction." From cases of tubal gestation he has demonstrated microscopically marked changes in the fringes within the Fallopian lumen. These changes principally comprise flattening out and destruction of the columnar epithelium, swelling of the fringe-core, and the presence within of large decidual cells. He asserts that only when this potentiality of "decidual reaction" exists can any of the ordinarily received factors influence the occurrence of ectopic pregnancy.

The *symptoms* during the earlier period of extra-uterine pregnancy are obscure, but in addition to the usual signs of pregnancy, there is often pain of a more or less local nature caused by the increased bulk of the misplaced ovum. Ventral pregnancy will frequently go on to the full period, as there is nothing to hinder the increase in fœtal bulk; but if the ovum is lodged within the Fallopian tube rupture of the sac takes place, as previously stated, before or about the third month, causing intense suffering and collapse, often speedily bringing the patient to a moribund condition. Should the rupture be only partial, temporary recovery may follow, to be succeeded by

[1] *Ectopic Pregnancy.* Edinburgh, 1895.

other attacks, after one of which the woman may die.

Parry in his valuable and exhaustive monograph, draws the following picture of a case of extra-uterine pregnancy. For the first six or eight weeks all may go on as in a normal pregnancy, when suddenly the patient is seized with violent colicky pains, usually on one side of the abdomen. These pains are attended by extreme prostration—threadlike pulse, cold surface, clammy sweats, and not unfrequently, vomiting. After an interval of from a few hours to one or two days, the patient recovers, to be again the victim of similar attacks every two or three weeks. These paroxysms are probably due to hæmorrhage into, and ruptures of the fœtal cyst.

A significant symptom which frequently accompanies these pains is hæmorrhage from the vagina, metrorrhagic in character. Sometimes in the early stage of gestation the decidua is expelled, giving rise to the suspicion of abortion. The discharged substances should therefore be carefully examined for the ovum. Vaginal examination reveals changes in the uterus corresponding to those of the early months of pregnancy, and to one side and behind a more or less tender mass of firm consistence is to be felt. Should development go on, the uterus, as before stated, never exceeds the size corresponding to a five months' pregnancy; under chloroform it can as a rule be differentiated from the fœtal sac. After quickening, preternatural intensity of the fœtal heart-sounds are very suspicious, and always indicate the necessity of careful combined internal and external examination; if the patient is too sensitive to endure this she must be put under the influence of an anæsthetic. Sometimes a tumour, which ballottement proves to contain a movable body, is found

alongside or behind the uterus. It has been recommended to dilate the urethra so as to enable the index finger to be passed into the bladder, and with the aid of the index finger of the other hand in the vagina or rectum to explore the fundus uteri and Fallopian tubes. The fœtal cyst generally displaces the uterus so that the os is more or less above the pubes, out of the reach of the finger. The possibility of pelvic hæmatocele should be borne in mind. It is sometimes difficult to distinguish extra-uterine from intra-uterine pregnancy when the latter is attended with certain complications, as, for example, the impregnation of one horn of a bicorned uterus. Again, tumours complicating pregnancy may occasion great difficulty in diagnosis; Greenhalgh relates how several medical men of much experience, mistaking a fibrous tumour of the uterus for a case of extra-uterine pregnancy, were about to perform gastrotomy, when a living child was expelled per vaginam.

If the patient arrives at the full term, pains, resembling those of ordinary labour, come on, often attended with vaginal hæmorrhage. In the majority of cases these pains do not cause rupture of the cyst. If rupture does take place the patient feels as though "something had given way in her inside;" this is followed by immediate and profound collapse, and prolonged syncope, convulsions, and delirium may severally supervene. There is abdominal pain of the most severe character. The patient may die at once, or more frequently she may live several days, the abdomen becoming tympanitic, the pulse quick, and the temperature elevated. These symptoms are usually attributed to acute peritonitis, but Parry states that an analysis of the post-mortem examination made in cases of rupture of the cyst shows that peritonitis is a rare sequel. The child dies about

the time of this quasi-parturient crisis or shortly after (even when the sac remains unruptured); the body, if retained, becomes mummified or converted into a substance resembling adipocere; in some cases it undergoes calcification, or in rare instances it may remain for a considerable time nearly if not quite unchanged. In one or other of these conditions the fœtus may remain encysted in the maternal abdomen for an indefinite period—twenty or thirty years, or, according to the record of one case, even over half a century. In other cases "nature makes an effort" to cast off what is now a foreign body. By inflammatory processes portions of the fœtus slowly make their way by ulceration through the intervening tissues to be discharged through the bowels, the abdominal walls, the vagina, or the bladder. According to an analysis of five hundred cases by Parry, the relative frequency of the exit of the fœtus was—into the bowels, 26·2 per cent; through the abdominal walls, 16·12 per cent; into the vagina, 4·83 per cent; and into the bladder, 3·62 per cent. These attempts at evacuation are most frequently initiated during the first six months after the death of the fœtus.

Treatment.—When an early diagnosis was established, until recently it was considered that the indications were to destroy the vitality of the ovum and thus prevent further growth. Attempts have been made to accomplish this by various means; by the administration of strychnine or ergotine to the mother so as to reach the embryo through the circulation; by puncture of the cyst with or without the injection into it of morphia or other narcotic; by passing shocks or a current of electricity through the sac either per-cutaneously or by means of electrolytic needles; and lastly, by gastrotomy. Parry laid down

the axiom that in order to procure retention of the embryo as an innocuous body within the maternal abdomen the cyst must be left intact, otherwise, in place of desiccation, decomposition sets in; therefore the child ought either to be removed entire or the cyst left uninjured. The dangers of puncture were hæmorrhage and septicæmia. Hæmorrhage might possibly have been avoided by using a very fine hollow needle. Septicæmia produced by decomposition of the fœtus was probably due not to the admission of air, but to the introduction of germs by the instrument used to perforate the cyst. With a very fine hollow needle, carefully freed from micro-organisms, the skin of the part about to be punctured being also well cleansed with carbolic wash—in a word, if the operation had been conducted on strictly antiseptic principles—the risk of septicæmia might have been lessened. There is, however, a more valid objection to simple withdrawal of the liquor amnii; the embryo is not thereby necessarily deprived of life, and this consideration, with the possibility of septicæmia, renders the operation unadvisable. The injection of narcotics is open to the same objection; moreover, it necessitates the introduction into the sac of a fluid containing micro-organisms likely to induce decomposition, for practically it would be impossible to sterilise the fluid to be injected. Electricity, if transmitted by needles, is for the foregoing reasons also objectionable. But if electricity were determined upon, I should be disposed to use static electricity, as the discharge of a small Leyden jar would be more likely to destroy the vitality of the embryo than a succession of induced currents. Keller raised a feasible objection to the use of electricity in any form—the danger of causing separation of the placenta through muscular contraction.

Nowadays, however, operative removal of the ovum, if possible with its sac, is regarded as the rational mode of dealing with such cases of ectopic gestation as are diagnosed early; unfortunately the difficulty of absolute diagnosis is an obstacle to its general employment. If with the subjective symptoms of pregnancy the uterus be found only slightly enlarged, and beside it a pelvic swelling; and if the patient has had recurrent attacks of pain with irregular "shows"—symptoms which may have caused her to consider she was miscarrying

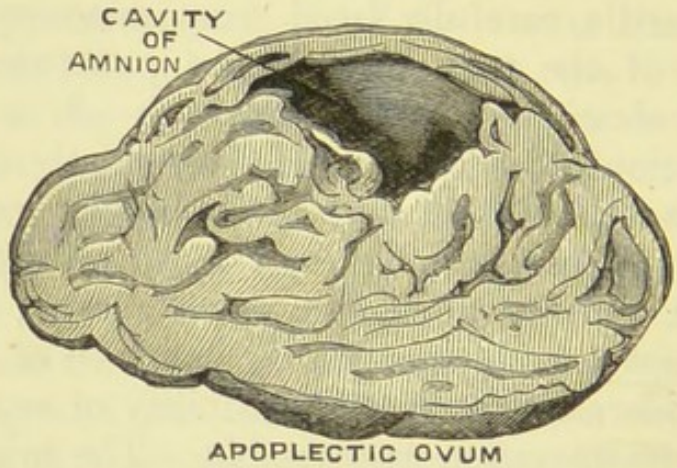


Fig. 225.—Apoplectic Ovum, or Tubal Mole. Natural Size. (Bland Sutton.)

—it may be fairly taken that operation is indicated and preferable to the risky procedure of waiting for a natural cure.

For a long time, when after death of the fœtus it has been slowly seeking exit by ulceration through the abdominal walls, or into one of the hollow viscera —bladder, rectum, or vagina—it has been customary to help the process by enlarging the aperture and extracting such fragments as become within reach. Section of the vaginal roof (kolpotomy) is especially valuable in cases of intra-ligamentous retention of a

carneous mole. Dr. Thomas advised the operation of vaginal section with the galvanic cautery and performed it with a successful result. In such instances, whether the vaginal section be done by cautery or knife the sac should be cleared as well as possible of its contents, packed with gauze, and during the after-treatment washed out daily through a drainage tube.

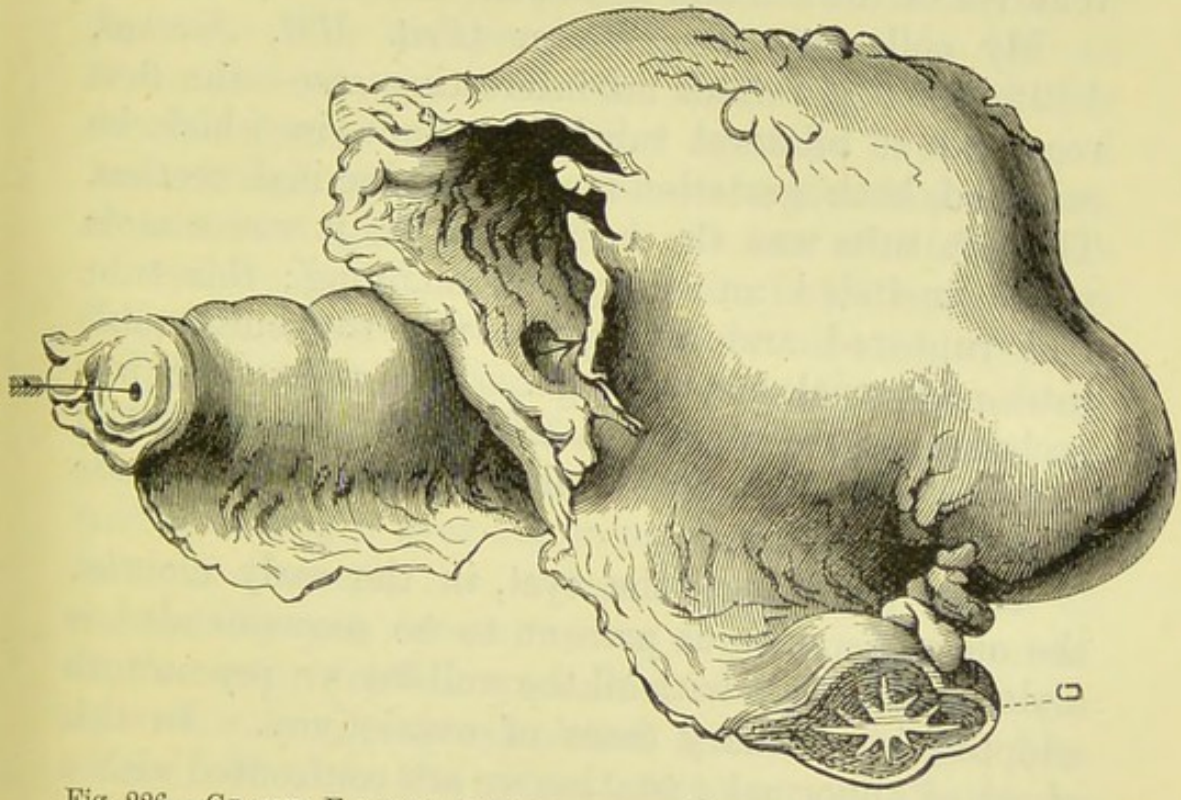


Fig. 226.—Gravid Fallopian Tube at the Tenth Week, showing Complete Occlusion of the Ostium. (Bland Sutton.)
O, Ovary with corpus luteum.

Very lately a large number of cases have been successfully treated by vaginal cœliotomy, *i.e.* opening the peritoneal cavity through the vaginal roof either anteriorly or posteriorly; then, the ovum and its sac have been completely removed through the orifice so made, ligatures have been placed on the proximal side of the sac, the stump returned, and the vaginal roof closed. This operation is one that promises

very well in certain cases, and further experience will soon establish its indications and its limits.

Abdominal section is the usual and probably as a rule the best plan of all. Sight can assist touch in the operation which, generally speaking, affords the best means of treating surgically any of those complicating conditions which so often occur in cases of ectopic gestation. The object after laparotomy is the total removal of the sac and contents.

My colleague, Dr. Walter (*Brit. Med. Journal*, 1892, ii. 732), relates an interesting case—the first recorded of bilateral tubal gestation—in which he removed both gestation-sacs by abdominal section. The left tube was the larger, and in it was a mole which included an embryo 6 cm. long: this tube had ruptured and had given rise to considerable intra-peritoneal hæmorrhage. The right tube was occluded, and contained a mole with a well-marked amniotic cavity, but no embryo. The patient made a perfect recovery.

After rupture of the cyst, in the early months, the only operation at present to be recommended is abdominal section with all the well-known precautions adopted in ordinary cases of ovariotomy. In this phase of abnormal gestation we are confronted with a condition which, if left to itself, may be regarded as certain death, the chance of recovery being infinitely small. There need be therefore no hesitation in dealing surgically with such a case, for only prompt and bold measures can save the patient's life. An incision is made through the abdominal walls in the median line, the divided vessels being twisted or tied before the peritoneum is opened. If the case is one of ovarian gestation, the whole ovary should be removed, the pedicle being tied as in ordinary ovariotomy; in tubal gestation the ligatures can be passed through

the broad ligament. In tubo-uterine gestation it is probably best, as in Porro's operation, to remove the uterus and appendages, since there is no other way of securing the bleeding surface.

When a case of extra-uterine pregnancy has passed the fourth month the risk of rupture of the cyst is materially diminished. The patient should be carefully watched, and on the occurrence of pseudo labour she should be placed under the influence of opiates. The question arises, Is she to be left to time and chance, or is she to be relieved of her burden by operation? From my own experience I am strongly disposed to advise abdominal section at once, as giving the best chance of life to the mother and child. So long as the fœtus remains, so long is the patient liable to dangerous complications —inflammation, septicæmia, or exhaustion from long-continued ulceration and suppuration. Gastrotomy is performed by making an incision six or more inches in length over the most prominent part of the tumour, through the abdominal parietes, so as to expose the cyst, into which an opening is then made. If the cyst is adherent to the abdominal walls, the operation is greatly simplified and the danger lessened. If not, the edges of the cyst should be stitched to the sides of the abdominal incision in order to prevent, as far as possible, the escape of any of the contents of the cyst into the peritoneal cavity; the child should then be carefully extracted and the cord, if intact, divided. The placenta should be left, as, owing to an entire absence of the means existing at the normal site of the placenta to arrest the flow of blood from the mouths of the ruptured vessels, the risk of hæmorrhage on its removal is very great. The cyst is generally so completely adherent as to debar any attempts at removal. It

should be carefully sponged out, and the divided edges of the abdominal walls brought together by sutures, an opening being left at the lowest part (through which the end of the cord should be brought) so as to provide a means of exit for the discharges. A glass drainage tube should be inserted, and the cyst should be washed out with a solution of permanganate of potass every four hours.

It will thus be seen that the treatment of ectopic gestation in any of its many varieties is one which requires careful consideration. No absolute directions can be given for individual cases, each must be treated on its own merits. In 1868[1] I collected and tabulated thirty-three cases of gastrotomy performed for extra-uterine pregnancy, in most cases long after death of the child. Of these sixteen mothers recovered and four children were born alive, showing that the maternal recoveries were nearly 50 per cent. These statistics I considered warranted me in recommending gastrotomy. In recent years the successes of abdominal section have been greater, no doubt owing to earlier diagnosis and improved modes of operating, together with the use of antiseptic precautions. At present the tendency is to proceed to operation as soon as the diagnosis is made, and results seem to indicate the propriety of such treatment.

[1] *Clinical Papers*, Manchester.

CHAPTER XXXII

PUERPERAL CONVULSIONS, OR ECLAMPSIA

UNDER the generic title Puerperal Convulsions, several distinct forms of convulsive seizure are included, which, by different authorities, have been classified in various ways. The most simple plan, I think, is to briefly dismiss attacks of a hysterical and an apoplectic nature, and then to consider (*a*) puerperal convulsions proper without renal complication; and (*b*) convulsions associated with albuminuria from confirmed Bright's disease, or from passive congestion of the kidneys resulting solely from the gravid state.

Hysterical Convulsions, as may be readily supposed, are confined to females of highly nervous and sensitive temperament. The attacks usually occur either during gestation or after parturition, rarely during labour; they are mainly excited by mental distress or violent emotion.

The symptoms are those of ordinary hysteria—premonitory fits of sighing, sobbing, and laughing, followed by a convulsive seizure, easily distinguished, however, from a true puerperal convulsion by the absence of spasm of the glottis and frothing from the mouth. If the attack comes on during labour, the patient evinces the utmost repugnance to

vaginal examinations, and will sometimes stretch herself at full length, with her legs and nates firmly compressed, and her whole body in a state of opisthotonos, so as to render investigation almost impossible, and if the attendant does manage to reach the vagina, the presence of the hand brings on another convulsion. At other times she will violently jerk herself about the bed, complaining loudly and bitterly of her sufferings.

Attention to the state of the stomach and bowels, the taking of regular exercise with carefully regulated diet, and the avoidance of any mental agitation, will tend to prevent an attack. If the fit occurs during labour, a certain firmness of manner on the part of the attendant will go a long way towards subduing it.

Apoplectic Convulsions.—The attack usually comes on during labour, and is generally the result of violent muscular exertion and prolonged retention of the breath during the later part of the expulsatory stage, producing either congestion or effusion, similar to ordinary apoplexy.

Symptoms.—Pain and excessive throbbing in the head, injection of the conjunctivæ, followed by a convulsive seizure which leaves the patient insensible, with fixed pupils (either contracted or dilated) stertorous breathing, and a slow, laboured pulse. If the attack is slight (congestive), consciousness in a short time returns, the patient simultaneously regaining the full possession of her bodily movements; if the attack is more severe, paralysis remains after return of consciousness. In fatal cases the coma deepens, death coming on without any return to consciousness.

Treatment.—Cold applications to the head, vesication of the neck, and sharp purgatives, as pulvis jalapæ co., croton oil, or elaterium. If the congestion

is very marked, venesection will afford immediate relief, and in appropriate cases should be promptly resorted to, in order if possible to reduce the pressure of the vascular system before the occurrence of effusion. Delivery should be effected as speedily as possible, artificial assistance being rendered if necessary.

Puerperal Convulsions of the epileptiform class are generally, as was pointed out by Lever in 1841, dependent on, or in some way connected with, albuminuria. Still, attacks comprising stages of tonic and clonic spasm, and followed by stupor or coma, are occasionally seen in cases where no renal mischief can be detected, and though these instances are comparatively rare, we must describe them. Such convulsions occurring *independently of albuminuria*, would seem to be the result of disturbance of the nervous centres—cerebral or spinal—originating in an altered condition of the nervous, genital, or alimentary systems, and sometimes due to certain forms of toxæmia, chiefly that produced by carbonic acid.

Tyler Smith divided puerperal convulsions into those of *centric* and *eccentric* origin; the *centric* including disorders of the cerebro-spinal centres resulting from hyperæmia, anæmia, and the presence of certain poisonous elements in the blood, together with causes of a purely psychical derivation, either prolonged, as in the case of mental depression produced in an unmarried woman through a keen sense of the degradation involved in her sexual lapse, or immediate, as from the receipt of unexpected news—*e.g.* the loss or unlooked-for return of husband or other dear friend. Hyperæmia of the cerebral or spinal centres or of their meninges, produces convulsions by mechanical pressure, which,

if confined to the cerebrum, induces a tendency to coma; if to the medulla oblongata, the tendency is to convulsions. Extreme anæmia likewise produces convulsions by disturbing the balance of pressure in the nervous centres. Convulsions from anæmia may be witnessed in cases of sudden and violent bleeding. I have seen them occur during the last stage of violent and persistent hæmatemesis. Further, the pressure of the gravid uterus on the diaphragm, by impeding respiration, may interfere with the due elimination of carbonic acid from the blood; another source of impurity is derived from the excrementitious matter of the fœtus, which has to be eliminated through the maternal system; the presence in the blood of the elements of bile also exercises a morbid influence upon the nervous centres, especially upon the spinal cord.

Amongst the *eccentric* influences are those reflected from the genital system, a transient convulsive movement not unfrequently occurring at the moment the head passes through the os uteri into the vagina, or when it emerges through the vulvæ. In ordinary cases this merely amounts to a slight rigor, but, if there is any excess of nervous irritability, a more or less severe convulsion ensues; when this peculiar irritability exists, a recurrence of the attack will generally take place on the introduction of the hand into the vagina, especially if any attempt is made to dilate the os uteri, or to detach the placenta manually.

Angus Macdonald, in his monograph on Puerperal Eclampsia, says:—"It is highly probable that in cases of puerperal eclampsia in which the kidneys are perfectly sound, irritation originating in the uterus and terminating in an eclampsic seizure, acts by irritating reflexly the vaso-motor centre in

the medulla oblongata, and thus inducing sudden anæmia."

Irritation from the alimentary canal may proceed from fæcal accumulation, produced through pressure of the uterus on the bowels interfering with their action. Vesical calculi and retention of urine have been known to act as excitors of reflex convulsions.

Symptoms.—These convulsions generally come on either immediately before or during the progress of labour. The attack may be preceded by premonitory signs, such as restlessness, giddiness, throbbing of the temples, or ringing in the ears. The crisis, perhaps, occurs at the acme of a pain; for a moment the eyes are fixed and the body is rigid. The face is the starting-point of muscular contraction, the eyes being upturned violently, exhibiting the whites only, with one corner of the mouth drawn to the side. The spasmodic movements rapidly extend to the trunk and extremities; the neck swells, its vessels become prominent, the larynx is spasmodically closed, and the face is congested and of a purple colour. This *tonic* condition lasts fifteen or twenty seconds, and is followed by *clonic* convulsions which contort the whole frame; frothy mucus, sometimes tinged with blood from the bitten tongue, oozes from the mouth; the circulation is impeded by spasm of the diaphragm and thorax, so that attempts at expiration produce a peculiar hissing sound, the unoxygenised blood imparting a dusky hue to the skin, especially to that of the face; the eyelids quiver, the eyeballs are contorted in a horrible manner, and the patient is now totally insensible to external impressions. The spastic contractions continue for two or three minutes, or more, according to the severity of the attack, and, as they subside, respiration becomes more regular, the swelling of the neck and face passes

away, the surface gradually assumes its natural colour, leaving a period of *coma* varying in duration from a few seconds to several hours. The pulse at first is full and bounding, but during the convulsions it becomes quick and feeble.

A very intense attack may destroy the patient during the condition of tonic spasm, or the comatose state may persist with repeated return of the convulsive movements, which either subside after a time or cease only with the death of the sufferer. When the patient recovers she is totally oblivious of what has happened, and recognises the results only in the shape of muscular pain, with general weakness and fatigue. As a rule, an attack does not influence the course of labour, but in some instances it accelerates delivery in a marked degree.

Treatment.—The occurrence of premonitory symptoms warns us to trace out the cause, and, if possible, to remove it. An overloaded stomach or rectum must be relieved by emetics, purgatives, or enemata; retention of urine by the catheter; mammary irritation by soothing applications, and the subcutaneous injection of morphia.

During the attack it is needful to take the precautions observed in ordinary epileptic seizures, such as placing a piece of cork between the teeth, and as far as possible restraining the patient from injuring herself by violent muscular movements, and to counteract the nervous excitation by fitting means. Indiscriminate bleeding was the panacea of the fathers of physic, as the attack was invariably assumed to be congestive in character; at the present day there is some danger of veering to the opposite extreme, and of neglecting venesection altogether. In certain cases, where the plethoric habit of the patient shows itself in suffusion of the eyes, with

other signs of cerebral congestion, abstraction of blood produces a marked and immediate improvement. The question of depletion, therefore, ought not to be dismissed without due consideration. A free and immediate evacuation of the bowels by the aid of some brisk cathartic, as pulvis jalapæ co. with or without calomel, or by elaterium or croton oil, if the patient is insensible, will usually produce a good effect.

The plan of general treatment most in accordance with modern views is to subdue the nervous excitation by means of anodynes and anæsthetics. Opium has been largely used, but of late years chloroform and its congener chloral hydrate have supplanted it. No remedy produces effects so immediate in subduing convulsions as chloroform administered when the attack seems imminent. It will generally cut the fit short, or at least mitigate its violence, in a surprising manner. During the extreme difficulty in respiration the inhalation should be stopped, to be afterwards renewed when spasm has ceased; the effects of the drug may, if necessary, be kept up for a prolonged period. Chloral hydrate may be advantageously employed to supplement the effects of chloroform, and so to ward off impending danger. Chloral should be given somewhat freely—thirty or forty grains at intervals—until the desired effect is produced, and if administration by the mouth is difficult, it may be given in the form of an enema. In these cases Fordyce Barker preferred the hypodermic injection of morphia to chloral.

The application of cold to the head is often of great service; it should be continuously applied, otherwise it will tend to counteract the effect of the anæsthetic.

To epitomise the treatment: After attending to

any special condition, as extreme cephalic congestion or alvine constipation, place the patient completely under the influence of an anæsthetic, to the extent of entirely suspending voluntary muscular movement, and so to remove pressure from the vascular system. If necessary, the anæsthetic condition may be maintained for hours until delivery is accomplished or the nerve-storm has passed away.

It now remains to consider what steps ought to be taken with regard to the contents of the uterus. Here again a radical change in treatment has taken place; the rule formerly acted upon was simply to hasten delivery in every case, but it is now deemed better practice not to interfere without special indications. If the patient gets rapidly exhausted, and the attack undergoes no diminution in intensity, steps must be judiciously taken to promote delivery. The os usually dilates readily under the influence of the chloral; if, however, it proves obstinate, one of Barnes' bags may be used, and when the os is fully dilated the membranes should be ruptured. If artificial delivery is necessary, the forceps is to be preferred to version (in the absence of any special reason in its favour), as the passing of the blades causes less irritation to the uterus than the introduction of the hand or arm; if version is necessary, the bi-polar method may be tried. Fordyce Barker thus summed up the position :—"Whenever delivery by art can be effected with less irritation than would be produced by the continuance of the child in the parturient canal, it should be resorted to."

Convulsions after delivery must be treated on the same general principles.

Puerperal Convulsions associated with Albuminuria.—The presence of albumen in the urine of eclamptic women is now recognised as a very common, indeed

as the usual, occurrence. It may exist in quantity so small as to produce no apparent effect on the system, and reveal itself only to the most delicate chemical tests, or it may exist to such an extent as to cause the urine to solidify on the application of heat, and give rise to some of the most fatal diseases of pregnancy.

Puerperal albuminuria manifests itself under two conditions, viz. Bright's disease and passive congestion. Bright's disease may be a mere coincidence, since impregnation may occur in a female who is already suffering from the disease, or the disease itself may come on from independent causes during the gravid state.

The etiology of the renal changes resultant upon pregnancy has not yet been clearly set forth. The causes usually assigned are pressure on the kidneys or renal veins and pressure on the ureters; and as subsidiary factors must be mentioned a high vascular tension and the increased work thrown on the kidneys during pregnancy. Lately, Blanc (*Lyon Medicale*, 1890) reports that he has obtained cultivations of fine short bacilli from the blood of an eclamptic patient, and that the inoculation therewith of rabbits was followed by albuminuria, anuria, and convulsions. In these cases, therefore, the albuminuria and convulsions were due to a common cause, and it is interesting to note that chloral hydrate solution, 4 in 1000, is stated to have effectually destroyed the germs.

It has been proved experimentally that *pressure on the renal veins* will produce albuminuria by causing distension of the renal capillaries, and so favouring transudation of the fluid constituents of the blood through their walls. This theory has been applied to the albuminuria of pregnancy by supposing that

the gravid uterus compresses the emulgent veins of the kidneys; and in support of this view it is stated that albuminuria is more frequent in primiparæ than multiparæ, on account of the less yielding condition of the abdominal walls, which thus exercise more pressure on the uterus. Brown-Séquard placed a patient with albuminuria in such a position that direct pressure of the uterus was taken off the renal veins, and after a time the albuminuria disappeared, but on the patient resuming the ordinary attitude the albumen returned. The fact that albuminuria usually occurs towards the end of gestation, when the uterus is fully developed, tends to corroborate this view. Cases have been also observed where the urine was free from albumen up to the end of gestation, but that after delivery it became present in abundance, thought to be due to muscular contraction compressing the renal veins.

It has been found in some instances that the albumen present in the urine consists largely of paraglobulin, with a small proportion of serum albumen, and it has been assumed that such a constitution of the albumen indicates simple vascular alteration in the cortex of the kidney rather than an actual lesion. The observations on which this assumption is founded are not sufficiently numerous as to establish the hypothesis; the proportion between serum albumen and paraglobulin in albuminous urine being influenced by a variety of conditions with which we are at present imperfectly acquainted.

On the other hand, we have immunity from albuminuria not only in the majority of pregnant women, but in cases of ovarian and other abdominal tumours, where, to say the least, the pressure equals that which exists in pregnancy. The position of the renal veins also affords strong evidence against the theory of

compression. Heller traced the course of the left renal vein—the one most liable to compresssion—and found in the great majority of cases that it crossed the vertebral column immediately above the second lumbar vertebra. Bartells points out that it would necessitate the bending back of the uterus at a considerable angle, just above the pelvic inlet, to enable it to touch with its posterior wall the body of the second lumbar vertebra, and that such a flexion is rendered impossible by the attachments of the round ligament. In autopsies made in the bodies of women far advanced in pregnancy, Bartells found that, at the level of the second lumbar vertebra, a considerable space exists between the uterus and the vertebral column. The pathological changes in the kidneys are also of a kind which do not result from venous congestion, but which agree with the changes produced by parenchymatous nephritis. The kidneys are larger than normal from increase in the cortical portion, which is anæmic, pale in colour, and soft in texture. The pyramidal portion is highly congested and of a deep red colour, affording a marked contrast with the cortex. The capsule is tightly stretched and peels off readily. The left kidney never suffers singly, nor is it affected to a greater extent than the right, as it probably would be were the disease produced by mechanical compression of the renal veins.

The rapid disappearance of albumen from the urine after delivery has been adduced in favour of the causation of the disease by compression of the renal veins. The striking alteration of the vascular system after labour is, however, quite sufficient to account for a speedy change in the state of the kidneys. Moreover, the return of the kidneys to the normal performance of their functions is not always so immediate as has been stated; I have frequently

found albumen many weeks, or even months, after labour. There is a marked tendency to nephritis in multiple pregnancy, so much so, that Litzmann utilises this fact for diagnostic purposes, and decides against the probability of twin gestation when the urine is free from albumen. This tendency to nephritis in multiple pregnancy appears to favour the theory of venous compression, but Litzmann states that an equal distension of the uterus from hydramnios is unattended by albuminuria; we are therefore compelled to admit that there must be some cause for nephritis in multiple pregnancy other than excessive bulk of the uterus.

Halbertsma suggested that the renal disorder is to be attributed to *pressure on the ureters.* The uterine tumour is, as he states, developed between the ureters, and consequently is more likely than other tumours to interfere with their permeability by stretching or compressing them. Lohlein, following Halbertsma, found, out of thirty-two cases of eclampsia, eight instances in which the ureters were markedly dilated, even to the size of a finger; these were evidently cases of long-continued obstruction. From the pathological evidence, therefore, it is probable that interference with the ureters is more correctly assigned to be the cause of renal mischief than is interference with the renal veins, for, on account of the low pressure at which the urine is secreted, it is only reasonable to suppose that urinary stasis soon hinders the proper tissue-activity of the kidney, in fact long before it would be possible to detect enlargement of the ureters post-mortem.

In the non-pregnant condition it is well known that the chief ultimate cause of nephritis is the presence of a poison in the blood, which sets up irritation in the renal epithelium. If the irritant

possesses active properties, the glomeruli and the cortical epithelium are at once affected—as for example in scarlatinal nephritis. The same condition ensues in cases of nephritis which are due to "cold": the functions of the skin are interfered with and products, which otherwise would be excreted by the skin, accumulate in the blood and irritate the renal epithelium. In the pregnant and parturient states a combination of conditions exists which is likely to lead to albuminuria, and further to the occurrence of convulsions. The products of metabolism of the fœtus have to be removed through the maternal circulation, which is thus burdened with extra elimination duty. With this excess of excrementitious matter in the blood, it is easy to believe that surface-chill would be likely to be followed by nephritis, much more likely than in the case of a woman who is not pregnant. As already stated, albuminuria usually occurs towards the end of gestation, at which period, of course, the excretory products of the fully-developed fœtus are the greatest. The fact that there is a marked tendency to nephritis in multiple pregnancy further corroborates this hypothesis: the metabolic products of an additional fœtus, added to the maternal blood, are still more likely to irritate the kidneys. Another factor is the increased arterial tension which accompanies gestation, and which has a tendency to cause active renal hyperæmia. Further, the possibility of the renal veins being compressed by the gravid uterus, causing passive renal hyperæmia, though probably of less frequent occurrence than is often assumed, cannot be ignored. The enlarged uterus, by compressing the ureters, may impede the flow of urine from the kidneys to the bladder, and so disturb the functions of the cortical epithelium, inducing a con-

dition analogous to that caused by prolonged over-distension of the bladder, such as occurs in men who are the subject of narrow stricture of the urethra. Finally, it has been supposed by some that the watery condition of the blood is a cause of the nephritis of pregnancy.

As regards the relation between albuminuria and convulsions, while it is not usual in pregnancy to find the amount of organic change in the kidneys that is frequently met with in cases of scarlatinal and other analogous forms of the disease, the resultant uræmic symptoms are much more common and more violent. Labour is doubtless a considerable factor in the production of eclampsia, as will be presently shown, but there still remains a marked predisposition to eclampsia, both before and after labour, in pregnant women affected with nephritis. Three factors may be enumerated as conducing to the occurrence of convulsions—the abnormal condition of the kidneys, which interferes with the elimination of effete products; an excess of effete products in the blood; together with an unstable state of the nervous centres, due to the pregnant condition.

When the connection between albuminuria and convulsions was first discovered, it was inferred that their mutual relation was simply that of cause and effect. According to Braun, convulsions are due to the presence of urea in the blood, which the disordered kidneys fail to eliminate, the albuminuria indicating this uræmic condition. Further investigations, however, failed to prove the presence of urea in the blood of patients suffering from albuminuria, and Frerichs then propounded the theory that urea becomes decomposed into carbonate of ammonia, which is the actual excitor of the nervous centres. Still more recent experiments tend to show that the proximate

products of the degeneration of the bodily elements (creatine, etc.), previous to their further decomposition into urea, are the active morbid elements in the blood, and that the compression of the ureters by the gravid uterus may cause reabsorption of the urinary constituents after their removal from the circulation by the normal action of the kidneys. It has been stated, however, that in many instances, so far from albuminuria being the cause of convulsions, the converse is really the case, the convulsions giving rise to, or at any rate being immediately followed by, albuminuria; for cases have been recorded where no trace of albumen could be detected in the urine prior to the seizure, but after the convulsion both albumen and casts of the uriniferous tubules were present, owing probably to the spastic contractions of the abdominal muscles producing pressure on the renal veins, which had hitherto escaped compression, precisely as happens in albuminuria produced by labour. Dr. Braxton Hicks thinks that in such cases, if albuminuria be indicative of uræmia, the convulsions are either the cause of the nephritis, or that both are due to the same cause.

The frequency with which convulsions occur has been variously estimated. The lowest percentage shows one case of convulsions in every 520 labours; the highest, one in 300.

Convulsions occur for the most part at the beginning or during the course of labour. According to Braun the proportion is 24 per cent before, 52 per cent during, and 24 per cent after labour. Wieger in 455 cases gives 109 before, 236 during, and 110 after labour. Von Mieczkowski out of 50 cases found that convulsions occurred four times before, and six times after labour. With regard to the relative frequency of convulsions in primiparæ and

multiparæ, Scanzoni states that of 296 cases 235 were primiparæ. Simon Thomas, of Leyden, gives the proportion as one in 234 primiparæ, and only 1 in 4000 multiparæ. Every pregnant woman suffering from albuminuria does not become eclamptic. Devilliers, Legnauld, Blot, and Mayer give the proportion as 25 per cent. Rosenstein saw three women with Bright's disease and Frankenhäuser six in whom the albuminuria was attended by previous heart disease, and all escaped convulsions and were safely delivered.[1]

The initiatory symptoms of uræmia are lassitude and drowsiness, with headache, usually frontal and of an obstinate dull character, amblyopia or impairment of vision, amounting often to total loss of sight, a symptom which is more frequent than in cases of uræmia apart from pregnancy. Albuminuric retinitis often occurs. Less frequently the hearing is affected; puffiness of the face, extremities, and especially of the vulva, is usually present, and pressure on the pelvic veins produces œdema of the lower extremities. Litzmann directs attention to a remarkable retardation in the pulse rate immediately before an eclamptic seizure. In albuminuria of some standing the stomach and bowels participate in the general derangement; nausea and vomiting with diarrhœa not infrequently precede an attack of convulsions. The urine is usually diminished in amount, the specific gravity varying from 1015 to 1025. It may be dark coloured, either smoky or red; it contains albumen, epithelium, blood discs, and granular and epithelial casts. There is almost always a notable diminution in the excretion of urea, which may be reduced to one-fourth of the normal diurnal amount.

[1] Vide *Leçons de Clinique Médicale par S. Jaccoud.* Paris, 1873.

As already stated, the amount of albumen present may vary from a mere trace up to sufficient to cause the urine to solidify when boiled. In some cases a large proportion of the albumen is represented by paraglobulin. Peptones and sugar have also been found in the urine.

Symptoms.—The actual attack of convulsions resembles an epileptic seizure, except that there is no initial cry. There is first a stage of tonic contraction followed by clonic spasms, the distinction between the two stages not being always well marked. The patient is quite insensible during the attack, and for some time afterwards is partially or wholly comatose. Like the convulsions of uræmia apart from pregnancy, the tendency is towards a succession of attacks, rarely is the attack limited to a single convulsion. The temperature of the body usually rises during an attack; it has been observed to reach as high as 109°, but in many cases the elevation is comparatively slight. On the other hand, in the comatose state the temperature is subnormal, especially towards the final stage. During the tonic spasm of eclampsia the respiration is arrested; in the clonic stage it is snorting and stertorous. The lips are covered with froth, which may be blood-stained from a bitten tongue. In favourable cases the patient remains in a state of stupor or coma for from a few minutes to half an hour or more, after which there is a gradual return to consciousness. In fatal cases the convulsions persist, and the patient dies from a combination of asphyxia and exhaustion. In exceptional cases death may be due to cerebral hæmorrhage. Convulsions are fatal to the mother in about 30 per cent of cases; and to the child in about 50 per cent. The death of the fœtus may be sometimes occasioned by the sudden rapid elevation of the maternal tempera-

ture, but generally it is to be ascribed to the poisoned condition of the blood, and the more or less complete asphyxia produced by the tonic contraction.

Independently of its common concomitant—convulsions—albuminuria is not infrequently a cause of abortion, and the impoverished condition of the blood renders the patient liable to become a prey to the various disorders common to the puerperal state. On the other hand, cases are by no means uncommon where copious albuminuria is attended with no untoward symptoms. I may here mention the striking case of a lady, whom I attended some time ago during the later period of her pregnancy, who was the subject of albuminuria, which continued after delivery until she again became pregnant after a lapse of ten months, and ceased only on the birth of the second child. Yet during the whole of this time her general health remained good; nothing but the chemical reaction of the urine and more or less œdema of the lower extremities indicated her actual state.

Treatment.—The occurrence of any suspicious symptoms during pregnancy makes it the practitioner's duty to examine the urine at short intervals to satisfy himself as to the presence or absence of albumen. The examination should be carefully made, as the detection of the first on-coming of the disorder enables us to combat it with more chance of success; therefore the testing should be so performed as to reveal the slightest trace of albumen, and thus put us on our guard whilst the mischief is in the incipient stage. The albuminuria of pregnancy is rarely got rid of previous to parturition, but certain indications must nevertheless be attended to. If the urine is scanty and high-coloured, dry cupping over the loins, with administration of acetate of

potash, infusion or tincture of digitalis, and Seltzer or Vichy water, will prove beneficial. Hypodermic injections of pilocarpine, $\frac{1}{5}$ to $\frac{1}{3}$ of a grain of the pilocarpine nitrate, not only relieve the system of fluid, but also of waste products through the skin. The bowels should be acted upon by saline purgatives, as the bitartrate of potash or the effervescing citrate of magnesia, care being taken not to give them too persistently. The impoverished blood should be enriched by generous diet, and by prescribing some of the preparations of iron—the tinctures of the perchloride or of the acetate are most to be relied upon. If the patient seems unlikely to survive to the full period of gestation, the question of inducing premature labour must be considered. This last resource should by no means be adopted unless the patient is in grave peril; but if the operation is deemed necessary, it must not be too long deferred.

In connection with this subject albuminuric retinitis is one of great interest to the obstetrician. My friend Dr. Snell (Reports of the North of England Obstetrical and Gynæcological Society, March 1895) relates an interesting case of threatened total blindness occurring in successive pregnancies in a patient aged twenty-one years. Concluding his valuable paper, he asks: "How often is it justifiable to recommend the hastening of labour in these cases? The woman whose case has been related has required it twice in scarcely over twelve months. She is only twenty-one, and, in the natural course of events, other pregnancies may occur, and, as was recently the case, the question of inducing labour may again be suggested by the patient or her friends. On the one hand it is clear, as the albumen has never disappeared, that there is a predisposition towards retinitis, and, should it recur, a grave risk of sub-

sequent blindness, a possibility which demands consideration quite apart from that which is bestowed on the general aspect of the kidney affection. On the other hand is the disagreeable position of the medical man who may be again and again called upon to interfere with the natural course of gestation.

"Should such a case be treated in a more radical manner by the removal of the ovaries, and would the condition of the patient be sufficiently favourable to allow such a proceeding being recommended?"

During an eclamptic attack the treatment is to be conducted on the principles already laid down when speaking of non-uræmic convulsions (*q.v.*): briefly expressed, the indications are to modify the violence of the fits by chloroform and chloral, to secure free action of the bowels by croton oil or pulvis jalapæ co., and to induce perspiration by means of pilocarpine, the steam bath, or the wet pack. In obstinate cases artificial completion of labour under the anæsthetic is very often the best treatment; in fat subjects venesection is frequently beneficial.

Finally, as regards *prognosis*, ante-partum eclampsia is the most dangerous, post-partum the least so; the points which influence the prognosis in any individual case are the frequency and severity of the fits, the depth and duration of the coma, the degree of albuminuria, the temperature, and the presence or absence of signs of cardiac failure and of œdema of the lungs.

CHAPTER XXXIII

PUERPERAL INSANITY

UNDER this head it has been customary to include four distinct forms of insanity :—

1. Insanity of pregnancy.
2. Frenzy of parturition.
3. Puerperal mania and melancholia.
4. Insanity of lactation.

With regard to the relative proportion of the varieties, Dr. Batty Tuke gives the following results deduced from 155 cases :—

Insanity of pregnancy .	.	18·06 per cent.
Puerperal insanity (proper)	.	47·09 ,,
Insanity of lactation .	.	34·08 ,,

Insanity in the pregnant, parturient, and post-parturient periods taken collectively occurs in about one case out of 400 gestations ; according to the averages of asylum statistics, about 8 per cent of their female patients suffer from post-puerperal maladies.

The Insanity of Pregnancy is almost always of the melancholic variety, and usually manifests itself in the third, fifth, or seventh month ; hereditary insanity,

in the great majority of cases, being the predisposing cause. The minor forms, not unfrequently met with in pregnant females, are indicated by perversion of the appetite and desires, uncertainty and irritability of temper, and in cases more developed, by a great tendency to the suicidal impulse. There is a proneness to re-development of the mental disorder after parturition. The treatment of this form of insanity must be mainly confined to moral means.

The Frenzy of Parturition occurs when the os uteri or vulvæ are distended to the utmost by the passage of the child's head; it is transient, and is merely the result of violent agony temporarily disturbing the balance of reason. All that is generally required in the way of treatment is to restrain the patient until the paroxysm passes away; but if time permits and further means are needed, the administration of chloroform is the most effective remedy.

Puerperal Mania proper.—This, the most frequent form of puerperal insanity, usually commences about the first or second week after parturition; in some instances it comes on almost immediately after delivery, but beyond the second week it rarely occurs. Out of 73 cases observed by Dr. Batty Tuke in the Royal Edinburgh Hospital 20 showed signs of insanity from the first to the fifth day after labour, 36 from the fifth to the fourteenth day, and 10 or 11 from the fifteenth to the sixtieth day. Dr. Burrows found the third and fourth days critical periods. After the second week the percentage of cases attacked at any given period is in inverse ratio to the length of time which has elapsed between the labour and the onset of the disease. Primiparæ are more liable to attacks than multiparæ; age is also a causal factor: between the ages of 30 and 40 years is the most dangerous period. When women become

pregnant for the first time between these ages they are peculiarly liable to puerperal insanity. A long and difficult parturition, with excessive hæmorrhage, has a direct influence in the causation of puerperal mania. The most important of the predisposing causes of puerperal insanity undoubtedly is heredity. It accounts for from 30 to 40 per cent of cases; that is to say, that in such a percentage can a distinct family history of insanity be traced. In addition to actual insanity, the occurrence of a neurotic strain in the family, and more particularly in the person, of a pregnant woman, strongly predisposes to mental aberration during the periods of gestation and parturition. The occurrence of a previous attack of insanity, whether of an ordinary type or of the puerperal variety, renders a patient extremely liable to a recurrence during future pregnancies. A distinction is to be drawn between cases in which insanity at some previous period has developed and subsequently passed off, leaving the patient in a lucid condition up to the time of her pregnancy, and cases in which the insane state is maintained, the woman becoming pregnant whilst mentally deranged; the latter obviously is not puerperal insanity. Anxiety and mental shock or emotion are very frequent excitants of this disorder, hospital practice showing a largely increased proportion of cases in time of war or famine. Again, unmarried women, deserted by their seducers, afford another example. Hysterical subjects and women of a highly intellectual type are liable to it. Debility, and especially anæmia, induced through over-lactation or rapidly recurring pregnancies, are other predisposing causes. It must never be forgotten that it is occasionally coincident with septic inflammation of the peritoneum or pelvic organs; and it may depend upon functional derangement of

the stomach and bowels. Sir J. Simpson sought to connect puerperal mania with albuminuria, but later researches have not established this interdependence.

Symptoms.—The first symptom usually noticed is a change in the patient's manner; she becomes either exceedingly loquacious or very taciturn, falls into fits of laughing or crying without apparent cause, and often presents a perturbed expression of countenance and a hurried, agitated manner, resembling that of incipient delirium tremens. The next thing to attract attention is the perversion of the moral feelings; she takes a strong dislike to those nearest and dearest to her, the husband and child being held in special detestation, the patient often going so far as to threaten or to attempt the life of her infant. Indeed, cases occur from time to time when, owing to want of proper restraint, she succeeds in carrying her morbid impulse into effect. As the symptoms increase in intensity the patient becomes irritable and obstinate, flying into a violent passion under the least provocation, or even without any obvious cause, her actions become outrageous, and her language vociferous, fragmentary, and incoherent. A strange characteristic in these cases, showing the total subversion of the feelings, is the tendency, even on the part of refined women, to profanity and obscenity of language and gestures; there is also a great proneness to the suicidal impulse, which, however, is but transient. Macdonald observes that: "In the acute form of mania which succeeds parturition we observe an intensity of mental excitement, an excessive incoherence, a degree of fever, and, above all, a disposition to mingle obscene words with broken sentences —things which are rarely noticed under other circumstances. It is true that in mania modest women

use words which in health are never permitted to issue from their lips; but in puerperal insanity this is so common an occurrence, and is done in so gross a manner, that it early struck me as characteristic." Dr. Savage also states that he has several times judged a case of insanity to be puerperal from the mincing gait and lascivious looks of the patient. During all this mental and physical excitement the pulse is rapid and thready, the eyes are unnaturally brilliant, the face pallid, pinched, bathed in a clammy sweat, and the patient presents a collapsed shrunken appearance, strangely at variance with the symptoms.

Prognosis. — Puerperal mania, of all forms of insanity, is the most curable; as a rule it subsides under treatment in from one to two weeks, more or less mental debility and tendency to aberration of temper frequently remaining for some time. From 70 to 80 per cent recover. Dr. Webster states that of every five cases of puerperal insanity three may confidently be expected to recover within the year. Dr. Savage shows by statistics that in puerperal mania the greater number of cases recover in the third month; in puerperal melancholia the greater number recover in the sixth month. If the disease is prolonged over several months, the chance of recovery becomes more remote, and sometimes the case assumes the permanent melancholic form. Death rarely takes place from uncomplicated mania. Cases in which death *does* occur are almost always associated with septic pelvic cellulitis, pneumonia, or some other lesion. The pulse forms a very good prognostic guide; with a full, hard, and impetuous pulse organic complications are to be suspected, and the case consequently assumes a grave aspect.

Treatment.—As this is a disease of exhaustion, it

must be combated by freely supporting the system with nourishing food easy of digestion, and a moderate amount of stimulants. Some patients obstinately refuse food, and consequently must be forced to take it, just as in the case of ordinary insane patients who reject nourishment. Strong essence of beef with a little port wine may be poured down the nostril with the aid of a funnel. Much may be done by moral treatment. It is highly requisite to have a kind yet firm nurse. A stranger to the patient can exercise much more control over her than one of the family; indeed, it is usually better that the relatives should entirely absent themselves from the sick-room. Insomnia is a very troublesome symptom, and it is highly important to subdue it by one or other of the principal agents commonly resorted to for this purpose—a single full dose of hyoscyamine, morphia, chloral hydrate, or bromide of potassium. In the majority of cases a full dose (30 grains) of chloral hydrate combined with a small dose (a quarter of a grain) of morphia will be found most efficacious. If there is any tendency to cerebral congestion, bromide of potassium in 30-grain doses every six or eight hours, followed up by chloral hydrate alone, will act more beneficially. Chloroform has been most effectually used to procure sleep, but the patient is often more excited after the effects of the drug have passed off. Some use cannabis indica and veratrum viride, apparently with good results; the latter being a favourite remedy of Fordyce Barker of New York. Complications, such as intestinal derangement, septic, pelvic, and abdominal inflammations, must be sought for in suspicious cases and treated, lest we lose sight of the greater disease in the prominent activity of the lesser. Disordered bowels should be relieved by

a smart purge, which is often productive of considerable mitigation of the symptoms, but it must be given judiciously, for we must ever bear in mind that we are dealing with an essentially asthenic disease. When the acuteness of the attack has been subdued, great care will still be necessary to prevent a relapse and to restore the patient to health. The general strength must be sustained by plenty of animal food, with a due proportion of stimulants. Iron and quinine, especially the syrup of phosphate of iron and quinine, will be of great service.

The presence of husband and child must be cautiously tried, and if they still seem to irritate the patient, more time must be allowed for the restoration of her mind; indeed everything provocative of the least excitement or emotion should be avoided. Now it is that good nursing is of inestimable service. A certain amount of control should be exercised without allowing the patient to be aware of it; her little eccentricities should be humoured, yet in such a manner as gradually to wean her from them, and to bring her mind back to its healthy tone, the danger chiefly to be apprehended being not so much death as protracted or permanent insanity.

Puerperal Melancholia, like puerperal mania, is a disease of debility, and is often associated with over-lactation: it usually manifests itself about one month after parturition, and generally creeps on very insidiously, the patient becoming silent and moody, seeking solitude, and ceasing to take interest in her infant, or indeed in anything: she will often be found weeping silently, endeavouring to conceal her sorrow: attempts to cheer her act as incentives for floods of tears, and she renders all around her as miserable almost as herself. Morbid ideas gradually develop into delusions of the most dis-

tressing character, chiefly bearing on religious topics, and, as is common in this species of insanity, she perpetually broods over the supposition that, by some wilful act, she has placed herself beyond the pale of eternal salvation. The lacteal glands cease their secretion, the breasts becoming flaccid. The general health suffers more or less, but permanent insanity is the result chiefly to be apprehended. It must be borne well in mind that in puerperal melancholy the patient is prone to the commission of infanticide or suicide.

The treatment of puerperal melancholia beyond the administration of a strengthening and gently stimulating diet, pertains more to the alienist than to the obstetrician, the cure being accomplished by judicious guidance of the mind rather than by the administration of physic. Still the septic origin of some cases must ever be borne in mind. The prognosis in puerperal melancholia is not so favourable as in the case of puerperal mania.

The insanity of lactation is usually restricted to a period commencing two months after labour. This form of insanity is less frequent than ordinary puerperal insanity. The cause is prolonged lactation, inducing anæmia and exhaustion. Dr. Batty Tuke shows that the greatest number of cases occur in the latter months of lactation; of 54 cases 33 occurred after the sixth month. The symptoms are usually of the melancholic type, only one-fourth of the cases assume the character of mania.

CHAPTER XXXIV

PHLEGMASIA ALBA DOLENS

THIS affection, generally but not uniformly associated with the puerperal state, is usually, as the synonym "white leg" indicates, confined to one of the lower extremities, most frequently the left, but occasionally the right leg suffers, and in rare cases even both legs are affected; it has been met with also in the arm. Sometimes it leaves the limb originally affected and attacks the other. I have seen at least one instance of white leg during pregnancy, and it occasionally occurs during the non-gravid state after the removal of uterine polypi. Multiparæ are more subject to it than primiparæ.

Symptoms.—The disease usually comes on from the fourth or fifth day to the twentieth or even later, and is ushered in with symptoms of variable intensity. As a rule, there is a sensation of chilliness, with rigors more or less marked, headache and faintness; the pulse is accelerated (120 or more), and in severe cases the tongue is dry and furred; round the pelvis pain is felt, which becomes localised in the inguinal region of the side about to become affected; the pain extends along the limb, which is now swollen, and for a time pits on pressure; the temperature of the affected part rises, and the swell-

ing increases until the leg presents a tense, glazed appearance, devoid of colour; pressure with the finger causes the surface to give way, but it regains its level immediately the pressure is removed; the veins, especially the femoral, can be felt as hard cords, painful to the touch, and the inflamed lymphatics appear as red lines distributed over the surface of the limb; the milk and lochia are generally suppressed. Sometimes the pain and swelling first appear about the knee or ankle, and spread upwards; but, as a rule, wherever the pain is first felt, there the swelling first appears.

The duration of the disease varies from one to two weeks, and in severe cases even longer. When about to subside, the pain and extreme tenseness decline, and the leg again pits on pressure; the constitutional disturbance passes away, and the pulse and tongue regain their normal state. The diffuse swelling is long in disappearing, the limb recovering but slowly its natural condition. Death is rare, but in unfavourable cases there may be diffuse inflammation of the cellular tissue, abscesses, suppuration of the femoral and inguinal glands and gangrene. Occasionally permanent traces of the affection remain in the form of varicose veins and loss of power in the use of the limb.

Pathology.—The most prominent pathological condition is the plugging of the principal veins of the leg, especially the femoral, with coagula, which commence forming in the uterine veins. The circumstances which lead to the formation of these thrombi are not satisfactorily determined: by some they are referred to the condition of the blood itself, by others to septic action. Our general knowledge of the subject of abnormal blood-coagulation in relation to the mouths of open vessels, would lead us to suspect

the presence of some septic product derived from the uterine discharges, which, acting on the blood contained in the open veins of the placental site, causes its coagulation. We are, however, met with the difficulty that in phlegmasia dolens no very marked symptoms of general septic poisoning appear. The usual result of the formation of septic thrombi is for the clots to be disintegrated by the action of the micro-organisms concerned, minute particles being carried by the blood to distant parts and setting up general septic poisoning. Nothing of this kind is seen in white leg. In by far the greater number of cases the disease, once developed, remains for a time quiescent and then disappears without complications; any additional mischief that does occur is limited to the parts originally affected. It does not appear impossible, however, that the initial phase of the formation of thrombi in the open uterine veins may be due to some form of septic action, which possibly has only a mediate relation to the presence of micro-organisms, and that the tendency to coagulation is propagated along the veins of the leg without a concurrent transmission of infectivity. In whatever way the coagulation is produced, it tends to spread along the veins of the leg or limb affected, and produces intense œdematous infiltration, which gives a hard, resistant response to pressure by the finger, very different to the yielding and pitting of ordinary œdema.

But the venous system is not alone affected. Charles White, of Manchester, who wrote the first classical description of the disease (1784), advanced reasons for believing that some obstruction or morbid condition of the lymphatics was the proximate factor in the etiology of the condition; and John Hull, of Manchester, was perhaps the earliest (1800) to insist

that both lymphatics and blood-vessels were implicated.

Tilbury Fox ascribed the characteristic appearance of phlegmasia dolens to obliteration of the lymphatics, which are thus incapacitated from carrying the fibrin into the general circulation, so that it accumulates, especially in the cellular tissue, which is rich in lymphatics, and gives rise to the hard, brawny resistance so different from that of œdema. This condition of the lymphatics is coincident with occlusion of the veins. It is probable that slow changes of an inflammatory nature take place in the walls of the veins which are thrombosed, and that the neighbouring lymphatics are involved and are thus obstructed, giving rise to the brawny hardness which is distinctive of phlegmasia dolens.

The complete and continued loss of power which characterises phlegmasia dolens is doubtless caused by pressure of the gelatinised fibrin on the nerve trunks. This rigid, unyielding compression is far more injurious than the elastic pressure of œdema.

Treatment.—Since this disease is frequently associated with great loss of blood, as after placenta prævia, and seems always to be consequent upon a debilitated condition of the system, it is obvious that the older method of treatment, which included local and general depletion, and cathartics, is not in accordance with the exigencies of the case. Unless the febrile symptoms run very high, a gently stimulating plan of treatment should from the first be adopted. The most successful plan of treatment is carefully regulated animal diet, with small but frequently repeated doses of dry old port, and carbonate of ammonia or hydrochloric acid. If the lochial discharge is stopped, frequent injections of warm water into the vagina are beneficial, adding,

if the discharge is scanty and foul-smelling, a few drops of a solution of permanganate of potash, with which the uterine cavity itself may be washed out. As the alvine evacuations are very offensive, mild purgatives should be administered at frequent intervals.

The prominent symptoms—pain and sleeplessness—must be treated with opium and chloral hydrate. In insomnia without much pain, chloral hydrate will be sufficient; but if, as is often the case, the want of sleep is caused by excessive pain, phenacetin or morphia hypodermically administered will prove more efficacious.

The limb or limbs must in all cases be elevated on pillows, and kept very quiet, and the foot of the bed should be raised by wooden blocks. Painting with glycerine of belladonna and the application of hot fomentations are very comforting, flannels wrung out of hot water and sprinkled with turpentine or laudanum often affording special relief.

After the swelling has reached the maximum and begins to subside, as shown by pitting upon finger-pressure, careful bandaging with flannel rollers is indicated.

During the convalescent stage, iron, quinine, and the mineral acids, may be advantageously substituted for the carbonate of ammonia. Moderate friction of the affected limb with stimulating liniments, tepid salt baths, and the passage of electricity in the constant current form are also useful. Friction should be cautiously used to avoid displacing any clots which may be present in the veins, an accident which might lead to embolism, causing sudden death.

If the glands suppurate or abscesses form, they must be treated in accordance with the general rules of surgery.

CHAPTER XXXV

PUERPERAL FEVER

Of all diseases incident to the post-parturient state, puerperal fever is the most to be dreaded, both by patient and physician; for, in addition to its high rate of mortality, it converts those who come within the sphere of its action, each into a separate and independent focus of contagion, whence the fell disease may radiate in all directions.

Puerperal fever was at one time regarded as a specific fever which affected parturient women—specific in the same sense as are typhoid and scarlet fevers. It was regarded as infectious in the same way, that is by aërial contagion; and further, that it might be autogenetically produced by the state of the patients' blood and secretions. In the year 1847 Semmelweis of Vienna first directed attention to the real nature of the disease, substantiating his views by experimental evidence. Still, for many years the older opinions prevailed, and indeed up to the present time the idea of a specific fever has not entirely faded away. Clinical experience, experimental investigations, and the recent advances in pathology — especially in bacteriology — have entirely altered the aspect from which puerperal fever is regarded. The disease is now known to be

an infective disease, caused by the introduction into the system, through an abraded surface of the genital tract, of pathogenic micro-organisms, or of their chemical products. It is in fact altogether analogous to surgical septicæmia, and by many authorities the term puerperal septicæmia is substituted for puerperal fever. Even whilst holding the idea of a specific puerperal fever many admitted a condition which they regarded as one of septicæmia, but they looked upon this as something apart and distinct from puerperal fever proper. According to the opinion held at the present day, puerperal fever *is* septicæmia.

Two questions naturally present themselves in relation to the causation of puerperal fever—the nature of the contagion, and the way in which it obtains access to the tissues. It is probable that there is no specific micro-organism to which the production of puerperal fever can be attributed. The disease itself runs an indefinite course, and differs in many respects from the ordinary types of zymotic disease. It is, therefore, not to be expected that it should possess a specific micro-organism; on the contrary, it is very probable that more than one type of micro-organism is capable of producing what we call puerperal fever. The micro-organisms which are most commonly found are the *staphylococcus pyogenes aureus* and *streptococcus pyogenes albus*, the latter being probably identical with the coccus of erysipelas; both are present in most cases of suppuration. Many of the other bacteria which are associated with the presence of pus may be frequently found in cases of puerperal fever; whether they are all capable of producing it is doubtful, at any rate it is not known. Most of these bacteria may be regarded as ubiquitous, but

obviously unless they are introduced into the organism the tissues escape infection. This leads to a consideration of the second point—the way in which the micro-organisms obtain access to the tissues. Two conditions have to be fulfilled in order that a parturient woman shall be infected with septicæmia: (1) the septic micro-organisms must be introduced into the genital canal, (2) the protective epithelium of which is abraded in some part, thus opening up a way into the system by which the bacteria can enter. The most common and obvious way in which a woman is infected with septicæmia is by the digital examinations of an accoucheur or a nurse who, within a certain period, has attended a patient suffering from puerperal septicæmia. In this way the micro-organisms actually derived from a case of puerperal septicæmia are deposited within the vagina, or it may be within the uterus. The second condition does not require much searching for: the occurrence of slight rents in the mucous membrane of the genital tract is common during labour; even a mere abrasion of the epithelium at one point is sufficient, and, if there be none, the placental site offers itself. Perhaps one of the most common among the channels of infection is afforded by slight tears or by laceration of the perineum. Through some such aperture pathogenic micro-organisms transferred, either by finger, instrument, or other object which comes in contact with the surface of the genital canal, obtain access to the system. They may be derived from pus occurring in a surgical case or from a patient suffering from erysipelas, or from the dead body,—the process of infection is the same.

After the micrococci have entered the system through the weak spot, they may take one or more

of many paths onwards. If they reach the uterus they may induce a septic condition which passes along the Fallopian tubes and infects the peritoneum. They may pass directly into the peri-uterine connective tissue causing septic parametritis. They may enter the uterine veins, in which case thrombosis results, with the subsequent detachment of septic emboli, setting up the condition known as *pyæmia*, and leading to distant foci of suppuration in the lungs, joints, kidneys, and elsewhere.

In order that a febrile condition with symptoms of a more or less localised inflammatory type should be set up, it is not necessary that the pathogenic micro-organisms concerned should invariably penetrate into the tissues. As already stated, it appears sufficient if some of the chemical products, derived from the splitting up of organic matter by the action of the micro-organisms, be introduced into the circulation without being accompanied by the micro-organisms themselves. Such a causation, known as *sapræmia*, may be fairly inferred, although it is not so susceptible of actual demonstration. The chief grounds for believing in the existence of such a mode of toxine poisoning are—the comparative mildness of some case of puerperal infection, and more particularly, the rapid cessation of the symptoms on removal of the causal septic matter, such as fragments of putrid placenta; or on rendering a septic surface aseptic, as, for example, by syringing out with an antiseptic solution a uterus which contains pathogenic micro-organisms. So long as the microbes are active, the chemical products formed by them, at the expense of the tissues which they have invaded, are absorbed and cause febrile and other symptoms; as soon as the septic matter is removed, *e.g.* by curetting, and the

microbes are killed by an injection of an efficient antiseptic, the formation of the toxine ceases, and the patient is at once liberated from its effects. Such an immediate cessation of symptoms would not occur had the microbes entered the system, inasmuch as they then would have been beyond the reach of the antiseptic injected.

The most common cause of sapræmia is a want of proper contraction of the uterus after delivery, which often follows a tedious, a too rapid, or an instrumental labour. This atonic state of the womb, coupled with the ragged wound left after the removal of the placenta, favours the lodgment and decomposition of clots, membranes, or bits of placenta, and forms a favourable nidus for the development and absorption of putrid fluids.

The explanation so far given of the way in which puerperal women are infected with septicæmia is founded on the assumed intervention of a medium by which the pathogenic micro-organisms concerned are transferred from the source of infection to the patient. Instances occur, however, in which there is an entire absence of any means of transference, as, for example, cases of abortion with retention of the placenta, with subsequent development of septicæmia, without any vaginal examination having been made, occurring, it may be, in patients who have been attended by neither doctor nor nurse. Such cases of so-called auto-infection have long been regarded as difficult of explanation, and consequently many views have been expressed as to the way in which the septic mischief is initiated. A probable explanation assumes the presence of pathogenic micro-organisms in the healthy vagina, not necessarily of all women, but of some, which under ordinary conditions do not give rise to any symptoms

whatever. It is a fact that pathogenic micro-organisms, under certain conditions, become attenuated as regards their potency to cause disease; and further, that such micro-organisms under more favourable conditions may re-acquire their pathogenic activity. The *staphylococcus pyogenes aureus* and the *streptococcus pyogenes albus* have been found in the healthy vagina. In order to develop septicæmia in such cases, all that is required is a suitable cultivating medium. On the healthy vaginal mucous membrane the microbes lose potency; in lowly-organised tissue, cut off from the circulation, such as fragments of placenta, they would probably regain it, and would then infect the system through the denuded uterine walls. Some authorities deny the possibility of pathogenic micro-organisms being at one period potent for mischief and at another harmless, or at any rate of much reduced potency. In this relation Winter's conclusions have been questioned, because, although the bacteria he found in the genital tract of healthy women resembled in form and size certain pathogenic bacteria, they gave negative results when experimentally introduced into the system of animals; their identity, therefore, is disputed. Another possible explanation is that, without losing potency, pathogenic micro-organisms may exist in the healthy vagina, but that they may be unable to develop in sufficient quantity as to affect the system—the normal mucous membrane and secretion being inimical to their growth. A fragment of placenta supplies a nidus in which a rapid increase takes place, and the micrococci are then present in numbers sufficient to set up mischief. Another explanation of the mode in which "auto-infection" is caused, assumes the almost universal presence in the air and in various objects which may

come in contact with the genital canal of parturient women of those pathogenic microbes which are capable of inducing septicæmia (*Zeitschrift für Geburtshülfe*, Bd. xiv.) In a normal condition of the genital tract any such micro-organisms which may happen to arrive there quickly lose their vitality; under abnormal conditions, owing to which the patient's power of resistance is greatly reduced, they may determine the occurrence of disease. Whatever may be the real explanation, it is evident that in cases of so-called auto-infection the causal micro-organisms are introduced from without; therefore the phrase "auto-infection" is to be regarded as simply expressing the fact that no obvious mode of infection has, in such cases, been discovered.

A considerable difference of opinion still exists as to the possibility of puerperal fever being caused by the contagium of some of the zymotic diseases, such as scarlet fever. Instances are given which favour the view that puerperal fever may be thus caused, and some eminent authorities regard the effect of the contagium of scarlet fever upon a puerperal woman as being in all respects equivalent to that produced by the contagium of puerperal fever itself. According to this view, in the puerperal woman the contagium of a zymotic disease loses its special character, and sets up processes which fundamentally differ from those produced by the same contagium in a non-puerperal individual. Whilst admitting that the symptoms produced by a zymotic disease with which a puerperal woman has been infected may occasionally differ in some respects from those encountered in the ordinary type of the disease, it is not in accord with universal experience to suppose that the contagium of a given zymotic disease is capable of inducing another disease which,

while possessing certain distinct characteristics of its own, is absolutely devoid of any of the well-marked symptoms which, under all other conditions, would alone be received as convincing evidence of the presence of the said zymotic disease. Moreover, many cases have been recorded in which puerperal women have been infected by the contagium of a zymotic disease—such as scarlet fever—and have suffered from that disease in the usual way; that is to say, they have had true scarlet fever. In other cases the symptoms produced by the contagium of scarlet fever in a puerperal woman are of a mixed type—that is, in addition to those of the specific disease, peri-uterine or peritoneal inflammation is present. Still, in these cases the essential nature of scarlet fever is manifested; any abdominal trouble partakes of the nature of a complication of the specific disease. This is quite different from the assumption that scarlet fever can develop puerperal fever, *i.e.* septicæmia, and not scarlet fever. In those instances in which it has appeared as though the contagium of scarlet fever caused septicæmia, it is most likely that septic micro-organisms, either with or without the specific contagium of the fever, found their way into the tissues of the patient—in the former case causing the pelvic symptoms mentioned as occasionally occurring along with scarlet fever in puerperal women, and in the latter causing ordinary septicæmia. It is to be noted that an erythematous rash occasionally accompanies puerperal fever, and there is good reason for believing that, in some instances, this rash has been mistaken for the eruption of scarlet fever. The contagium of diphtheria when deposited in the genital tract of a puerperal woman is admitted to be capable of causing septicæmia. The presence in the exudation

membrane of pyogenic micro-organisms along with the specific bacteria of diphtheria, especially when the membrane is breaking down, is a probable explanation of the fact. The micro-organisms found in cases of erysipelas, as before mentioned, appear to be identical with those found in septicæmia, so that the contagium from erysipelas may set up septicæmia in a puerperal woman. Moreover, the infants born of women attacked with puerperal fever are frequently attacked with erysipelas, thus showing in a remarkable manner the correlation of the two diseases.

Another disputed point exists in relation to the etiology of puerperal fever; can puerperal fever be caused by foul air, such as that which escapes from an imperfect drain, or from decomposing animal matter, the contagion being carried by the air? Authorities in favour of the affirmative answer to this question cite cases of puerperal disease in which, on the one hand, no evidence of direct local contagion could be discovered, while, on the other hand, some insanitary condition was found to exist in or near the house occupied by the patient. Dr. Playfair, amongst other instances, narrates a case in which a puerperal patient for the first ten days after delivery remained in bed in a satisfactory condition. On sitting up she became exposed to a current of sewer-gas (the existence of which was afterwards proved by the smoke-test), and at once became ill, the symptoms increasing during the three days she was subject to the influence of the gas. She was removed to fresh and uncontaminated air, when all the threatening symptoms quickly disappeared. Dr. Handfield Jones relates the case of a woman who seemed on the point of succumbing to puerperal

disease. It was discovered that her bedroom was immediately over a slaughter-house; the patient was removed to another house, when her condition began to improve, and she recovered from an attack which had all the appearances of being about to terminate fatally. Those who deny the possibility of puerperal fever being produced by drain-air, decline to accept cases such as the two quoted as being cases of puerperal fever—*i.e.* septicæmia. Dr. Playfair, although a strong advocate of the sewer-gas etiology of puerperal disease, admits that the condition caused by sewer-gas may be distinct from septicæmia. Indeed, it seems as though one of the facts relied on to prove that contaminated air may be the medium by which contagion is conveyed—the fact that improvement at once sets in on the removal of the patient from impure to pure air—clearly demonstrates that the morbid condition induced by contaminated air differs in degree if not in kind from septicæmia. Drs. Hermann and Cullingworth, who deny that puerperal septicæmia can be communicated by impure air, contrast the indefinite symptoms which ensue in cases of sewer-gas poisoning with the uniform and well-marked phenomena of septicæmia, and further pertinently observe that instances of septicæmia being produced by sewer-gas are never heard of excepting in the case of puerperal women. The opponents of the theory of aerial contagion hold that it is a dangerous as well as an erroneous doctrine, inasmuch as it is likely to lead to neglect of strict antiseptic precautions. Believing as they do that, by strict observance of cleanliness and antisepsis, puerperal septicæmia may be held in abeyance, they fear that, when septicæmia occurs, to allow any way out of the difficulty other than a frank avowal that the

precautions taken were insufficient, would be to perpetuate a perfunctory method of prevention, the tempting opportunity being afforded in unfortunate cases of laying the blame on defective sanitation. The possibility of sewer-gas being the cause of puerperal septicæmia is difficult to prove or to disprove. It is a fact that some of the micro-organisms which we associate with septicæmia, such as the *staphylococcus pyogenes aureus*, are met with in air, and therefore it would be dangerous to deny the possibility of an aerial causation; on the other hand, it is difficult in instances of assumed aerial contagion to eliminate with absolute certainty the possibility of contagion by direct contact; in other words, to prove a negative. There is no doubt that a febrile state, with possibly some pelvic symptoms, may be set up by aerial influence, but convincing evidence is not forthcoming that septicæmia can be thus caused.

The extreme contagiousness of puerperal fever is its best known characteristic. Long before any true idea was entertained as to the etiology of the disease, the fact was fully recognised that it could be transmitted from patient to patient, and further, that it was an extremely difficult matter to limit its spread. Various theories were evolved to account for this excessive tendency to radiate in all directions when once a case occurred. So great is the tendency, that long after the mode of transmission by the hands of the accoucheur from one sufferer to another puerperal woman was recognised, it was held that epidemics of the disease occurred, at stated intervals, when enormous numbers of parturient women were attacked simultaneously, or within a short time of each other, with the result that vast numbers died. These epidemics

were regarded as being analogous to epidemics of small-pox or of cholera. They were supposed to be due to the presence of some causal agent in the atmosphere, and that, therefore, they were beyond human prevention. At the present time it is fully recognised that these so-called epidemics were really due to transmission from an infected source; they occurred more especially in lying-in hospitals, and were caused by the entire absence of antiseptic precautions, or as exemplified by Dr. Playfair, by an outbreak of erysipelas in a neighbouring surgical ward. Since the introduction of effective antiseptics into the lying-in room, the so-called epidemics have disappeared. The extreme contagiousness of puerperal septicæmia is still illustrated from time to time by a number of cases happening in a limited area, which, on subsequent investigation, are usually found to have been attended by the same midwife.

Many signal examples prove the contagiousness of puerperal fever, infected medical men and midwives having left behind them a track of death in a succession of lying-in rooms. Roberton gave a notable instance, showing how one midwife attached to a lying-in hospital, among twenty labours, had sixteen fatal cases of puerperal fever, whilst the other midwives connected with the same institution attended, during the same period, 380 labours without the occurrence of a single instance of puerperal fever. The cases attended by the infected midwife were scattered amongst the patients of the other midwives, so that the infection was clearly traced to personal contact and not to local epidemy. Infection may be also carried from the dead body—dead from any disease, contagious or otherwise—to the lying-in woman; hence any one engaged in

dissection should rigorously avoid the lying-in room.

The virulence of the morbific element may be further estimated by the failure of the extraordinary precautions taken by medical men who have been in attendance upon cases of puerperal fever. In one instance a doctor, who had become infected, had his hair shaved off, changed the whole of his garments, used baths, and washed his hands in disinfecting fluids, yet, notwithstanding all these precautions, the first labour he afterwards attended resulted in puerperal fever. This instance occurred before the present methods of procuring asepsis were discovered. Very much depends upon the efficacy of the antiseptic fluid used to cleanse the hands. Recent systematic investigations as to the relative value of various so-called antiseptics have proved that some which were formerly depended upon as efficient sterilisers are really of no utility whatever.

From time to time severe outbreaks of puerperal fever have produced an excessively high rate of mortality in childbirth. The cases first attacked are most severe and intractable; after a time the contagium seems to become diluted or in some manner to lose its extreme virulence, the cases then diminish in severity, and become more amenable to treatment. The character of an outbreak varies from time to time, one batch of cases inclining to abdominal, another to chest or head complications, and consequently observers are apt to arrive at erroneous conclusions through making general deductions from the results of a single outbreak.

It has long been customary to describe a number of conditions which often occur coincidently, but may also occur separately, giving rise to certain local symptoms: such are puerperal endometritis

and metritis, puerperal salpingitis, pelvic and general peritonitis; phlebitis, with thrombosis and embolism; angeioleucitis and cellulitis. The interpretation now given to such conditions is that they are all due to septic infection, and are so many manifestations of septicæmia—the particular tissue or organ attacked being determined by the route the contagium takes. In the case of endometritis, salpingitis, and peritonitis, the infection may spread along the mucous tract; in phlebitis, the veins; and in angeioleucitis and cellulitis, the lymphatics and areolar tissue are principally involved; finally, amongst the invasion routes must be mentioned that afforded by mere contiguity of tissue.

Puerperal Endometritis and Metritis.—*Endometritis* is almost of constant occurrence, at any rate in the commencement, in many of the septic puerperal troubles. In slight, favourable cases it may be the only local manifestation. It is attended by general febrile disturbance corresponding to the virulence of the inflammation. The lochial discharge is offensive, and is associated with a sloughy condition of the endometrium generally, or of some retained products of conception; it may cease to drain from the uterus if the tumefaction of the cervical mucosa be excessive. In some cases an exudative deposit takes place on the endometrium, forming a false, or so-called *diphtheritic membrane*. This first commences in grayish-coloured spots, which increase in size and coalesce so as to form large patches. Such spots or patches may be found also in the vagina or on the vulva.

Metritis.—When the contagium obtains access to the tissues of the uterus, a diffuse low suppurative type of inflammation ensues. The walls are infiltrated with exudative products, and are the seat of

multiple depôts of pus. The whole organ is greatly enlarged, and is boggy to the touch; it is friable, being easily torn, and is prone to become gangrenous. The cavity of the uterus may be abraded in parts; any remaining mucous membrane has undergone fatty degeneration, and can easily be detached from its bed. While endometritis may be present without implicating the rest of the uterine structures, parenchymatous metritis is invariably associated with inflammation of the lining membrane. In fatal cases, then, the uterus itself is larger than normal, and when cut into is found to be infiltrated with pus or in a semi-sloughing condition; in the worst cases gangrene is more or less manifest. When death occurs in the early stage the mucous membrane is found soft, thickened, and covered with a layer of tenacious mucus mixed with blood and epithelial débris.

Symptoms.—The initiatory rigor ushering in puerperal peritonitis and phlebitis is rarely met with in uncomplicated metritis. Within the first few days after delivery the disease commences with a dull uterine pain, which may be mistaken for after-pains, but it is more persistent, and remains after the after-pains have usually ceased. The pain differs much from that of peritonitis, inasmuch as pressure is fairly well tolerated, and indeed it has to be occasionally resorted to in order to ascertain the morbid sensibility of the uterus. The pulse ranges from 100 to 110, the temperature from 100° to 104° Fahr.; respiration is not much interfered with. The inflammatory process checks the process of involution, so that the uterus can be distinguished above the pubes after it ought to have subsided into the cavity of the pelvis, which in ordinary cases takes place before the tenth day. Besides

the arrest of involution, the uterine structures become swollen by the inflammatory action; the enlargement due to these two causes is often sufficient to keep the uterus so far above the brim that the os can hardly be reached by the exploring finger in the vagina; when the os *can* be felt, it is found to be hot, tumid, and sensitive to the touch. As stated before, the lochial discharge is sometimes checked, at others it takes on a purulent and exceedingly offensive character, and if necrosis of the uterine structures occurs, the discharge is characteristically fetid. Hervieux calls attention to the condition of the lochia as a diagnostic sign, stating that if it continues sanguinolent for several days longer than the normal period (three or four days), metritis is to be feared.

Puerperal Salpingitis. — The morbid processes affecting the uterus very commonly spread into the Fallopian tubes. Their lining membrane becomes inflamed and the lumen contains pus and epithelial débris, which, by oozing from the fimbriated extremity, causes localised peritonitis, with its concomitant symptom, pain. On vaginal examination the earliest noticeable condition is prolapse of the swollen tube; afterwards the parts become masked by peritonitic exudation, and finally, after the surrounding inflammation has undergone some resolution, the tube will probably be recognised as a more or less sausage-shaped swelling—a pyosalpinx,—the fimbriated extremity being sealed up and the lumen distended with pus. In other cases tubo-ovarian and ovarian abscesses have been formed, and may be found more or less fixed by adhesions.

Pelvic Peritonitis and Cellulitis. — We have just indicated, in treating of salpingitis, how *pelvic peritonitis* commonly arises from the introduction into the

peritoneal cavity of some septic agency through the Fallopian tubes; previously we have mentioned that it may arise from local extension of inflammation. *Pelvic cellulitis* is to be defined as a septic inflammation of the areolar tissue—the virus generally gaining access to the pelvic connective tissue through some tear or abrasion of the genital tract. Pelvic cellulitis almost always determines the existence of more or less pelvic peritonitis, and whilst the converse is not nearly so often the case, the co-existence of the two conditions so frequently occurs that they may conveniently be discussed together.

Pelvic Peritonitis or Perimetritis commences by hyperæmia of the peritoneal covering of the pelvic organs, speedily followed by exudation of lymph and subsequent matting together of the neighbouring organs. The adhesions thus formed, if few, may not materially restrain the mobility of the organs affected; usually, however, they are sufficiently numerous as to bind the uterus and its appendages into fixed positions, and not unfrequently to completely agglomerate the entire pelvic viscera so as to form the resemblance of a solid tumour. Portions of the peritoneal cavity may be sealed off from the rest, and being filled with serum or pus, may form fluid tumours without any cyst-walls other than those afforded by the surrounding viscera. The exuded lymph, instead of organising, may break down into pus, sometimes in several places, so as to form distinct abscesses.

Pelvic Cellulitis or Parametritis.—When the inflammatory processes which attack the connective tissue in immediate relation to the uterus and its appendages do not extend beyond these organs, the resulting condition is known as pelvic cellulitis or parametritis. Although the uterus may be relatively

slightly affected, even when the cellulitis is fully developed, it is probable that the mischief commences in the cavity of the uterus or in the neighbourhood of the cervix. The inflammation most frequently results from the admission of pyogenic micro-organisms or their chemical products into the sub-mucous tissue; in some instances, however, it appears as though the mechanical injury sustained by the tissues during labour, arising from the bruising and stretching they have undergone, gives rise to exudative processes, which cause collections of leucocytes to form, producing swellings which have all the appearance of abscesses in the early stage, but which in the end are slowly absorbed without any escape of their contents. When due to septic causes, the process begins by cloudy swelling of the connective-tissue cells immediately around the uterus and in the layers of the broad ligament; exudation follows into the cellular interspaces, and diffuse and localised swellings form in the pelvic cellular tissue. The position and shape of the swelling varies: at first it may be globular; soon, however, it takes an irregular form, and extends between the layers of pelvic fasciæ towards the pelvis, the direction being from the centre to the circumference. The anatomy of the pelvic fasciæ has been carefully studied with the view of determining its influence on the course of cellular inflammation. König made some striking experiments to show the various routes by which fluids may traverse the pelvic fasciæ. He injected water and air into the uterine cellular tissue, and found that the fluid flowed by the side of the psoas and iliacus muscles into the pelvis, or along the round ligament towards the iliac fossa, or towards Douglas' fossa, according as to

whether the injection was passed into the fasciæ of the Fallopian tubes, the uterine cervix, or the posterior part of the broad ligaments. Sir William Priestley very truly remarks that, however valuable such investigations may be as a guide to the direction taken by serous effusions or purulent fluids, which ordinarily follow the path of least resistance, it is of little use as an index to the course of active inflammatory exudation, which readily passes by contiguity—the layers of fasciæ opposing no efficient barrier. The most frequent site of a localised phlegmon is between the cervix uteri and the rectum, tending to spread along one or other broad ligament to the other side of the womb. Sometimes the swelling is situated between the bladder and the uterus, and more rarely in front of the bladder. The most remarkable characteristic of the swelling at this stage is its extreme hardness; it seems as unyielding as a uterine fibroid, and to the finger gives a sensation of resistance like the very bones of the pelvis. The swelling is irregular in shape, in accordance with the direction taken by the exudation; the uterus, rigidly fixed, seems as though welded to the pelvic walls. This condition may terminate in resolution, the effused fluid being gradually absorbed, whilst the tumour, without losing its hardness, slowly diminishes in bulk until it finally disappears, leaving the uterus either temporarily or permanently adherent to the neighbouring organs. In less favourable cases purulent degeneration takes place, the matter seeking exit through either the abdominal walls, the rectum, vagina, or bladder, or even into the cavity of the peritoneum. The formation of pus rarely takes place before the tenth or twelfth day after the hyperæmic stage, and it may occur much later.

Since the surrounding tissues are all infiltrated and thickened, it is often no easy matter to detect the pus by physical examination, more especially as suppuration is frequently set up in isolated loculi; these may discharge their contents independently, or may in the end unite and form a large collection of pus.

Pelvic abscess, then, as it occasionally occurs after confinement, may either be peritonitic or cellulitic in origin. The usual opinion is that these large collections are most commonly cellulitic, although Bernutz considers the pelvic peritoneum, not the cellular tissue, to be the seat of inflammation, and observes that the cellular tissue surrounding the uterus and its appendages is so scanty (with the exception of a small ring round the juncture of the body and cervix, and between the folds of the broad ligaments) that it is impossible for a phlegmon to be formed in it. He further holds that the collections of pus which succeed the phlegmons are intra-peritoneal, being contained in cavities formed by the matting together of the pelvic viscera, and not in the connective tissue between the organs and their serous envelopes. This view is not as yet received in England, although to a certain extent the statements of Bernutz have been corroborated by Duncan and others, who have reported cases where collections of fluid, generally serous, have been retained in cysts formed by the separation of a portion of the peritoneal cavity by adhesive inflammation.

Symptoms.—The invasion is usually marked by a slight rigor followed by pelvic pain, which spreads to the hypogastric region, the pulse quickens to about 100 in a minute, and the temperature rises to 100° or 102° Fahr.; the tongue is furred; there

is a tendency to nausea, the bowels are constipated, and after a time micturition and defæcation become painful and difficult. To relieve the tension as far as possible, the patient will generally be found lying on her back, with the thigh of the side affected flexed on the trunk, this position being very significant of pelvic inflammation. In some cases there are no premonitory symptoms, but merely a gradual falling away from health for several weeks after labour, until at last the pelvic indications assert themselves. In these cases, however, there is generally a considerable acceleration of the pulse from the first, which ought to put the attendant on his guard, and lead him, from time to time, to investigate the state of the pelvic organs.

Physical examination reveals at first tenderness over the lower part of the abdomen, with a hot, dry, and painful condition of the vagina. After a time a diffuse swelling, low down in the pelvis, may frequently be detected by careful pressure on the hypogastric region. The tumour gradually becomes well defined and very hard, and may be detected also through the vaginal walls, for on carrying the finger to the top of the vagina, the cervix uteri is found tumid and patulous, with a hard nodulated swelling round it, so as often completely to obliterate the vaginal *cul-de-sac*. Rectal examination further corroborates the estimate of the size and position of the tumour. When the exudation is slight the finger in the vagina can often detect the presence of a thin layer of plastic material which forms a roof to the pelvis, fixing the pelvic contents and separating them from the other abdominal viscera. This is the result of pelvic peritonitis without cellulitis. When the swelling is localised its excessive hardness may lead to the suspicion of malignant

disease; the previous history of the case, however, will determine the diagnosis.

If the disease goes on to suppuration, there is an increase in the febrile symptoms of a hectic character, with night sweats and diarrhœa, the swelling softens, and the pus seeks exit by one of the various channels previously indicated.

Pelvic peritonitis does not usually come on till two or three weeks after labour, and its duration varies from a few days to several months. The uterine fixation often lasts for years, and in many cases remains permanent.

Dr. Braxton Hicks gives the following epitome of differential symptoms in pelvic cellulitis and peritonitis:—

Pelvic Cellulitis.

1. Tumour easily reached; generally easily and early felt in neighbourhood of broad ligaments and above pelvic brim.
2. Abdominal pain, increased by deep pressure.
3. Temperature usually not above 102°; pulse full, soft, dicrotic in septic form.
4. Retraction of thigh with abduction. Pain down leg.
5. Nausea, vomiting not excessive.
6. Not accompanied by tympanitis.
7. Marked tendency to suppuration.

Pelvic Peritonitis.

1. Tumour not noticeable for some days.
2. Abdominal tenderness of an acute kind, quickly increased on pressure. Form of coils of intestines mapped out on abdomen. Fixation of abdominal muscles.

3. Temperature above 102° usually; pulse wiry in benign, dicrotic in septic form.

4. Pain down leg and retraction of thigh never present.

5. Nausea, vomiting excessive.

6. Tympanitis present in severe cases.

7. Constipation often marked.

8. Suppuration not often present.

General Septic Puerperal Peritonitis. — Of the various inflammatory diseases commonly associated with puerperal fever, one of the most frequent is puerperal peritonitis.

The septic infection may travel from the uterus along the Fallopian tubes to the peritoneum, or it may spread from the cervix by continuity. In severe cases the whole of the peritoneum is more or less implicated: the surface is irregularly injected, it becomes dull-looking and is covered with a semi-purulent exudation, the cavity of the membrane containing turbid, shreddy, offensive fluid. The effect of the septic agents present is to cause paralysis of the muscular coat of the bowel, which is consequently distended with flatus. The more marked signs of inflammation usually found in non-puerperal peritonitis may be almost if not quite absent; the puerperal disease often running a very rapid course without any manifestation of the so-called attempts at repair. In milder cases the morbid processes are more localised about the pelvic organs, and in character they more nearly resemble those due to what are usually regarded as non-septic conditions.

Symptoms. — Puerperal peritonitis usually first manifests itself on the second or third day after labour, but in rare instances its commencement coincides with, or even precedes, parturition, whilst, on the other

hand, it may be delayed until the sixth or even the eighth day after labour. The symptoms are those of ordinary peritonitis aggravated in intensity and asthenic in type; the patient is seized with a rigor, generally of a marked character; her face is clouded with an expression of anxiety and dread of impending danger; the abdominal pain quickly increases in intensity; the temperature rises to 102° or 104°, and the pulse, thin and thready, is accelerated to 120 or 140, and the respirations to 25 or 50, or even more, in a minute; the tongue becomes furred, or is sometimes red, becomes afterwards dry and brown, and there is insatiable thirst; the bowels are copiously relaxed, the diarrhœa being often preceded by vomiting; the abdomen is distended with flatus; the uterine discharge is either arrested or becomes offensive; mammary secretion ceases; and the body is bathed in a copious perspiration. In fatal cases the disease pursues a rapid course, the pulse becoming more thin and wiry, the abdomen more tympanitic, low delirium sets in, and the patient dies.

The principal distinction between the simple peritonitis of childbirth and the peritonitis accompanying puerperal fever lies in the inflammatory character of the simple peritonitis as compared with the markedly septic nature of puerperal peritonitis. In simple peritonitis the bowels are usually confined; but, as just stated, in puerperal peritonitis there is diarrhœa. Examination after death shows that the lymph effused in simple peritonitis tends to organisation, being of that adhesive character which mats together the adjacent organs; whereas the effusion of puerperal peritonitis is a dirty-looking fluid, with floating flakes of lymph, having no tendency to organisation.

I may here mention the disorder first noticed by Gooch, and afterwards very fully described by Ramsbotham, and named acute tympanitis, or false peritonitis, in which, without any inflammatory action, the symptoms very much resemble those of peritonitis. A careful examination of the case, however, with a consideration of its history, will enable us to form a correct diagnosis. The treatment consists in the administration of opiates.

Puerperal Phlebitis.—The entrance of pathogenic micro-organisms into the open mouth of a vein causes coagulation of the contained blood, and the thrombus thus formed, being of septic origin, sets up intense inflammation in the coats of the vessel. The middle and external coats are infiltrated with leucocytes and serum, the infiltration rapidly becoming purulent and spreading along the vein. The thrombus softens, due to the disintegrating effects of the micro-organisms, and detached fragments, each a focus of septic contagion, are carried along in the blood-current and produce secondary deposits in the lungs and other organs, the condition which ensues being known as *Pyæmia.* When pathogenic micro-organisms are introduced into the puerperal uterus they may reach the open mouths of the uterine sinuses and, if coagulation in them has already taken place, they may attack the clots and cause them to break down. When a septic fragment reaches the *lungs* it produces a wedge-shaped infarct, with its broadest part directed to the periphery of the lung. Pneumonia, abscess of the lung, and pleurisy may ensue. The *spleen* is usually much enlarged and softened; on section infarcts may be seen. The *kidneys* may also be the seat of infarcts, or there may be more diffuse morbid appearances—such as cloudy swelling of the epithelium, and fatty

changes; pus may be present. The *liver* is not often the seat of secondary abscesses, but it is probably enlarged and shows more or less advanced fatty changes. The *heart* is very liable to be affected with ulcerative endocarditis caused by deposition of pathogenic micro-organisms (the staphylococcus pyogenes aureus and albus and the streptococcus pyogenes have been found) on the valves, where they attach themselves, producing a roughened surface which easily disintegrates, the detached particles giving rise to metastatic abscesses in other organs. The myocardium may also be the seat of a collection of pus. The *joints* are not unfrequently affected by the septic microbes, which cause an acute inflammation that tends rapidly to become suppurative. More than one joint is usually affected. One, and sometimes both *eyes* are destroyed by septic inflammation. The *skin* is liable to become erythematous (this has been mistaken for the eruption of scarlet fever), and occasionally deep-seated abscesses form in the muscles.

Puerperal phlebitis comes on usually a few days after labour. The first indication is a rigor, which is much less marked than in peritonitis; indeed the premonition not infrequently takes the form of a series of slight shivers, rather than one well-marked shaking; the pulse and respirations increase in rapidity, though not so decidedly as in peritonitis, the pulse not often exceeding 120, and the respirations 25 or 30 in a minute; the temperature rises to 102° or 103°. The tongue is thickly coated, the bowels as a rule are relaxed; the uterine discharge is generally excessive and very offensive. The patient is bathed in copious perspirations, and she suffers from great mental depression. The pain is usually accompanied with more or less abdominal distension, is confined to the uterus, and is not

nearly so great as in peritonitis. Béhier states that if the uterus is steadied with one hand, and grasped between the finger and thumb of the other (the bladder being empty), "a painful cord-like induration" will be felt on one side—a symptom he holds to be of great diagnostic value, since it is invariably present before the other symptoms declare themselves. A vaginal examination reveals nothing special.

We have now to direct our attention to the *general aspect of puerperal fever*. The disease usually commences on the second or third day after delivery, though, as was previously stated, it may be developed during labour, or be retarded until the seventh or eighth day after, but not later. The invasion may be marked with a rigor, though it is often slight enough to escape notice; the patient's mind is from the first much depressed, and she is harassed with gloomy forebodings, a condition painfully shown in the pinched and haggard face and sunken eyes. The tongue is moist, with a white or brown fur, and shows the indentation of the teeth; the pulse is very rapid, from 110 to 160, and the respirations are increased to 50 or 60 in a minute; the temperature varies from 102° to 106° Fahr. The skin, as a rule, is hot and dry, although in some instances there is excessive perspiration; vomiting of a green or brown coloured fluid is sometimes met with, especially at the later stage of the disease; diarrhœa is generally present, and in cases of septicæmic origin the alvine discharge is more than usually fetid. The secretion of milk is arrested. The condition of the lochia is greatly dependent upon the state of the uterus; in metritis or phlebitis the discharge may become foul or cease entirely, but when no complication exists it not unfrequently remains little affected.

At the outset there is usually a certain amount of vague abdominal pain in the hypogastric region, which, if followed by peritonitis, rapidly increases to positive agony, and radiates over the whole abdomen; the pain is aggravated by abdominal tension, first from flatus simply, and afterwards from the effusion of serum. As a rule the brain is not implicated to any extent, though there may be low delirium. If the case is of adynamic form, the foregoing symptoms rapidly lead to dissolution, and shortly before death the pain frequently lessens in violence, and the patient lies prostrate without complaint. As was previously remarked, the special character of puerperal fever changes from time to time, the local complications now attacking the abdomen, now the chest; but in the most severe form the patient is cut down without the supervention of any local symptom whatever. The adynamic form of puerperal fever is usually the result of a very smart septic infection, and is now chiefly confined to the lying-in wards of hospitals, being comparatively rare in private practice. In cases of this type death takes place within the first week, sometimes on the second or third day; and indeed cases are recorded where the patient succumbed within twenty-four hours. Post-mortem examination reveals nothing of pathological import except the condition of the blood, which is very dark and possesses a peculiarly offensive odour; the coagulum is friable and of the consistence of jelly, the lowest stratum containing an excess of the dark colouring matter which falls to the bottom of the vessel during coagulation; the usual conditions of hydræmia are evidenced by the diminution of the quantity of red discs, and the increase of the white corpuscles, fibrin, and extractive matter.

Treatment.—In order to systematise our description of the treatment, for just as the disease itself presents many forms so the treatment is by no means a routine one for all cases, we may consider it under the divisions—prophylactic, general, and special local treatment.

The *prophylactic treatment* is of the first importance, and involves consideration and attention (1) to the general health and environment of the patient; (2) to the aseptic management of labour; and (3) to asepsis of the puerperium.

(1) As regards the patient's general health, it is a well-observed fact that blood-deterioration and anæmia are powerful predisposing causes of puerperal fever, and render the patients unable to withstand the effects of a contagium which a system of stronger vitality could bear with more or less impunity. In a slightly different manner mental depression may lead to diminution of tissue resistance to infection. It follows, therefore, that it is well for the pregnant woman to have a generous diet, plenty of fresh air, and a due amount of exercise. Hæmatinics and stomachic tonics may be administered if required, and change of scene with cheerful company will do much to alleviate the lowering of nervous vitality. It is clear also that the surroundings of the patient about to be confined should be free of any source of infection; the house and its inmates—the former especially as to the drains, and the delivery chamber—all require some scrutiny. Apart from the occurrence of grave diseases among the other inmates, as for instance a case of erysipelas, which should never be allowed to remain in the same house with a woman about to be confined, it is by no means uncommon to find people helping in the delivery who are suffering from

purulent discharges of the mucous passages, from ulcerated legs, and other similar disorders.

(2) The asepsis of labour involves the surgical cleanliness both of the patient and of all her attendants. The most scrupulous care must be taken by the attendants to avoid the risk of carrying any toxic influence to the lying-in woman. The accoucheur should avoid dissecting and post-mortem rooms, and as far as possible should refrain from attendance on all cases of septic disease. If he should, however, come into contact with any sources of infection, the hands should at once be assiduously washed with the aid of a nail-brush for some minutes with several changes of soap and water, and then with 1-1000 corrosive sublimate solution. Briefly stating the case:—to render himself perfectly "pure," the accoucheur should sterilise his clothes by dry heat or steam, his bath should contain some antiseptic, he should never examine during labour without (each time) having immediately before cleansed his hands; and, finally, it may be added that the fewer the examinations the better for the patient.

It has been found that organisms exist in considerable numbers even in the healthy vagina, and certainly any "show" remaining about the vulva soon becomes further charged, as it were, from the atmosphere. It is, however, very difficult to entirely free the vagina from organisms which to some extent invade the epithelium. Generally speaking, it will be found sufficient to attend to the external condition, reserving the preliminary vaginal douche to such cases as appear to be likely to require more than the usual assistance. Finally, tissue injuries, such as perineal tears, should have immediate surgical and special antiseptic treatment.

(3) The asepsis of the puerperium also involves strict surgical cleanliness. An attempt to *preclude access* of germs should be made by using some antiseptic pad instead of the common diaper; and there must be repeated cleansing with antiseptics so as to leave no nidus for the development of the infective virus; but the vaginal douche is usually best avoided as it is a source of danger, unless administered by a very competent person.

The *general* treatment varies with the character of the disease in each individual case; the increase in temperature should be combated by quinine in large doses, 10 or 12 grains dissolved in a solution of hydrobromic acid being given every six or eight hours until the desired result is obtained. The body may be sponged with cold or tepid water, which is rendered more refreshing by the addition of a little toilet vinegar; restlessness and insomnia are to be treated by morphia, either in the form of pill or draught, or by hypodermic injection; occasionally it is advantageously administered as a suppository; chloral hydrate, either alone or combined with morphia, is a valuable hypnotic. Fordyce Barker highly extolled the action of veratrum viride in five-minim doses of the tincture every hour until its influence is established as a controller of the heart's action. Digitalis and aconite have also been recommended for the like purpose, and in the hands of some the internal administration of turpentine has proved of much value. Enemata containing castor-oil or turpentine are generally to be preferred to purgatives. An early trouble in puerperal septicæmia is caused by the rapid decomposition of the secretions and excrementitious matter in the intestinal canal, which develops toxines, and materially increases the

general septic condition; it is therefore of importance in the early stage of the fever to begin treatment by securing free evacuation of the bowels, so as to quickly dislodge any intestinal accumulation. For this purpose an occasional five-grain dose of calomel is very effective; sulphate of magnesia is also useful. Inordinate diarrhœa demands the use of opium; sickness should be allayed by ice, soda or other effervescing waters, champagne, and morphia. General depletion is not admissible in any stage of the disease, but, as will be presently mentioned, leeches are sometimes serviceable.

Attempts to destroy the morbific element in the blood by means of chlorine or carbolic acid have hitherto proved futile. Chlorate of potash and perchloride of iron are of much use in restoring the healthy character of the blood. In the three outbreaks of puerperal fever, more or less severe, which I have witnessed, I, in common with other observers, have been struck with the uncertainty of the action of remedies. In one outbreak turpentine seemed to be much more efficacious than in the other two; but in those adynamic cases where retching, gulping, nausea, vomiting, and diarrhœa come on at an early stage, it is impossible to give this remedy; in such cases I have found a combination of chloral hydrate, morphia, and aconite very useful. Calomel, 1 grain, with opium, $\frac{1}{2}$ grain (in powder or pill), twice or thrice daily, forms a combination which has also seemed of the greatest value, especially where there are peritonitic symptoms.

The diet, of course, must be regulated by the exigencies of the case; nutritious, but not stimulating, in the more sthenic form; freely stimulating from the first in the adynamic form. In all cases pepsine, being an intestinal antiseptic, may be

given with much advantage. In case of thirst, a little dilute phosphoric acid sweetened with syrup forms a refreshing drink. Abdominal pain should be mitigated by turpentine stupes, or by the application of flannel or cotton-wool sprinkled with laudanum. Poultices, though sometimes very comforting, are, as a rule, too heavy to be borne. In extreme pain from violent peritonitis, the application of leeches to the abdomen will generally afford relief; some recommend blisters, but I prefer fomentations, and, if necessary, leeches. Flatulent distension of the intestines, so apt to intensify the pain and distress, may be reduced by the use of a long rectum tube, or, if needful, by the introduction into the colon of a very fine hollow needle. The abdominal pain must be treated with morphia, administered either hypodermically or by the rectum; it must be given freely, for under the circumstances the tolerance of this drug is very marked. Dr. Rigby's encouraging advice on the necessity of persevering treatment, notwithstanding all adverse symptoms, forms a fitting conclusion. "Even when the face is assuming a Hippocratic appearance, the pulse so rapid and feeble as scarcely to be counted, where the abdomen is immensely distended, with cessation of pain and cold clammy state of the skin, we ought not to despair. No case, however bad, is entirely hopeless; and although the majority of such cases perish in spite of the greatest care and activity, still we are justified in persevering till the last, knowing from experience that we every now and then succeed, even at this late hour, in rescuing our patient."

We have now to consider the *local* treatment; and in view of the local invasion and the manifold local lesions presented by puerperal fever, the

subject is only second in importance to prophylaxis.

In the very mildest cases, with slight uterine tenderness, and perhaps some diminution of the lochial discharge accompanying a mild febrile condition generally, it may often be sufficient to apply hot fomentations over the fundus uteri, and to administer a hot (110°) vaginal douche every four hours. If there is not speedy amelioration, the uterine cavity must be systematically washed out with 1-6000 corrosive solution; and indeed it would perhaps be the safer if this plan were undertaken from the first. Douching the endometrium must, however, be done both carefully and thoroughly; moreover, it is not without contra-indications; for instance, it is capable of producing more harm than good when there is any lesion of the tubes with local and general peritonitis. The vagina should first be douched or very gently swabbed with wet cotton-wool, and when all discharge is cleaned away from the cervix a Budin's catheter, or similar instrument providing for a return flow from the uterus, should be carefully inserted. A stream of at least a quart of hot lotion is then allowed to flow in and out again, from a douche-can or syphon—*not* from a syringe. In order to avoid the possibility of propelling the uterine secretions through the Fallopian tubes into the abdominal cavity, the uterus must not be distended with fluid, nor should any air be forced into it; this will not occur if a douche-can or syphon be used, and the intra-uterine tube be the lowest part of the apparatus. The objections to a syringe are, first, the liability to inject air, and secondly, the risk of back-flow from the uterus into the syringe. The superior efficacy of corrosive sublimate over other antiseptics is strikingly illustrated by

the results obtained by Dr. Boxall (*Obstetrical Trans.* vol. xxxii.), from an elaborate statistical analysis of nearly 3000 cases of child-bed. Dr. Boxall lays stress on the greater value of strong douche-solutions as compared with solutions of weak antiseptic power.

The local treatment of sapræmia is obvious and will almost always be successful if undertaken early enough. The uterus must be explored by the finger, and all retained fragments of placenta, membrane, or decomposing blood-clot removed by forceps or Sims' curette. As the intra-uterine douche should also be employed, the use of a flushing curette effectually fulfils both indications. If not contra-indicated, the endometrium should afterwards be irrigated twice daily as long as the temperature remains high. A special point in the medicinal treatment of the sapræmic condition is that extract of ergot may be given in 20-30 minim doses twice or thrice daily, inasmuch as the retention of secretion is sometimes largely due to imperfect contraction of the uterus; otherwise the medicines to be administered are sufficiently indicated in the paragraph on general treatment.

Treatment of Perimetritis, Parametritis, and Pelvic Abscess.—If in the early stage there is much pain, with inflammation of a sthenic type, a few leeches may be applied to the abdomen. Poultices and hot fomentations prove soothing, and the vaginal douche as hot as can be comfortably borne may be advantageously used. Opiate suppositories, or the hypodermic injection of morphia, will lull excessive pain. Some recommend a mercurial form of treatment, but care must be taken, as it is apt to bring on inordinate diarrhœa. Diarrhœa must be controlled by opium, and sickness may be alleviated by hydrocyanic acid, bismuth, ice, or potass water.

The patient must be kept perfectly quiet, and should be supported by a nourishing and slightly stimulating diet. Quinine, the mineral acids, and chlorate of potash will, each or all, be found useful during certain stages. If the temperature is very high, quinine is indicated, but as the stomach often rejects this drug, it is a good plan to inject ten or fifteen grains mixed with gruel into the bowel. When the tumefaction is slow to depart, and still no signs of suppuration are manifest, "flying" blisters and iodine inunction may be resorted to. A collection of matter must not be opened too early: indeed some authorities, amongst whom are West, Aran, and Becquerel, advocate leaving the time and course of exit entirely to nature; but in many instances much time and suffering may be saved by a judicious resort to the scalpel. The following localities, in the order of their enumeration, are the most favourable sites for the discharge of pelvic abscesses,—rectum, vagina, abdominal walls, and bladder.

Whilst it is comparatively common for pyosalpinx, resulting from septic processes following labour or abortion, to be treated by abdominal section at a later time, this operative measure is not yet generally received as an immediate method of treatment. Sometimes success may follow laparotomy where peritonitis has resulted from the disturbance of an *old* pyosalpinx or a small pelvic abscess during the progress of labour; the immediate operation has also been successfully performed in cases of recent suppurative salpingitis. But these measures represent only a *dernier ressort*, as it is now thoroughly well recognised that *the* treatment lies not in the direction of post-partum operation, but rather in that of careful prophylaxis. "Prevention is better than cure."

CHAPTER XXXVI

THROMBOSIS AND EMBOLISM

THESE affections, which, for reasons presently to be assigned, are specially liable to attack puerperal women, are, with certain differences, essentially analogous. By thrombosis is meant the occlusion of a vessel, arterial, venous, or lymphatic, through the local formation of a fibrinous clot or coagulum. Embolism consists in the plugging of a vessel through the detachment of a clot formed at a distance from the point of arrest, the clot being first deposited in one of the larger vessels, or in the heart itself. After a time, a part or the whole being detached, it is carried forward with the blood current, until, arrived at a branch too small to allow it to pass, it is forced into the vessel as far as it will go, and embolism is the result. When the pulmonary artery is the seat of mischief, as is most frequently the case, intense dyspnœa, with pallor of the face, coldness of the extremities, and the usual symptoms of severe collapse, set in, quickly to terminate in death, although in some cases the patient responds to the action of stimulants and rallies, either again to sink in a few hours, or, in rare instances, finally to recover.

If thrombosis takes place in one of the

peripheral vessels, the danger to life is not so imminently threatening, the peril being in direct proportion to the size of the artery obliterated. The symptoms are, severe pain, often agonising, about the seat of mischief, generally in one of the extremities, without at first any corresponding swelling or inflammation; pulsation ceases below the seat of obstruction, and the temperature is reduced. If the occluded artery is large there is generally immediate paralysis of the motor or sensory or of both nerves of the affected limb, which is sometimes followed by gangrene. If one of the cerebral arteries is plugged, hemiplegia more or less pronounced is the result. Cerebral and peripheral thrombosis, except as in "white leg," is of rare occurrence in the puerperal state.

The causes which lead to the formation of fibrinous clots are the hyperinotic condition of the blood in the gravid state, coupled with its undue tendency to coagulation. This tendency to coagulation is increased after excessive hæmorrhage, and from other causes which reduce the activity of the circulation, and induce a proneness to syncope. The introduction of certain septic matters into the blood, as was explained in the section on phlegmasia dolens, exerts a direct influence in causing coagulation. In the non-gravid state, in rheumatism, typhus fever, and phthisis, thrombosis not unfrequently proves suddenly fatal.

There can be little doubt that, in by far the greater number of cases, the presence in the blood of some product of infective origin is the actual determinator of coagulation. It is also probable that the primary alteration in the blood takes place in the uterine veins. The coagula there formed, like those of phlegmasia alba dolens, are not septic,

and, unless a fragment is detached and carried into the general circulation, no symptoms are produced. This is as much as to say that embolism rather than thrombosis is usually the pathological condition by which the pulmonary artery is occluded, when the lungs are the seat of the mischief. The extreme suddenness and momentousness of the attack, indicating that a large artery is abruptly obstructed, points to embolism rather than to thrombosis as the cause. In suddenly fatal cases it appears as though the passage of the blood through the lungs is instantaneously arrested, and in consequence, that the brain, suddenly deprived of its supply of blood, ceases to act. In many of these cases of pulmonary embolism death occurs too rapidly to be due to asphyxia alone; the probable explanations being that after a few futile efforts to breathe, or even before there is time for any effort at all, the patient succumbs to the effects of instantaneous cerebral anæmia. In such cases the lungs, after death, are found to be paler than usual, and there is an absence of infarcts such as are met with under other embolic conditions. Exceptionally the interference with the pulmonary circulation may be due to thrombosis, the cause of obstruction arising in the pulmonary artery itself independently of clot-formation in distant vessels. This mode of development is probably extremely rare.

The acute symptoms usually come on after some slight exertion, causing, in the case of embolism, detachment of a fragment of a clot already softened and but loosely adherent to its site, and in thrombosis, the propulsion of the clot forward so as to totally occlude the vessel through which it previously allowed the passage of sufficient blood to carry on the circulation.

The sudden deaths resulting from these causes were formerly attributed to a condition termed idiopathic syncope, but the characteristic dyspnœa indicates the actual cause of death.

Dr. Playfair points out that as it takes time for a clot to undergo the amount of retrograde metamorphosis necessary to loosen it from its attachment, embolism is not likely to occur before the third week after delivery, but that thrombosis may occur much earlier, owing to the tardy degenerative stage not being an element in its causation.

Treatment.—In the rare instances where death does not anticipate the arrival of the physician, stimulants freely administered are his mainstay—alcohol and carbonate of ammonia being the most efficacious forms. The pain of peripheral thrombosis must be relieved by opium; the subcutaneous injection of morphia affords the most speedy mitigation of suffering.

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APPENDIX

Anæsthetics in Midwifery

The *propriety of administering* anæsthetics during labour is not now the subject of controversy, as it was many years ago. Then, whilst chloroform was generally regarded as admissible in operative midwifery for the purpose of lessening the amount of suffering, shock, and exhaustion, there existed a wide difference of opinion as to the propriety of its administration in cases of non-obstructed "normal" labour. Simpson and Barker extolled its virtues; Montgomery and others opposed its use. The argument against anæsthesia was that it interfered both with the auxiliary forces of labour and with the normal contraction of the uterus, thus predisposing to hæmorrhage. Neither statement can be received without qualification. For instance, as regards the auxiliary forces, a limited degree of anæsthesia will not completely inhibit the reflex action of the abdominal muscles accompanying a pain; indeed, in many cases the auxiliary forces are rendered more regular and helpful by the removal of the partial inhibition due to the patient's nervousness and fear. There can be no doubt as to the beneficial effect of chloroform in aiding dilatation of the os, and in pre-

venting laceration of the cervix and perineum in cases of rapid and forcible expulsion of the child; it is now generally admitted that, by allaying muscular and nervous excitability, and by steadying and regulating the uterine contractions, chloroform often augments the power of each pain, and in the long-run quickens labour by warding off inertia. If chloroform is given early enough and in the manner to be described, hæmorrhage is less likely to arise than if the uterus were allowed to wear itself out and thus produce inertia.

The *choice* of anæsthetic to be used lies between chloroform and ether. From statistics gathered mainly from surgical sources, ether undoubtedly appears the safer, but chloroform in many ways is especially suited for obstetric work, and generally speaking is to be recommended. Deaths have occurred during labour under chloroform, some of which have certainly been due to chloroform poisoning, but in several cases the possibility of pulmonary embolism could not be excluded; vomited matter has been known to cause the death of a patient under chloroform by blocking the air-passages—an accident which might also occur with ether. Finally, among undoubted cases of death from chloroform narcosis, it must be remembered that in many the attention of the anæsthetist was not solely directed to its proper administration; it cannot be too strongly insisted upon that, in all cases where complete anæsthesia is necessary, the anæsthetist should neither operate nor assist in the operation.

The cases suitable for chloroform include certain "normal" labours (or rather, certain cases of delivery without instrumental or manual help), as well as most cases of operative midwifery. It may be given in "normal" cases which are accompanied by excessive

pains, especially in primiparæ, when the cervix and perineum are in consequence subject to great risk; also in cases when insufficient dilatation of the os has followed premature rupture of the membranes; in very nervous patients when the parts are exceedingly tender; in cases when the pains are very frequent but are of little expulsive value, and tend to exhaust the patient and to induce coincident uterine inertia; and, lastly, chloroform, to a slight degree of anæsthesia, is of the highest value in cases where cardiac valvular disease complicates labour. In instances of this kind the sedative action of the anæsthetic is most advantageous, and delivery can often be most satisfactorily completed, whereas, without chloroform, it would be fraught with the greatest risk to the mother.

In most cases of labour requiring operative assistance, chloroform is both admissible and advisable; that is to say, in labour *obstructed* by rigidity of the soft passages, by all kinds of pelvic deformity, by tumours of soft parts, and by fœtal malformations or malpresentations; also in cases of *eclampsia*, and in certain cases of hæmorrhage.

In cases of *obstructed* labour, operation under anæsthesia early in the second stage is to be advised, even after the dilatation of the os has been assisted artificially. In this way uterine inertia and hæmorrhage during or after the third stage can be avoided; but if, beside the obstruction, uterine inertia from prolonged labour has occurred, the possibility of post-partum hæmorrhage must be borne in mind, and preparation for its treatment should be made before the anæsthetic is administered. The hot douche must be ready, and plenty of ice should be at hand; the operator should remember that it may be necessary for him to proceed at once to remove the placenta and to bimanually compress and stimulate the uterus

during the douche. It is most important that the operator should inform the anæsthetist when the difficult stage of the operation is over—for instance, when the head has passed an obstructing brim, or when, in version, the leg is down and the child is "turned"—that little if any more chloroform will be needed.

Chloroform in *Eclampsia* has already been sufficiently advocated, but anæsthesia in patients the subject of *Hæmorrhage* requires some little discussion.

In cases of *post-partum* hæmorrhage with flaccid uterus, chloroform is certainly contra-indicated; as a general rule, it is best to do without anæsthesia, although in some cases of irregular contraction of the uterus the operator may find great difficulty in removing a retained placenta without the administration of a few whiffs of chloroform; also in some cases the surgical treatment of tears cannot be undertaken without anæsthesia. In cases of irregular uterine contraction, the hot douche will often prove of considerable help, and may obviate the necessity for chloroform. In many cases of post-partum hæmorrhage from laceration the proper treatment may be undertaken without an anæsthetic, but with excitable, muscular patients in the conscious state accurate suturing would be out of the question. Here some temporary hæmostatic treatment, such as plugging, may be employed until the patient is placed under the influence of chloroform.

The expediency of administering chloroform in cases of *hæmorrhage from placenta prævia* must be decided upon general principles. Ordinarily no anæsthetic is needed, nor would it be advisable if the patient is collapsed, but if there is severe bleeding through a small os uteri, chloroform will facilitate the performance of version; and further, presuming that

without chloroform a leg has been brought down through a partially dilated os, if the immediate completion of delivery be decided upon, the administration of an anæsthetic will lessen the risk both to mother and child.

In cases of *accidental hæmorrhage* the desirableness of administering an anæsthetic may became a question of the greatest importance. No anæsthetic is required in the simple cases, *i.e.* those in which the uterus can be stimulated into proper action (by proper action is meant contraction of the upper portion of the uterus with coincident dilatation of the cervix); but in grave cases, especially of concealed accidental hæmorrhage, where a flaccid uterus is almost always associated with an undilated or rigid os, the question of anæsthesia may become a serious addition to the responsibility of the accoucheur. If in a case of internal hæmorrhage with rigid os it is deemed desirable to effect immediate delivery, the first consideration is — should an anæsthetic be administered or not? On one hand, if an anæsthetic be administered a risk is thereby incurred of interfering with the contractile power of a uterus already predisposed to post-partum hæmorrhage; on the other hand, if no anæsthetic be given the process of dilating the os is very difficult: it involves loss of valuable time and probably produces severe laceration of the cervix. The consensus of opinion would be probably against the administration of an anæsthetic, and on good grounds if chloroform were alone available; but the question arises whether ether would not be of service. It most probably would, and in such a dilemma as we have imagined the attendant may be pardoned the use of even a dubious remedy, if without it he must either helplessly watch the patient go from bad

to worse, or to the risk of post-partum hæmorrhage from inertia add that of flooding from laceration of the cervix.

The administration of an anæsthetic during labour should be carefully and systematically conducted; in the case of operative midwifery it should be the duty of a special assistant. If possible there should be some preliminary preparation—the bowels should be evacuated by an enema, and no solid food should be eaten for some hours beforehand. All false teeth must be removed, and it is well to examine the heart —more especially to ascertain the "tone" of the cardiac muscle. Prominent parts of the face should then be protected from the local action of the anæsthetic by being smeared with vaseline or cold cream, and the patient must be encouraged to breathe quietly and fully—this is often facilitated by making her count from 1 to 20 or more, naming each figure after drawing a breath. Then when she is calm and breathing steadily—for giving an anæsthetic forcibly to a frightened patient cannot be too strongly condemned—a little of the chloroform may be poured on the lint (or into whatever apparatus be used), and the administration begun.

In the "normal" cases only a very slight degree of anæsthesia is required—usually it is sufficient to place the lint to the patient's face just at the commencement of each pain, and remove it before, or as soon as, the pain is over. In this way enough drowsiness is produced to satisfy the patient, and answer the purpose of the attendant; it is very seldom that the patient need be fully "under." Slightly more chloroform may be required in cases of rigid os, or of precipitate labour; but in no case should any anæsthetic be given after the head is born.

In operative cases complete anæsthesia is often

indispensable. The assistant must then keep the charged lint more or less close to the patient's face till the necessary stage is reached. From time to time, after the patient becomes unable to count, the anæsthetist should ascertain that the tidal air is of sufficient volume by roughly measuring it with his hand, the pulse should be watched, and the condition of the pupil and corneal reflex ascertained. When the patient is once "under," the lint may be removed now and then, as only little of the anæsthetic is required to maintain the patient in the proper state of unconsciousness. The object should be only *just* to inhibit reflexes and to keep the pupil about normal size; dilation of the pupil means either too much or too little chloroform—the patient is suffering either from chloroform poisoning or else from pain, or impending vomiting is indicated. If necessary, deep breathing must be promoted by pulling the jaw well forwards when the patient's head is turned on its side, or by pulling out the tongue by means of tongue-forceps. Should the patient make attempts at vomiting, it is best, if there is anything in the stomach, to allow her to complete the act; but if there be simple retching, such as is frequently produced by dilatation of the cervix, it may be readily quietened by a little more of the anæsthetic. Finally, as previously insisted upon, the anæsthetist should be told when the difficult part of the operation is over, so that no more chloroform be given, for it is generally best to rouse the patient before the third stage of labour is completed.

There only remains to be said a few words respecting the early signs of chloroform poisoning and its treatment. If the breathing and the colour of the patient are good, we know that all is well;

failing circulation speedily produces pallor, or even cyanosis, in spite of the respiratory movements continuing for some time. If therefore the pulse fails, or the slightest cyanosis appears, the inhaler must at once be removed; if the amount of tidal air is not materially diminished, the patient will, as a rule, rapidly come round. Should the recovery be slow, or the respiration appear to flag, immediate recourse should be had to artificial respiration, the injection of ether hypodermically over the heart, the application of hot cloths to the cardiac region, and the induced current applied, one pole to the region of the apex beat, and the other above the left clavicle; if these remedies are applied *sufficiently early*, recovery will almost always occur. The anæsthetist must be aware that everything depends on the early perception of cardiac or of pulmonary failure, and on the promptness with which appropriate remedial measures are taken. A special point to be remembered—one already suggested—is that in all cases of chloroform poisoning where there has been vomiting, it is of the utmost importance to clear out the pharynx, to invert the patient, to forcibly compress the chest, and then, whilst the patient is inverted, to carry out the measures above enumerated.

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