



**OBSTETRICS**  
**AND PERINATAL CARE**  
*FOR DEVELOPING COUNTRIES*

Saad Rana

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# 22

## CLINICAL COURSE OF LABOR: MECHANISM OF LABOR: Occiput-anterior Positions

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### CLINICAL COURSE OF LABOR

Normal labor at term seldom begins with the unexpected suddenness. There are usually premonitory indications.

#### Premonitory Signs and Symptoms

**Lightening.** Two or three weeks before the onset of labor the patient, especially if primigravid, experiences a feeling of "lightening". This happens due to the engagement of the presenting part. The uterus sinks lower in the abdomen with the result that the waist becomes lowered; the pressure on the diaphragm is diminished, giving greater ease in breathing and a sense of lightness. At the same time there may be increased difficulty in walking, and a recurrence of the frequency of micturition experienced in the early weeks (fig.22.1).

Careful abdominal examination will show that in the case of primiparous women the head is now "engaged". In multiparae, on the other hand, this engagement of the head does not usually occur until labor has actually begun. This difference is due to the fact that in a primigravida the lower segment commences to form before the onset of labor and this, combined with the greater tautness of her

abdominal musculature, allows the child's head to descend into the pelvic cavity. Non-engagement of the head at the start of labor, or few days before it, is a point of great significance and its cause should always be determined. The reasons of non engagement are:

- cephalo-pelvic disproportion;
- occipito-posterior position;
- placenta previa;
- pelvic tumor;
- polyhydramnios, and multiple pregnancies.

In the past, there has been emphasis on the importance of non-engagement of head in primigravida only, because, their pelvis has not been tested before and cephalopelvic disproportion is feared. This factor is equally important in multipara, particularly the grand multipara because:

1. The subsequent fetuses are heavier than the previous ones. A delivery of lighter fetus does not ensure the subsequent vaginal delivery of a heavier fetus.

2. There is subluxation at the lumbosacral joint in some women due to laxity of ligaments and weight bearing resulting in disproportion which did not exist at the time of previous delivery.

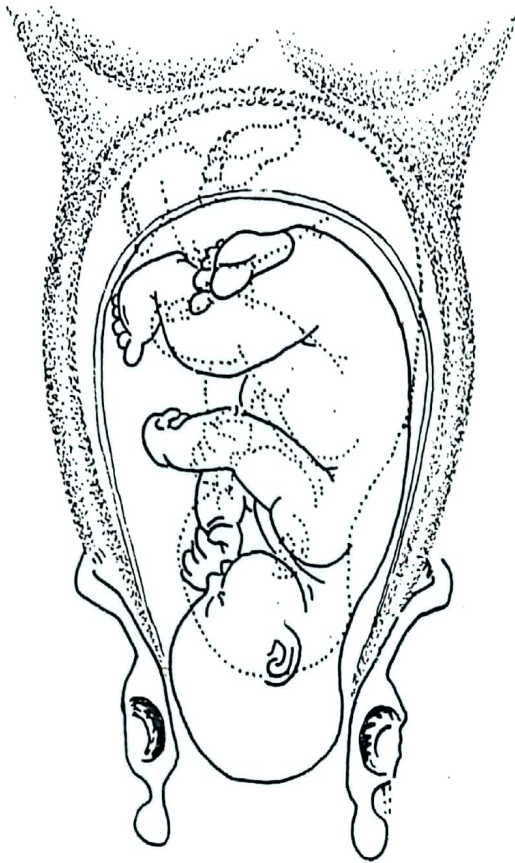


Fig.22.1: Lightening. Descent of unengaged head.

3. The uterine muscles in multipara are comparatively lax and weaker due to greater amount of fibrous tissue, deposited with each previous pregnancy. Such uterus does not stand the stress of labor as well, as the stronger uterine musculature of the primigravida in case of disproportion and rupture of uterus occurs much earlier, sometimes immediately after the onset of labor. The uterine musculature of young primigravida is much stronger and can stand the stress of labor much better. Therefore, contrary to the general impression, the multipara needs, if not greater, as much care and supervision as the primigravida in cases of non-engaged head.

During the last few days there is a marked increase in the secretions of the genital tract, and the vulva becomes moist and succulent, and more gaping than formerly.

**Show.** There is slight discharge of blood

stained mucus from vagina few days before the onset of true labor. It represents the mucus plug that fills the cervical canal during pregnancy and is extruded out of cervix on effacement or slight dilatation of cervix. The amount of blood is nearly always slight, but heavy shows are occasionally seen. Substantial bleeding should not be ignored and pathological cause should be excluded.

**Abdominal discomfort and pain.** Before the establishment of true labor, pregnant women feel low abdominal discomfort and intermittent pains. These are felt from few days to few weeks before the true labor. They are nearly an exaggeration of the relatively painless intermittent uterine contractions that occur throughout pregnancy. This discomfort is bearable and is relieved by analgesics.

**False labor.** In late prenatal period, particularly last four weeks of gestation, many women feel painful uterine contractions. They are intermittent and regular like labor pains but lack the effectiveness, i.e. the effacement and dilatation of cervix does not take place. Both upper and lower segments contract at the same time unlike the true labor contractions. This condition is called false labor. These contractions are usually felt at night when the woman is resting and are felt more in the back rather than the front. They are not progressive and their frequency and intensity does not increase with passage of time.

### Stages of Labor

Although labor is a continuous process, it is divided into three functional stages for management purpose (fig.22.2):

1. The first stage is the *stage of dilatation*. It is the time interval between the onset of painful uterine contractions associated with cervical changes to full dilation of the cervix. It is subdivided into two phases:

a. *latent phase* is the time taken for cervical

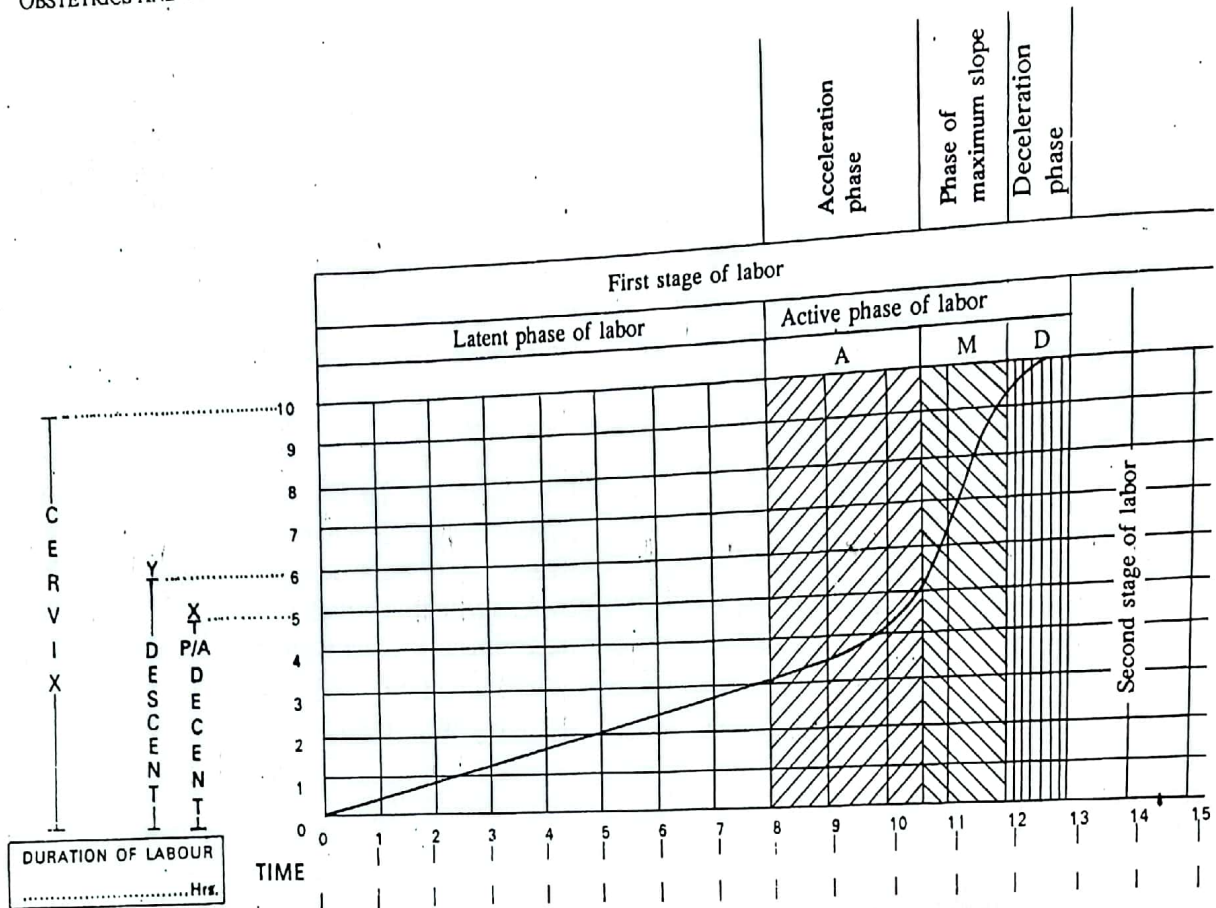


Fig.22.2: Stages of labor and the normal cervicogram.

- effacement and for it to dilate to 3 cm;
- b. *active phase* during which there is more rapid dilatation of the cervix. It starts at 3-4 cm and the rate of cervical dilatation is equal to 1 cm/hour or more.

2. The second stage is the stage of expulsion of the child. It is the time taken from complete dilatation of the cervix to the delivery of the infant. It also consists of two phases:

- a. *Pelvic phase or the phase of descent* during which the head rotates as it is pressed on the gutter shaped forward sloping levator ani muscles.
- b. *Perineal phase or the outlet phase* when the head is on the thinning pelvic floor and the perineum and becomes visible.

3. The third stage is the period from birth of infant to delivery of the placenta and membranes.

Most postpartum complications like postpartum hemorrhage and perineal vulval hematoma tend to occur in the first 2 hours after delivery of the placenta and hence the mothers are observed in labor ward during this period. The uterus has sustained contraction after delivery of placenta and may relax and contract to empty itself of blood if collected inside. These pains may be felt by woman. Some authors prefer to call this period as *fourth stage*, but is a misnomer as there is no process of labor at this stage.

**Prelabor** is a period of few weeks before active labor during which increased uterine activity occurs. This leads to softening of the cervix, expansion of the isthmus and supravaginal cervix allowing formation of the lower uterine segment.

**First stage.** The onset of labor is marked by

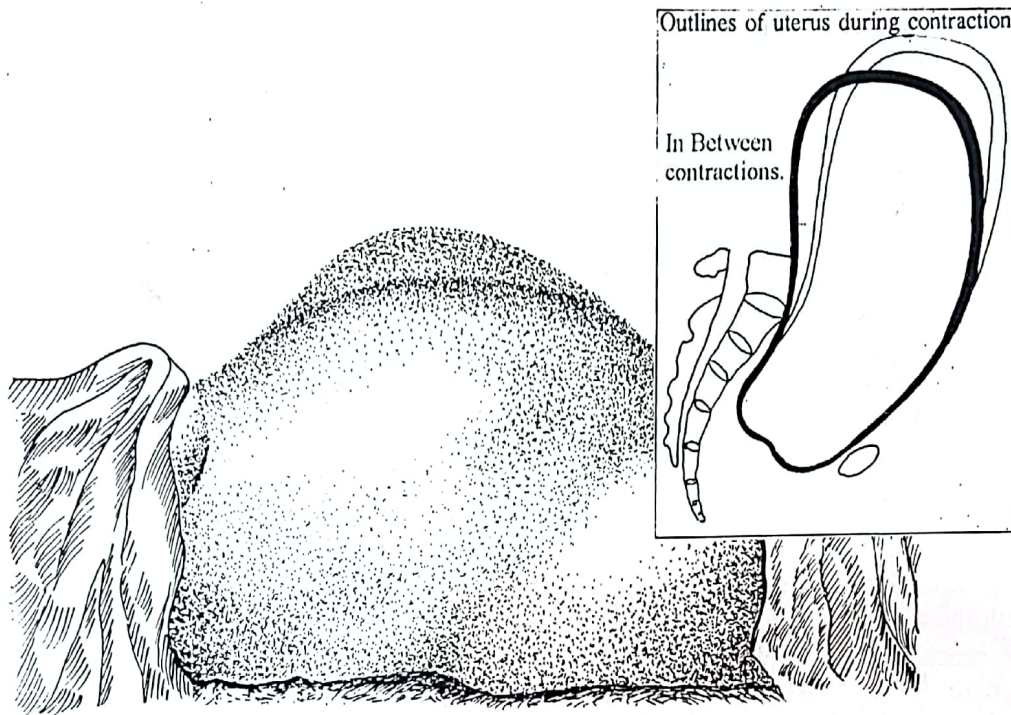


Fig.22.3: Abdominal shape during uterine contraction. Dotted line shows it without contraction. Inset shows uterus during and between contractions.

the occurrence of periodic pains due to the contractions of the uterus and therefore synchronous with a hardening of that organ which can be felt by a hand placed on the abdomen. This is a very important point in the diagnosis of labor. Whenever the uterine muscles contract, the round ligaments also contract. Because the round ligaments are anchored to the lowermost part of the anterior abdominal wall, they pull the uterus forward with each contractions. The uterus pushes the anterior abdominal wall forward as its long axis is aligned with that of the birth canal (fig.22.3). At first the pains are but slight, and may be mistaken for colic. They are short, mild, occur in every 10-20 minutes, and are not very painful. The woman may walk about and remain quite comfortable between pain. As time goes on, they become more severe and more frequent, beginning in the back and passing round to the front of the abdomen and thighs. These contractions bring about the dilatation of the cervix, and this is usually accompanied by marked "show" from the

separation of the fetal membranes immediately inside the internal os, and from minute lacerations of the cervical mucosa. There is also rupture of some capillary vessels in the cervix and also from the area where the membranes have separated from decidua. The commencing dilatation of the cervix and the show are two more points in the diagnosis of labor. The uterine contractions, although physiological are painful. The common designation in all languages for such contractions is pain. The cause of pain is not definitely known. The following mechanisms may be involved.

1. Hypoxia of muscles as in angina.
2. Compression of nerve ganglion in cervix and lower uterine segment by the tightly interlocking muscle bundles.
3. Stretching of cervix.
4. Stretching of peritoneum.

As the labor advances, the pains recur at decreasing intervals recurring every 3-5 minutes and become stronger and longer. They

are excruciating and difficult to bear. As the pains become more frequent and severe, the patient begins in most cases to cry out during the pains; and to seek relief by sitting bent forwards, or leaning against some piece of furniture. Pressure over the sacrum seems to give slight ease. Towards the end of the first stage she probably may prefer to lie down. This stage may occupy from twelve to eighteen hours. At the end of it there is commonly a sudden gush of fluid, indicating that the fetal membranes have ruptured, and the forewaters, or that portion of the liquor amnii lying in front of the head, have escaped. This rupture of the membranes usually synchronizes with the full dilatation of the cervix, and therefore with the end of the first and the beginning of the second stage. Sometimes the membranes rupture earlier, particularly in cases of malpresentation; at other times they may remain intact until well on in second stage, rarely even until the child is expelled, and require to be ruptured by the attendant.

**Second stage.** The pains often stop for a few minutes after the rupture of the membranes, and then begin again with greater intensity and frequency. The pains are severe and long, lasting 50-100 seconds and occurring at intervals of 2 or 3 minutes. They gradually become more expulsive or "down-bearing" in character, and the abdominal muscles are brought into play to help the expulsive efforts. At first the abdominal muscles are under the control of the patient's will, but later their contractions become quite involuntary, like those of the uterus.

As the pain comes on, the patient braces herself by holding on some solid object, or pressing her feet against the foot of the bed. She then takes a deep breath and holds it as long as possible. The diaphragm is thus fixed and the intra-abdominal pressure brought to bear on the expulsion of the child. As the pain passes off she relaxes the spasm of the glottis and diaphragm, and takes several deep breaths. The face during a pain becomes deeply

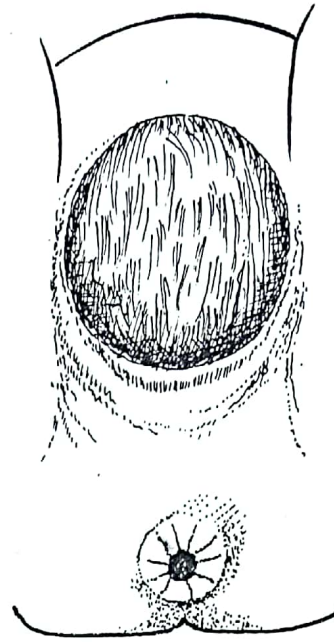


Fig.22.4: Crowning of head.

congested, and the patient perspires freely.

The effect of these pains is to drive the head through the cavity of the pelvis. As it descends it presses upon the rectum, and unless that organ has previously been thoroughly emptied, the patient feels a desire to defecate, and the feces are squeezed out during each contraction. As the head comes farther down it presses on the perineum, which begins to bulge a little during the pains. The vulva also begins to gape more. In the intervals between the pains, which become shorter as the pains become longer and more frequent, the head recedes a little, but with each succeeding pain it is driven a little farther down. Thus the peri-neum bulges more and more, and the vulva gapes more and more, and after a time the scalp can be seen when the head is forced down vulvar opening during successive pains, that opening becomes transformed from a slightly gaping slit to an oval, and ultimately an almost circular opening. With the cessation of each contraction the opening becomes smaller and the head recedes, to advance again with the next pain. As the head becomes increasingly visible the vulva is stretched further until it ultimately encircles the largest diameter of the baby's



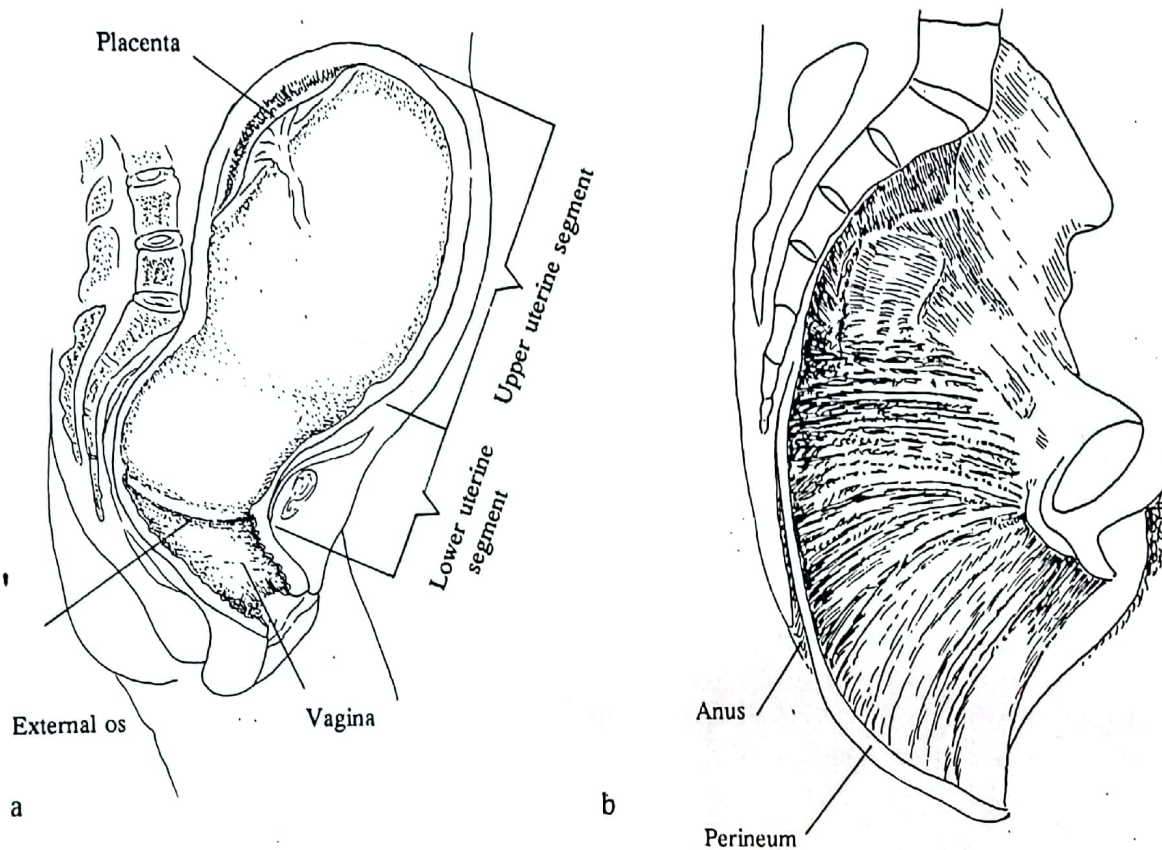


Fig.22.5: Birth canal in second stage of labor. It is directed downwards and backwards in its upper part, directly downwards in middle and downwards and forwards in the lower part. a. Shows position of uterus as well. b. Cross section showing muscles of lateral wall.

head. This encirclement of the largest diameter of the fetal head by the vulvar ring is known as *crowning* (fig.22.4). The perineum meantime has been so pressed upon anterior margin. Here it is often no thicker than a piece of notepaper at the moment of birth. Behind it the anus becomes stretched into a large D-shaped opening, and the anterior wall of the rectum is seen bulging through it. The perineum becomes converted into a deep gutter 5 to 6 cm long (fig.22.5). At the end of this is the vulvar opening, directed forwards, and distended by the fetal head. The distention of vulva is more marked at its peri-neal margin than at its upper and lateral parts.

As the head advances, the occiput becomes pressed against the under margin of the symphysis pubis. The alternate advance and recession of the head during and between pains go on until the largest diameter of the head is forced through the vulva by a strong pain. After that there is no recession, and the

head is rapidly born by a movement of extension of the neck, the bregma, brow, and face of the child sweeping in succession over the perineum. This is the moment of most excruciating agony to the mother.

After head is born there is a short pause during which the face of the child becomes congested. This happens because the perineum has retracted round the neck of the infant. An inexperienced obstetrician often becomes impatient and attempts to complete delivery rapidly by traction upon the head. It is usually unnecessary as the next pain effectively forces the anterior shoulder down. Very soon, however, pains recur, and the head rotates so that the face usually comes to look towards the mother's right i.e. if she is on her left side, the face looks upwards (fig.22.6). This indicates that the shoulders are coming into the long antero-posterior diameter of the outlet. The anterior shoulder is now pressed against the symphysis, and the posterior shoulder is

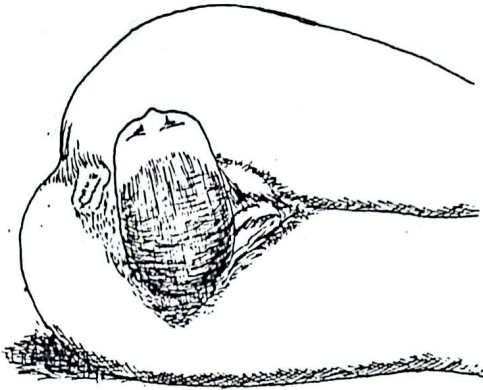


Fig.22.6: Head after delivery. The patient is lying in left lateral position.

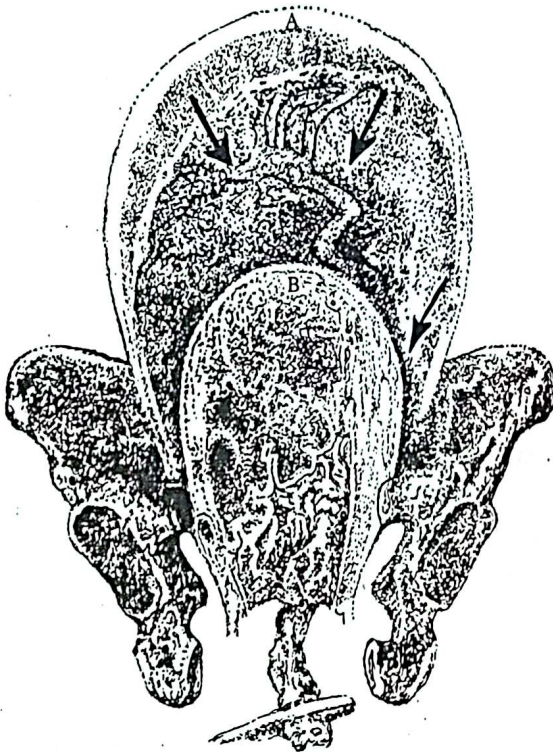


Fig.22.7: Uterus before (A) and after (B) separation of placenta. Arrows point out umbilical cord.

born by being swept over the perineum. The trunk and lower limbs of the child follow almost at once, and then comes a gush of the remainder of the liquor amnii, which did not escape at the rupture of the membranes.

The second stage occupies two or three hours in a primipara, but in a multipara may be very much shorter. At the end of the second stage the retracted uterus may be felt as a firm ovoid tumor extending up to just

below the umbilicus.

**Third stage.** There is usually a slight flow of blood immediately following the birth of child. There is now usually a short cessation of pains, with a corresponding relief to the patient. Ultimately, however, the uterus begins to contract again, and may be felt by the hand to grow more hard and solid. In the intervals it becomes softer, but should never become at all flabby in ordinary circumstances. The uterus becomes a firm discoid mass just below the level of the umbilicus. It resumes a globular shape after relaxation. With each subsequent contraction the uterus changes from globular to discoid (fig.22.7). The globular shape persists after the separation of placenta. Frequently there are little gushes of blood during the pains, indicating the separation of the placenta, but sometimes there is no bleeding. In the end the placenta is expelled by a strong pain into the vagina, where it may remain. More usually the uterine force is sufficient to expel it right through the vagina to the outside. If the placenta remains in the uterus following its separation, further clinical changes occur. The fundus of the uterus rises upto or above the umbilicus, or 3 to 4 cm above its original position. A slight prominence appears immediately above symphysis pubis. The length of umbilical cord protruding from the vulva increases by 10 to 12 cm. These changes indicate that the placenta has been extruded from the upper portion of the uterine cavity into the lower uterine segment or in the vagina. The fundus rises because the lower uterine segment which had collapsed upon itself, distends by the placenta and mechanically lifts the tightly contracted body of the uterus to a higher level. There are thus four cardinal signs of separation of placenta.

1. The uterus becomes globular instead of discoid in shape.
2. Bleeding which may come as gush or merely trickle.

3. Increase in length of umbilical cord.
4. Rise of uterine fundus.

The third stage may occupy anything from a few minutes to an hour, or even more. The average is about twenty minutes. During it the woman may have a shivering fit, the "physiological chill" of labor. This is due to the cooling of the body surface by the perspiration, combined with the effects of the severe muscular exertion.

### Duration of Labor

The average duration of labor in multiparae is about twelve hours but in primiparae the process occupies about six hours more say eighteen hours on an average. The distribution of this duration in three stages is shown in table 22.1.

## THE FACTORS OF LABOR

There are certain important phenomena in each stage of labor which need to be understood:

### *First Stage of Labor*

- the uterine contractions;
- the functional development of the lower uterine segment;
- the formation of the bag of waters;
- and the canalization of the cervix.

### *Second Stage of Labor*

- the contractions of the abdominal muscles;
- the rupture of the membranes;
- the descent of the fetus;
- the dilatation of the vagina;
- and the displacement of the pelvic floor.

### *Third Stage of Labor*

- the separation and the expulsion of the placenta;
- arrest of hemorrhage.

Two or more of these events are always

Table 22.1: The duration of three stages of labor.

	Primipara	Multipara
First stage	15-16 hours	10 hours
Second stage	2 hours	1½ hour
Third stage	half hour	half hour

coincident, but for purposes of description they must be studied separately.

The numerous factors involved in their production may conveniently be studied under three headings:

- I. the powers or forces concerned;
- II. the changes which these produce upon the passages;
- III. and the movements of the passenger, i.e., the fetus and other contents of the uterus.

### I. The powers

Two sets of forces are brought into play in labor.

1. The action of the musculature of the uterus or primary powers.

2. The action of the abdominal muscles or secondary powers.

In the first stage only the primary powers are involved, namely, *the contractions and retraction of the uterine muscle*.

During the greater part of pregnancy intermittent contractions are passing over the uterus from time to time. The contractions during labor are simply an exaggeration of these, increased to the point of being extremely painful, and modified in as much as the uterine muscle retracts as well as contracts. Retraction is a characteristic of the muscle of the uterus and bladder. It means that a certain amount of the shortening produced by contraction is permanently retained, the muscle fibers becoming shorter with each contraction and not relaxing back quite to their original length (fig.22.8). There is thus during labor a

progressive diminution in the capacity of the uterus, which is one of the principal factors in expelling its contents. The contractions of the uterus are probably peristaltic in nature, passing from fundus to cervix, but this feature can rarely be made out clinically in the human being. When the uterus is inspected prior to its incision at Cesarean section performed under local anesthesia, such peristaltic contractions may occasionally be observed. By electrical recordings made at several points simultaneously it has been found that, once true labor has begun, the strength and duration of the contractions are always greater in the fundus than in other parts of the uterus.

Clinically, however, a typical contraction has definite characters. It begins gradually, and becomes more and more marked until it reaches its acme. This is maintained for a moment or two, and it then gradually ceases, and there is an interval, followed by another contraction. There is thus a sort of cycle-increment, acme, decline, interval (fig.22.9). The value of this intermittent character is enormous:

- gives rest to the mother;
- relieves the pressure on the child;
- and in the second stage when the abdominal muscles are brought into synchronous action, it permits the restoration of the placental circulation, which is stopped at the acme of the pain.

For survival of the fetus, it is essential that the interval between contractions is long enough to permit adequate passage of oxygen to the fetus. Normally rate of contraction in uterine muscle is such that adequate relaxation usually occurs during which circulation in uterine vessels is restored. That the child is killed by a too prolonged contraction which stops the circulation is seen in cases where the uterus undergoes a tetanic contraction as a result of the misuse of ergot or some other cause. In normal uterine action, pain is not experienced until the uterine contraction is well established, and it ceases before the

contraction has fully passed off. This<sup>1</sup> can easily be appreciated by a hand placed on the abdomen during a contraction.

Another law which governs the contractions during labor is that as labor advances the pains become longer, stronger, and more frequent; the intervals between them becoming shorter. At the beginning of labor the contractions may last perhaps thirty seconds, and come at intervals of ten or twenty minutes, or even more. Towards the end they last for sixty to ninety seconds, and come every one or two minutes (fig.22.10 & 22.11). In most languages the word "pain" is popularly used as a synonym for "uterine contraction", because the suffering is the most noticeable feature to the patient. The suffering is due to the muscle fibers squeezing the nerve endings in the uterine wall just as in cramp. In the second stage, especially as the head is being born, the pain is increased by the excessive stretching of the birth canal, and the most agonizing suffering is at the moment when the head is passing over the perineum.

The amount of pain felt seems to vary with different individuals, and very occasionally there is none. The mental attitude of the patient is important in making her either more or less able to bear pain. The woman who regards reproduction as a purely natural physiological function probably has, for that very reason, an easier time.

In the second stage the primary forces of the uterus are supplemented by the secondary powers, i.e., the contraction of the diaphragm and abdominal muscles. In many cases these secondary powers are the main driving force; that is why a second-stage pain differs so much from the earlier pains. As already explained, the action of these muscles is, to begin with, under the voluntary control of the patient, who can materially shorten her labor by deliberately "bearing down" or straining. Later the muscles come into action involuntarily and act reflexly in concert with the uterus. The amount of force exercised by the secondary powers varies greatly in individual

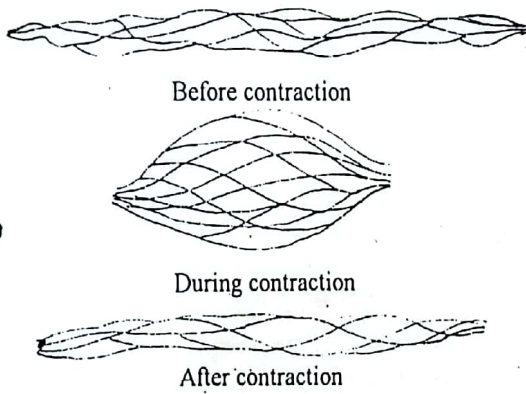


Fig.22.8: Muscle fibers in state of contraction and retraction.

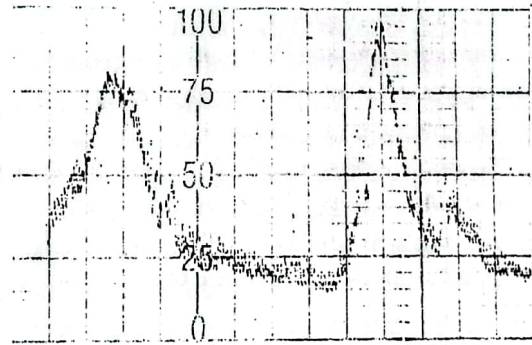
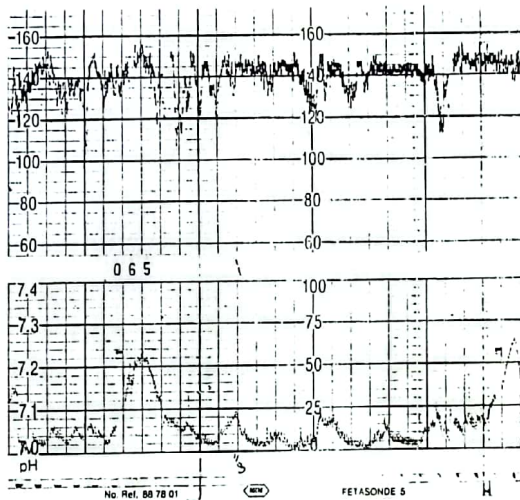
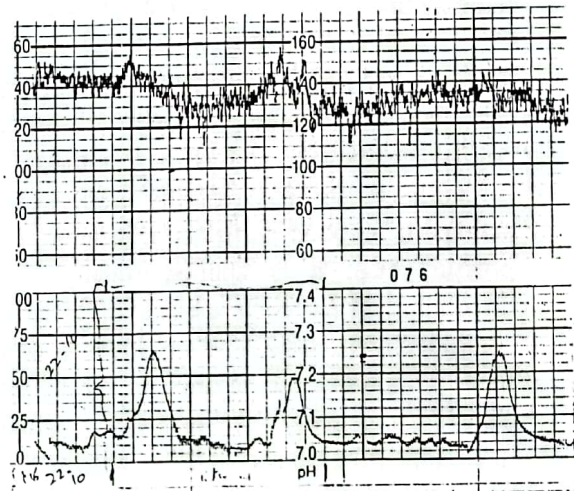


Fig.22.9: Typical uterine contraction showing increment, acme and decline followed by an interval.

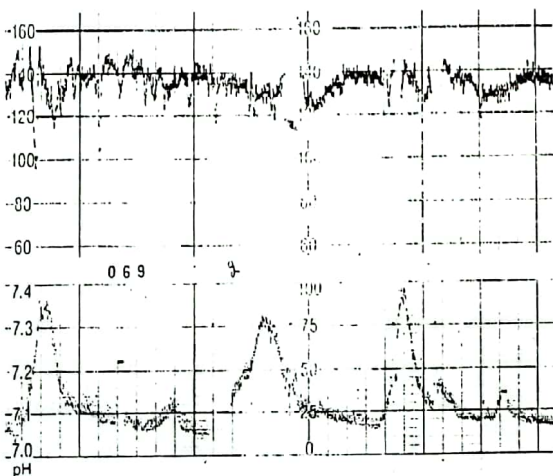


a

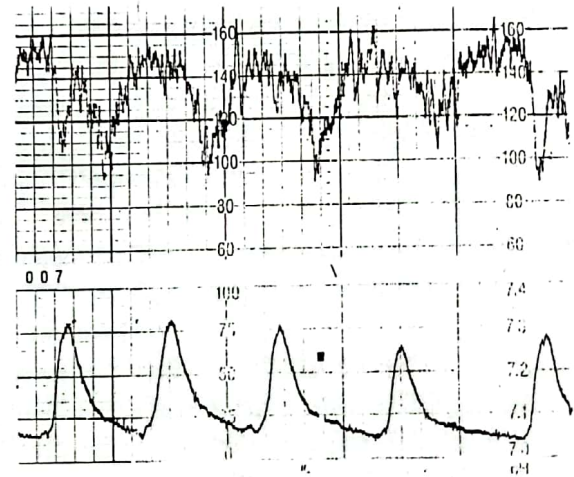


b

Fig.22.10: Cardiotocograph showing frequency and intensity of uterine contractions in first stage of labor. a. early first stage. b. late first stage.



a



b

Fig.22.11: Cardiotocograph showing frequency and intensity of uterine contractions in second stage of labor. a. early second stage. b. late second stage.

cases, due to different degrees of muscular development and of voluntary cooperation by the patient. While labor can, as in paraplegics, be completed normally without the aid of the secondary powers, yet there is no doubt that they are of very great value. When they are feeble or are not adequately used by the patient owing to fear, more frequent recourse has to be had to instrumental interference (forceps). It is important for doctor and nurse to be able to recognize second-stage pains as such without having to have recourse to vaginal examination.

*Nature of the transmission of force.* During the first stage the fetus is entirely enclosed in the bag of membranes, and as long as the cervix is undilated, the force of the uterine contractions is applied to it as a general fluid pressure, i.e. it is applied equally in all directions. Were such a state of affairs to continue, there would be no advance of the fetus. This, however, is obviated by the stretching of the lower uterine segment and the dilatation of the cervix transforming the lower pole of the uterus into an area of diminished resistance, and thereafter the fluid pressure acts downwards on the cervix (fig.22.12).

After the rupture of the membranes much of the fluid is kept back by the accurate fit of the head into the lower segment of the uterus, and above this level the uterine force continues to be transmitted as a general fluid pressure. But if much of the fluid has drained away, the fundus of the uterus comes into direct contact with the breech of the child, and some of the force is then directed downwards through the axis of the fetus itself (fig.22.13).

*Force of the uterine contractions.* The force of strong labor pains is on average, 470 pounds acting perpendicularly upon "the head". The total intra-amniotic pressure may be measured during labor by inserting a fine plastic catheter above the presenting part and connecting this to a recording apparatus. During the first stage of labor the basal intra-uterine pressure lies

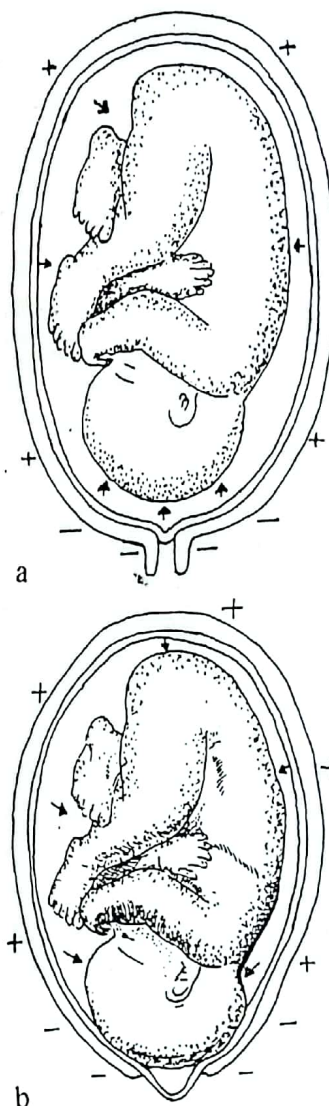


Fig.22.12: Transmission of the force of uterine contractions to the fetus through liquor amnii. a. Closed cervix, b. Cervix opening up under the influence of hydrostatic pressure.

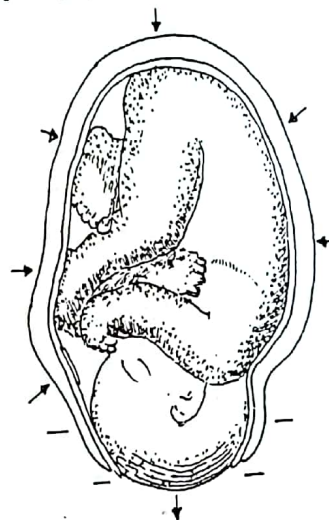


Fig.22.13: Transmission of the force of uterine contractions directly through fetal axis after rupture of membranes.

between 4-10 mmHg. First-stage contractions raise the pressure to between 40-90 mmHg. During the second stage there is no increase in tonus but with the appearance of the secondary powers the pressures recorded during the acme of a second-stage contraction may reach 120-180 mmHg. The placental circulation ceases at an intra-amniotic pressure of about 80 mmHg, so that if this pressure is exceeded too frequently and for too long embarrassment of the fetus occurs as adequate oxygen transport to it ceases.

### Clinical Phenomena During a Strong Contraction as Happens in Second Stage or Late First Stage

1. The arterial pressure is raised.
2. The pulse is quickened, to become slower again in the interval.
3. Respiration is slowed or stopped during the acme, to become more rapid afterwards.
4. The intra-uterine pressure is raised.
5. The fetal heart-beat is slowed owing to interference with the maternal blood supply to the placenta.
6. The uterine souffle becomes louder and more high pitched at the start, but inaudible during the acme, as the circulation is momentarily stopped.
7. The uterus becomes narrowed and elongated, and rears itself slightly forward so that its long axis is brought to lie in the axis of the pelvic inlet (fig.22.3).

### II. The passages

In many cases the lower portion of the body of the uterus, particularly the anterior wall, becomes thinned during the last two or three months of pregnancy. There is no definite boundary between the thick part and the thin, but merely a gradual diminution in the thickness, which is most noticeable in the 5 cm (2") immediately above the internal os. This thinned region is the *lower uterine segment*. In other cases no lower segment is definitely

recognizable before the beginning of labor, but it becomes clearly and fully developed only after labor has begun.

The internal os remains closed until the beginning of labor, except in some few cases in which the painless contractions in the last few days or weeks of pregnancy result in the upper part of the cervical canal being expanded.

Normally, therefore, there is at the beginning of labor a narrow cervical canal closed above at the internal os, which leads into the cup-shaped lower pole of the uterine cavity. During the first stage of labor these two parts become opened out so as to form one continuous canal (fig.22.14). In order that a hollow and practically closed organ like the uterus may expel its contents, it is essential that there be a weak area to determine the direction of movement of the contents and an adequate opening through which they may pass, otherwise the effects of the contractions would be merely to raise the intra-uterine pressure without causing any expulsion of its contents. In the case of uterus, nature provides the lower uterine segment as the weak area and in the center of it the opening of the internal os leading to the cervix, which is the channel of exit. The first stage of labor is devoted to the dilatation of this channel of exit; the canalization of the cervix and the development of the lower uterine segment. The interaction of the various factors involved can best be understood by considering the following points in order:

- the polarity of the uterus;
- the development of the lower uterine segment;
- the formation of the bag of waters;
- and the opening up of the internal os.

By the term *polarity* is meant that when the body of the uterus is in a state of contraction the cervix is in a state of relaxation, and vice versa. The same principle applies to other hollow organs like the bladder and rectum. During pregnancy the body of the uterus

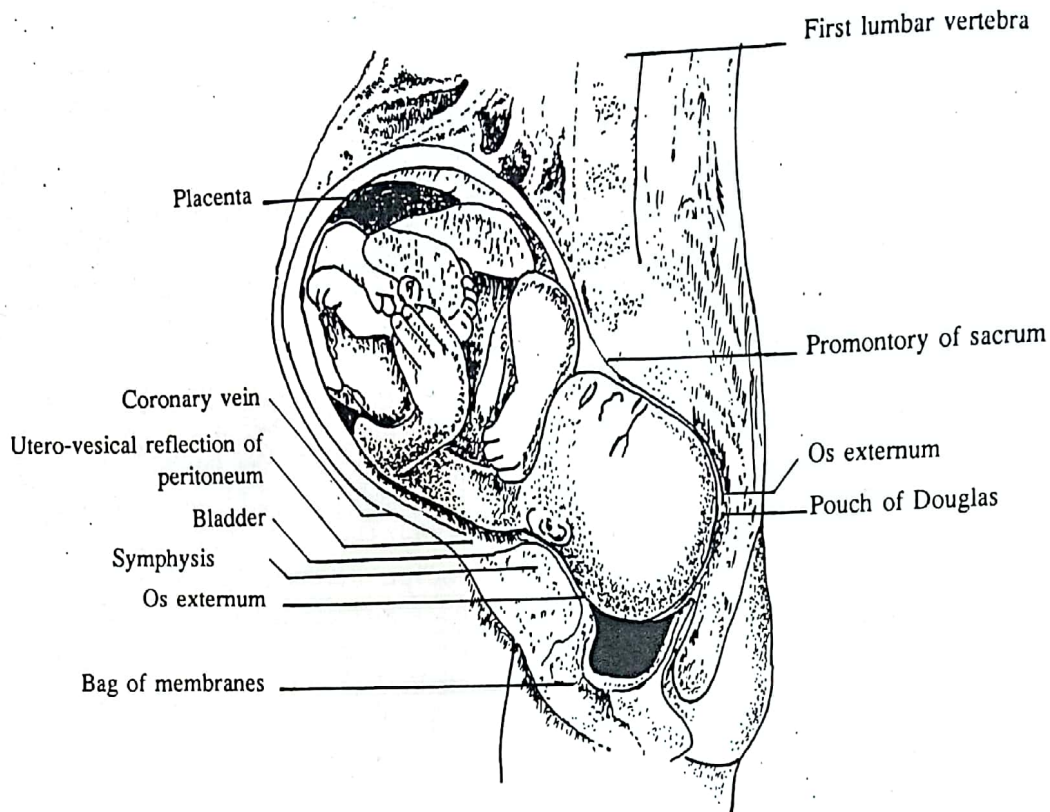


Fig.22.14: Bag of membranes after full effacement and more than half dilation of cervix.

may be said to be in a state of relaxation (except for the intermittent contractions) and the cervix in a state of contraction. During labor the reverse obtains, the body contracting and the cervix relaxing. The principle is made use of in treatment when elective dilatation of the cervix is employed to set up contractions of the uterus. The polarity of uterus is a nervous function and therefore subject to interference from emotional or other causes affecting the nervous system.

**The lower uterine segment.** The portion of the body immediately above the internal os is an area of diminished resistance. This part of the uterus may actually be thinner than the rest before labor begins, but in any case it becomes progressively thinned after labor begins. This is largely due to the weakness of its structure, which makes it practically passive during labor. The muscle fibers of the lower segment are mostly longitudinal, and arranged in parallel lamellae with no great proportion of transverse fibers to give strength

and cohesion to it. The result is that when the upper segment contracts and retracts the weak lower segment is pulled upon, and stretched, and expanded.

The presence of the lower uterine segment is essential to the easy expulsion of the uterine contents. But for its presence as an area of diminished resistance, the contractions of the uterus would merely compress its contents, for the direct downward drive of the uterus is, owing to the arrangement of its muscle fibers and the nature of the transmission of its force, comparatively small. But the weakness of the lower uterine segment and the internal os that is to say, their diminished powers of resistance as compared with the upper segment naturally leads to the general fluid contents pressure exerting special influence upon them, and as the internal capacity of the upper segment gradually diminishes with the retraction of its walls, the uterine contents tend to be squeezed downwards into the lower segment and thus directed towards the point of exit.

A second way in which the lower uterine



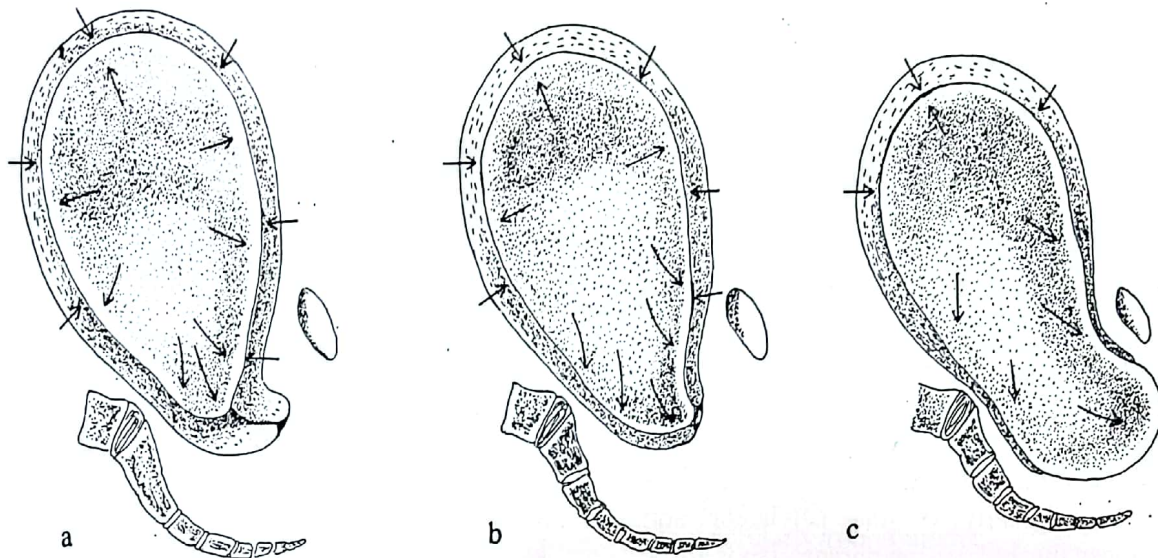


Fig.22.15: The hydrostatic action of the fetal membranes and liquor amnii. a. Closed cervix, b. Effaced cervix, c. Dilated cervix.

segment promotes the progress of labor, is that it transmits to the margin of the internal os the stretching force resulting from the contractions and retraction of the upper segment. It is vital that the musculature of the upper segment should have its characteristic tangled arrangement in order that it may control hemorrhage when the placenta separates. But this has the disadvantage that it deprives the upper segment of any direct pull on the internal os and of any great degree of direct downward drive on its contents. These are achieved by:

- a. the progressive shrinkage (retraction) of the upper segment and;
- b. the progressive diminution of its capacity.

The result of (a) is transmitted as a "pull" through the lower segment to the internal os, while the simultaneous effects of (b) is to squeeze the uterine contents in the direction of least resistance.

**Bag of waters.** The inside of the uterine cavity is lined by the fetal membranes fused to the decidua. Accordingly, when the lower uterine segment becomes stretched and its surface area enlarged, the attachments of the

membranes to the decidua are torn through, because the same contractions which stretch the lower segment by pulling it up tend also to push down the membranes and their fluid contents. The separation of the membranes from the lower segment is the origin of the "show".

As soon as the internal os begins to open, this detached portion of the membranes and its contained fluid bulge into the opening. Each successive contraction makes this "bag of waters", with its incompressible fluid contents, protrude more into the upper part of the cervical canal, and in this way it acts as a fluid wedge for the forcible canalization of the cervical canal (fig.22.15).

It is worthy of notice that the pressure of the bag of waters on the margin of the internal os appears to excite uterine contractions, as also does the pressure of the presenting part when it begins to descend. This reflex mechanism is important, as is shown by its absence in some malpresentation associated with pre-labor spontaneous rupture of the membranes.

In a primigravida the whole cervical canal is expanded into a funnel before the external os begins to open. Sometimes, indeed, the cervix is so thinned out that the edge of the os externus feels no thicker than parchment. Ulti-

mately, however, the os is dilated by the bag of water like the rest of the canal.

In a woman who has previously borne a child the external os is usually partially open from the very beginning of labor, and its complete dilatation quickly follows upon the canalization of the cervix (fig.22.16).

During the first stage the bag of waters may be felt by the examining finger as soon as the external os begins to open. It is best felt during a pain, when it become tense, and shaped like the convex surface of a tent. In malpresentations, and in cases where there is some abnormality of the pelvis or soft passages, the bag of membranes tends to be more elongated, and may occasionally resemble a sausage or glove-finger. The reason of this is that in a vertex presentation the head accurately fits the lower uterine segment and the brim of the pelvis, and has a "ball valve" action in preventing any great quantity of the liquor amnii from getting past it. That is to say, that each contraction which tends to squeeze the liquor amnii past the head also forces the head so accurately into the lower segment that not more than a drop or two of fluid is allowed to slip past. In this way the quantity of the forewaters is only very gradually increased, and the elasticity of the membranes preserves them intact until the cervix is fully dilated.

In cases of malpresentation or of deformity of the pelvic brim there is less accuracy of fit between the presenting part and the lower uterine segment, and a considerable quantity of the liquor amnii is forced past the presenting part with every contraction. The membranes yield before this rapid increase of pressure, and bulge through the incompletely dilated os in a sausage shape. Such membranes usually rupture early before the end of the first stage.

The time taken for dilatation of the external os to the size of 4 cm is usually greater than that required for the remainder of the dilatation, because the bag of waters is better formed and the uterine contractions are stronger and more frequent in the latter period.

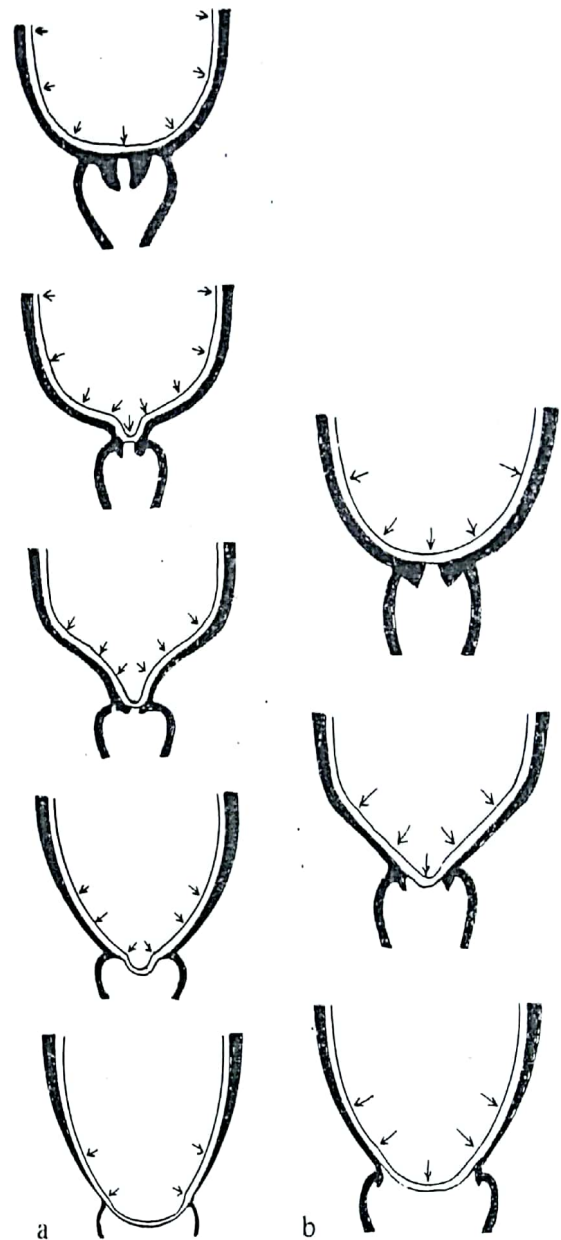


Fig.22.16: Changes in cervix in labor. a. Primipara, b. Multipara.

**Rupture of the membranes.** This most commonly occurs as soon as the cervix is fully dilated, and the escape of the forewaters is thus in many instances a clinical indication of the beginning of the second stage. It must be clearly understood, however, that this is not necessarily the case. The membranes often rupture long before the complete dilatation of the cervix. In other cases they may remain intact long after the beginning of the second

stage, and even require to be ruptured artificially at the vulva in order to allow the escape of the child. The rupture of the membranes is brought about by the increasing force of the uterine contractions and the increasing fluid pressure inside the bag of waters on the one hand, and by the diminished support offered by the dilated cervix on the other.

In all cases, but particularly after the prelabor spontaneous rupture of the membranes, the presenting part itself shares in the dilatation of the cervix. But no presenting part is so effective as the fluid wedge of the forewaters, and "dry" labor often tend to be prolonged.

**The retraction ring.** It has already been explained that the faculty of retraction possessed by the muscle of the body of the uterus leads to a progressive diminution in the capacity of the uterine cavity, which causes the fetus to be pressed down into the yielding lower segment. At the same time the surface area of the wall is progressively diminished a process which ultimately leads to the separation of the placenta in the third stage.

The progressive shortening and thickening of the upper segment of the uterus so produced is attained in part at the expense of a corresponding expansion and thinning of the lower uterine segment, in part by descent of the fetus. As labor advances the lower edge of the thickened upper segment becomes more and more clearly demarcated from the thinned area below it, until it comes to form a sort of ridge running round the uterus. This ridge, known as the retraction ring or Bandl's ring, is never palpable externally in a normal labor, although it may sometimes be possible to recognize a difference between the consistency of the thick, firm upper segment and the rather fluctuant feeling of the lower on abdominal examination. It will readily be understood that the more the lower uterine segment is distended and thinned, the more prominent does the retraction ring become, and the higher does it go owing to non-descent of the fetus.

The retraction of the upper segment is wholly at the expense of the lower segment. The lower segment is apt to be unduly expanded, and the retraction ring may be seen and felt as a transverse ridge on the abdomen, rising higher and higher as the excessive expansion of the lower segment, with the probability of its rupturing unless delivery be speedily accomplished.

In structure and function the upper and the lower segments of the uterus afford an interesting contrast (table 22.2). Boundary between upper and lower segments are marked by the retraction ring, and sometimes by a vein running circularly round uterus.

*Origin of the lower uterine segment.* The origin of the lower uterine segment was long a matter of doubt and a subject of great controversy. It is now accepted that the lower uterine segment, as it is called in labor, corresponds to the isthmus in the non-pregnant uterus. This isthmus in the non-pregnant state is the short tubular canal, about 5-10 mm long, immediately above the internal os. Its lining is similar to that of the body, but it is said to take little part in menstruation and to be less affected by the decidual change than the endometrium of the body proper. The isthmus becomes opened out after the third month of pregnancy so as to form a component part of the uterine cavity, but its mucosa is throughout thinner than the decidual lining of the rest of the cavity, and its muscular wall is also thinner and shows the parallel arrangement of fibers.

**Elongation of uterus.** The uterus becomes narrowed and elongated and rears itself forward from the spinal column during contractions (fig.22.3). This change is more noticeable in the second stage of labor than in the first. There is, of course, a corresponding elongation of the fetal ovoid inside the uterus, as it is compressed into a more cylindrical object. The increased length of the fetal ovoid thus produced has been estimated at about 6 cm (2½") and there can be little doubt that it

Table 22.2: Structural and functional differences between upper and lower uterine segments.

Features	Upper Segment	Lower Segment
• Anatomically	Upper part of uterus	Lowermost 5 cm
• Develops from	Corpus uterus	Isthmus
• Peritoneum	Firmly attached all over.	Loosely attached, particularly in front, absent at sides.
• Muscle arrangement	In several different layers running in different directions, giving strength.	Principally in longitudinal lamellae, easily separated, and relatively weak.
• Membranes	Firmly attached. Separation at end of labor.	Loosely attached. Separation at beginning of labor.
• Effect of labor	Active during labor.  Becomes progressively shorter and thicker, by retraction and diminished in area.	Relatively passive.  Becomes stretched and expanded, and progressively longer and thinner.

is one of the factors compelling the descent of the head in the second stage. This explains why there is little appreciable descent of the fundus in the second stage until the head reaches the outlet of the pelvis, although the head has in the meantime descended through the pelvic canal.

**The Bladder during labor.** During the first stage the bladder is partially drawn up by the ascending cervix and lower uterine segment, and in the second stage the upper part of the organ is in the abdomen while the lower lies behind the symphysis. This explains two well-known clinical facts:

- a. full bladder obstructs and delays labor;
- b. prolonged compression of the bladder between the head of the fetus and the pubes may lead to necrosis and fistula formation.

**Displacement of the vagina.** This is effected

by the descent of the presenting part, or by the bag of waters if not already ruptured. The vertex is a good rounded wedge-shaped dilator, but other presentations are less effective.

**Displacement of the pelvic floor.** It will be remembered that the pelvic floor is made up of an anterior or pubic, and a posterior or sacral segment. In the last days of pregnancy both segments sag downwards owing to the increased succulence of their tissue.

During labor the pubic segment is drawn up by the ascent of the cervix, just like the bladder, which is really a component of this segment.

The posterior segment is, however, right in the line of advance of the fetal head. It is therefore exposed to the full force of the uterine contraction, with the result that, as it is firmly fixed above to the sacrum, it becomes stretched out and pushed downwards

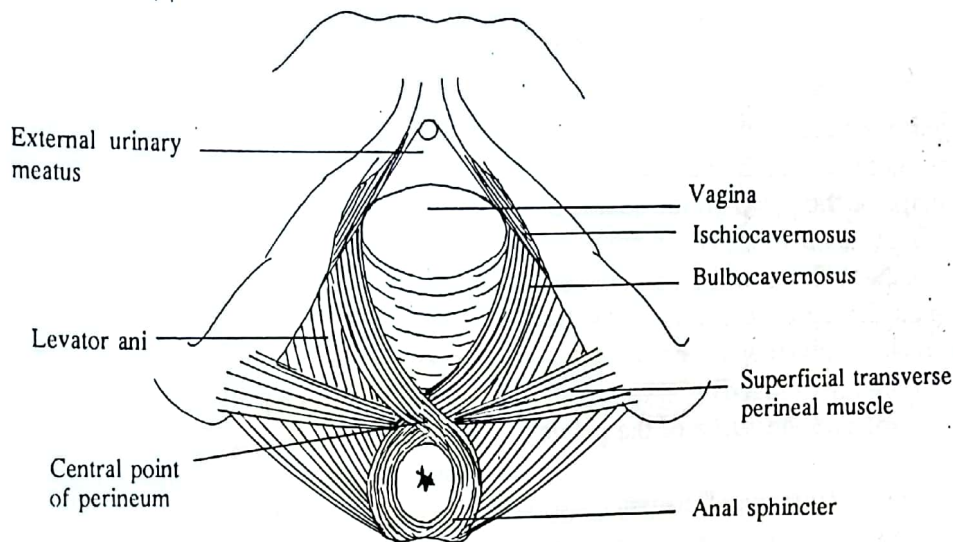


Fig.22.17: During delivery, the perineum bulges downwards 6-8 cm and its initial anteroposterior length of 5 cm is increased to 10 cm thus forming the soft tissue component of the curve of the birth canal.

and backwards. Outwardly this shows itself in the elongation and bulging of the perineum (fig.22.17). The distance between the anus and the posterior commissure of the vulva is lengthened from about one and a half of the head. This displacement of the two segments of the pelvic floor is like the displacement of two halves of folding double door through which one passes by pulling in the one half and pushing out the other.

**III. The passenger.** The movements of the fetus in relation to the pelvis during labor constitute what is known as the "mechanism of labor".

### THIRD STAGE

The phenomena of this stage are the separation of the placenta and the expulsion of the placenta; two separate occurrences which in a normal third stage are almost simultaneous.

**I. The powers.** These are in the main the uterine contractions. The abdominal muscles may also act, but they do so at the will of the woman, and not necessarily in concert with the uterus. The hand of the physician or nurse on the fundus may have to be invoked as an

additional power, but that is, strictly speaking, not normal.

**II. The passages.** These are the dilated soft passages. The thin lower uterine segment collapses after the expulsion of the child, and becomes somewhat folded on itself by the body sinking down upon the cervix.

**III. The passengers.** These are the placenta and membranes.

**Control of hemorrhage.** As the placenta is separated from the wall of the uterus, the blood-vessels passing from the one to the other are torn across, and many of the large sinuses in the uterine wall thus laid open. Bleeding from these is, however, prevented by the very retraction of the uterus which causes the separation. The uterine muscle fibers are arranged in a sort of network around the vessels, which are tortuous and angular. Hence when the fibers retract they close up the blood-vessels in the manner of "living ligatures", and only a very little if any blood escapes. If, owing to exhaustion of the uterus, retraction fails to occur after the separation of the placenta, then free and alarming bleeding may take place as post partum hemorrhage.

## MECHANISM OF LABOR

The "mechanism of labor" comprises the various movements by which the head adjusts itself to the shape of the pelvis in the course of its passage. Some method of accommodation of the one to the other is necessary if the head is to pass through the pelvis under the greatest mechanical advantages because of:

- irregular shape and the curve of the pelvic canal;
- the fact that the longest diameter lies obliquely or transversely at the brim and antero-posteriorly at the outlet;
- and the fact that the head is nearly as large as the pelvic canal through which it has to pass.

### OCCIPITO ANTERIOR POSITIONS

In these positions, the head that usually enters pelvis in occipitolateral position has already rotated 45 degrees from the transverse position. The head may be in left or right occiput anterior position and requires to rotate only 45 degrees to the direct occipito anterior position, whereas a 90-degree rotation is required if the occiput is in the transverse positions.

The mechanism in a Left Occipito-anterior Vertex presentation will be described in detail, because it is the commonest (table 22.2), and because it is the archetype of all other mechanisms.

#### Left Occipito-Anterior Position

The situation and position of the head at the start of labor depend on whether it is a first labor or not. In a first labor the head is usually already engaged and lies well down in the pelvis; it is fully flexed, the suboccipito-bregmatic plane lying horizontally across the pelvis; the sagittal suture lies approximately in the right oblique diameter of the pelvis, the occiput being to the left and anterior (fig.22.18).

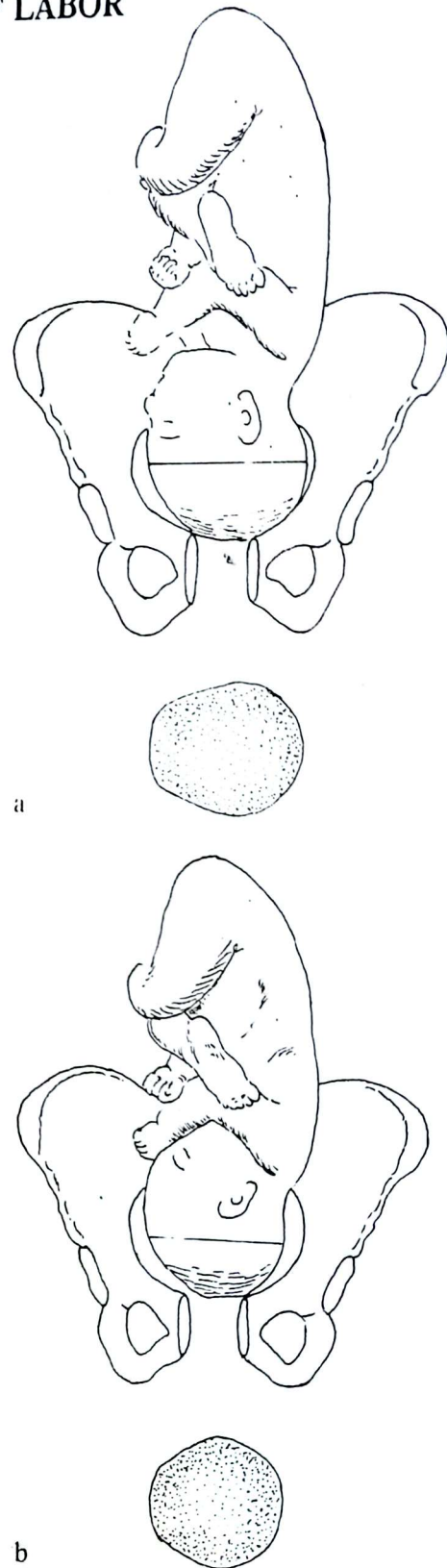


Fig.22.18: Engaged head in left occiput position. a. Occipitofrontal circumference, b. Suboccipitobregmatic circumference.

In second and subsequent labor the head lies above the brim until labor begins. It is mobile and less flexed, the suboccipito-frontal or even the occipito-frontal plane lying parallel to the plane of the brim. The sagittal suture lies more transversely, the occiput being to the left side.

**Diagnosis. Abdominal palpation.** Although presentation can be easily ascertained by the abdominal palpations, the position is difficult to determine for which vaginal examination is necessary. The palpations should be done in the interval between the uterine contractions. The difficulties may arise in cases of:

- obesity;
- polyhydramnios and;
- uterine tumors, e.g., fibroids.

Leopold's maneuvers findings are (fig.22.19):

First maneuver:	Broad breech is felt at fundus.
Second maneuver:	Back of the fetus is felt in the left and anterior part of abdomen and the small part in the right flank.
Third maneuver:	Unengaged head is easily felt and may be mobile. Engaged head may not be felt. Anterior shoulder may be detected instead.
Fourth maneuver:	Cephalic prominence is on the right opposite to the back.

The fetal heart is best heard on the left at a point just below and to the left to umbilicus.

**Vaginal examination.** The sagittal suture of the head is found in right oblique diameter of the pelvis. The small posterior fontanel is directed anteriorly near the left iliopectineal eminence and the large anterior fontanel near the right

sacroiliac joint.

The cardinal movements of the head during labor are (fig.22.19 - 22.25 & 22.33):

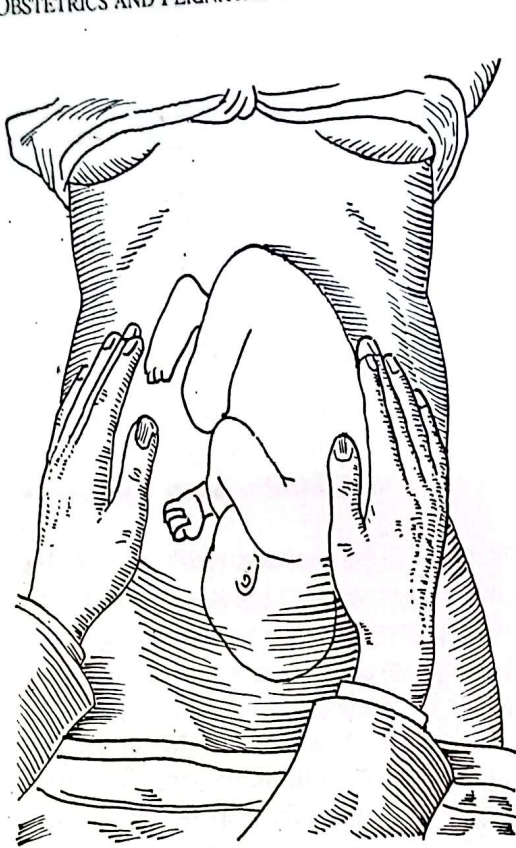
Descent	Engagement Flexion Internal Rotation Extension Restitution External Rotation Expulsion
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**Engagement.** The normal sized head usually does not engage with its sagittal suture directed anteroposteriorly. It must enter superior strait either in the transverse, as usually occurs, or in one of its oblique diameters.

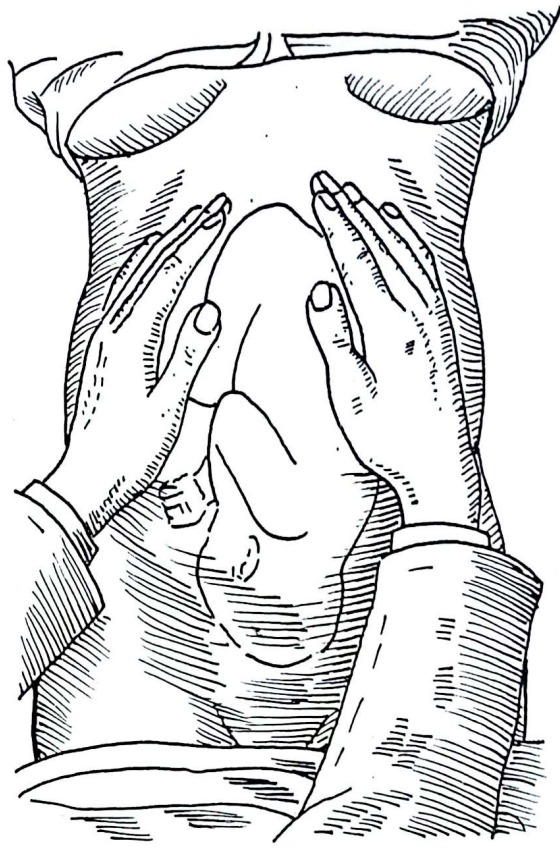
Although the head enters the pelvis in occipitotransverse position, its sagittal suture, while parallel to that axis, may not lie exactly midway between the symphysis and sacral promontory; it is frequently deflected either posteriorly towards promontory or anteriorly towards symphysis. Such deflection of head is called asynclitism or obliquity.

In case of normal synclitism the sagittal suture is centrally placed midway between the symphysis pubis and sacral promontory and meets the examining finger. Moderate degrees of asynclitism are the rule in normal labor. The posterior asynclitism is common when head is at the brim and anterior is commoner when the head is deep in pelvis. Successive posterior and anterior asynclitism facilitate descent by allowing the fetal head to take advantage of the roomiest areas of the pelvic cavity.

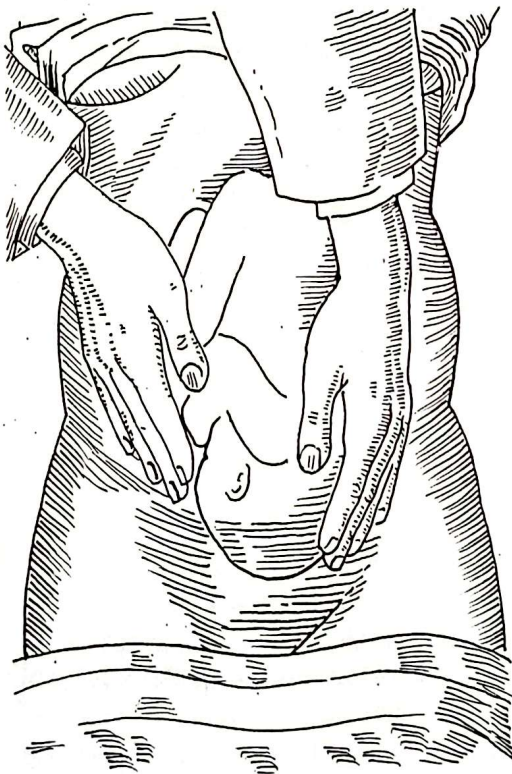
**Descent.** This movement is mentioned at the start once for all, but it must be remembered that it is going on throughout labor and that the other movements are merely superimposed upon it. A considerable descent has already occurred in the process of engagement. Apart from the movement of engagement, descent is in the main a phenomenon of the second stage, when the cervix has opened.



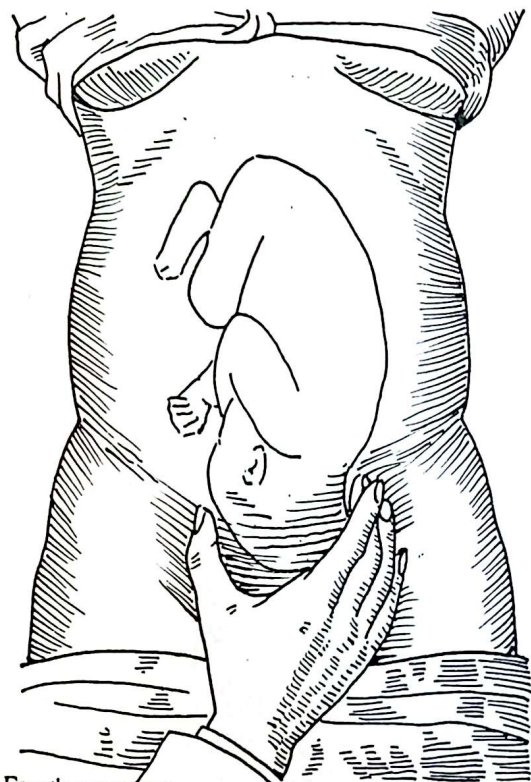
First maneuver



Second maneuver



Third maneuver



Fourth maneuver

Fig.22.19: Palpation in left occiput anterior position.



The forces that bring about descent are:

- amniotic fluid pressure;
- direct pressure of fundus during contraction;
- contraction of abdominal muscles;
- extension and straightening of the fetus.

**Flexion.** In flexion the occipital end of the head dips down in advance of the sincipital, so that the posterior fontanelle comes to lie at a lower level than the anterior. The chin is brought into direct contact with the sternum.

Flexion of the head exists in great part before labor begins, being characteristic of the natural attitude of the fetus. In first labors in which the flexion is full and complete to start with, no "movements", can be described. But in second and subsequent labors the flexion is not complete when labor starts, and in them there is certainly a movement of "increase of flexion".

The increase of flexion occurs where the head first meets resistance. This may be, and probably in most cases is, at the brim of the pelvis; or it may be as low down as the floor of the pelvis. The resistance may be due to the hard passages or to the girdle of contact of the soft passages.

*Cause.* It is probably due to a combination of several factors.

1. *Lever theory.* The spinal column is articulated to the head nearer the occipital end than the sincipital (fig.22.26a). Therefore, supposing the resistance at the two ends of the head to be equal, any force transmitted through the spine to the head will cause the short occipital end to dip down in advance of the sincipital. This factor applies after the rupture of the membranes; but in cases where the head descends before the membranes have ruptured, the force is transmitted not through the spine but as a general fluid pressure.

2. *Wedge theory.* It has been pointed out that the fetal head looked at from the side is unevenly wedge-shaped. In terms of the side

of the head that makes the more acute angle with the side of the pelvis ought to descend first, i.e. the occiput.

3. If flexion exists even to a small extent before descent begins, the elastic resistance of the soft passages will act upon the two ends of the descending head as two equal forces acting in opposite directions in parallel lines. The effect of such a "couple" of forces must be to increase the existing flexion (fig.22.26b).

4. The anterior part of the pelvis is more roomy than the posterior, therefore the part of the head lying anteriorly will meet less resistance.

The important result of flexion is that the head enters the pelvis with its small suboccipito-bregmatic plane in engagement with the plane of the brim. In other words, it substitutes its suboccipito-bregmatic diameter of 9.5 cm ( $3\frac{3}{4}$  inches) for its occipito-frontal diameter of 11 cm ( $4\frac{1}{2}$  inches), or some similar measurement. The mechanical advantage so gained is very considerable, as can be illustrated, for example, by the relative ease with which a small hat can be put on the back of one's head as compared with the top (fig.22.27).

The head and body of the fetus are also more "compacted", so as to form one single ovoid or cylindrical mass upon which the uterine force can act to complete advantage.

In view of the next movement it is important to remember that one result of flexion is to make the occiput the leading part of the fetus.

**Internal rotation.** The occiput, the leading part is rotated round to the front, so as to lie under the pubic arch. The sagittal suture then lies in the antero posterior instead of the right oblique diameter.

This movement occurs when the head comes on to the pelvic floor, i.e. in the lower part of the cavity.

*Cause.* Several factors are involved:

1. The absence of the bony wall makes

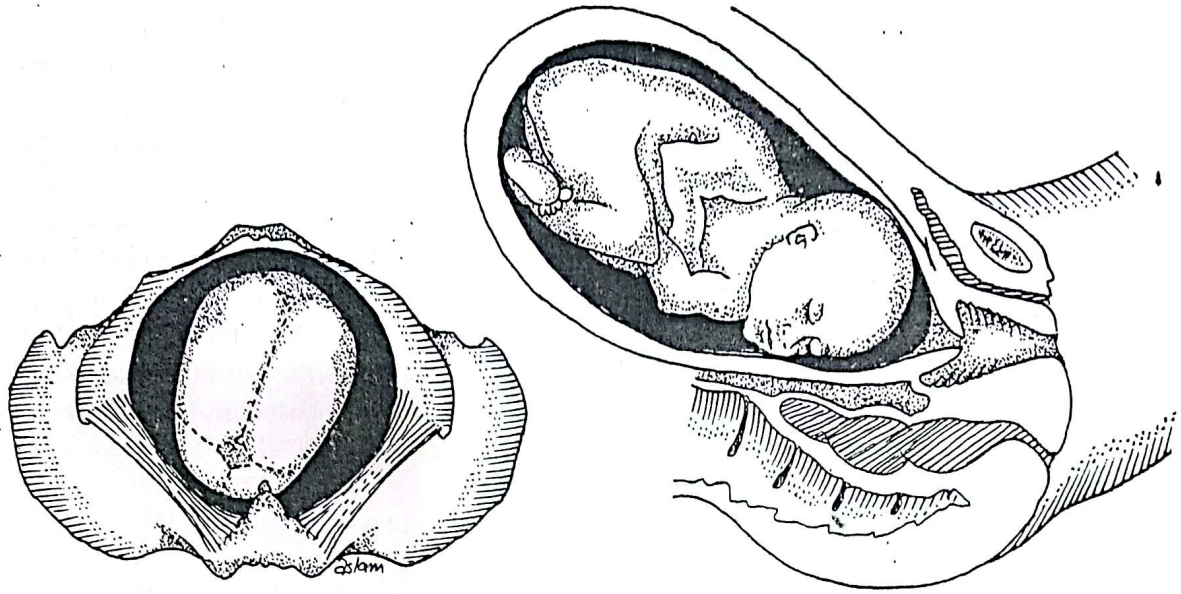


Fig.22.20: The beginning of labor.

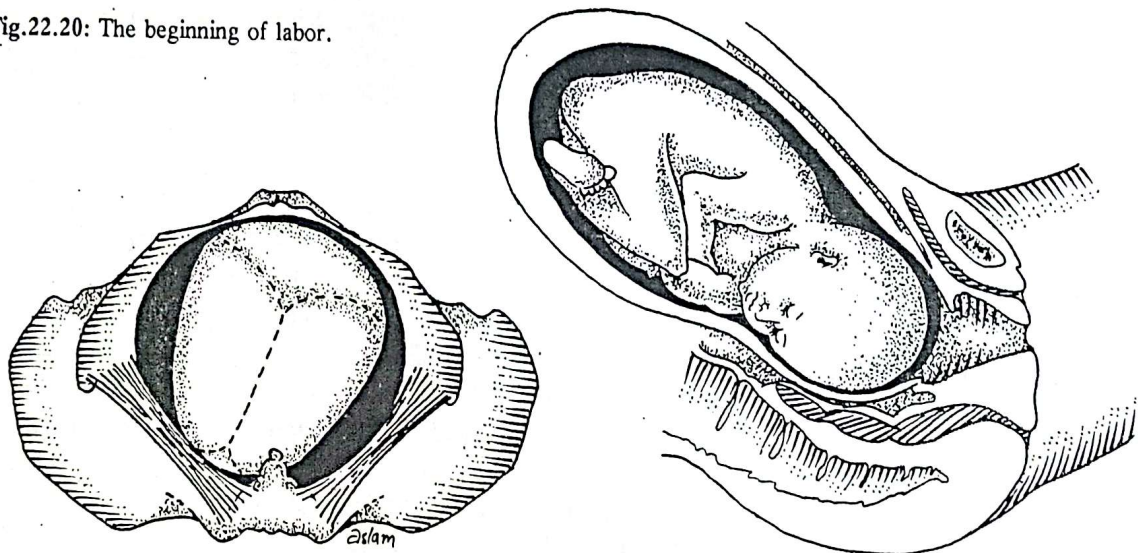


Fig.22.21: Descent and flexion.

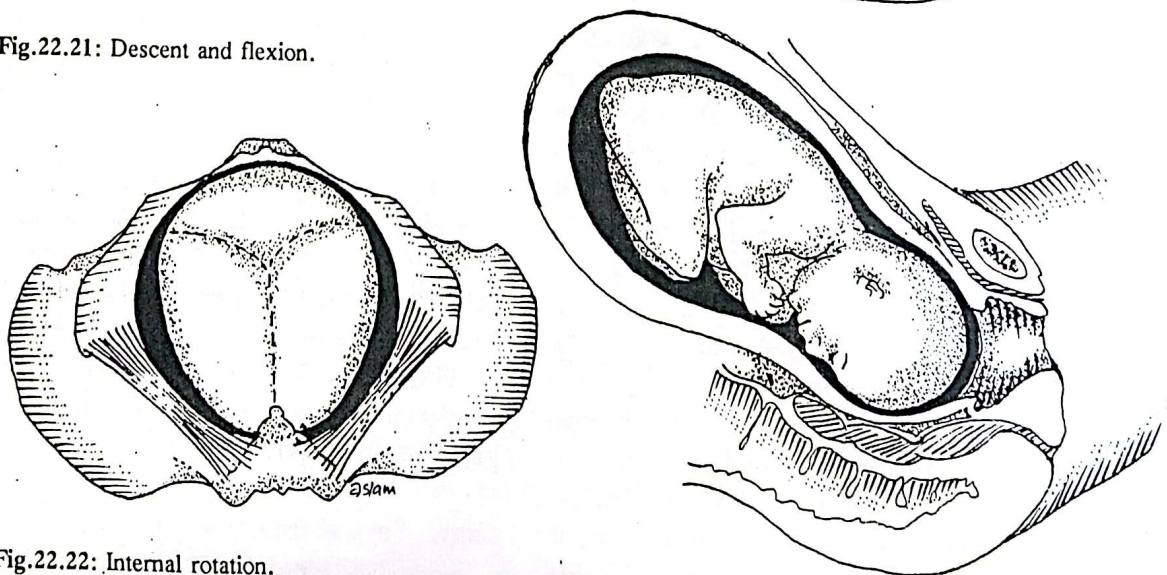


Fig.22.22: Internal rotation.

Illustrations showing mechanism of labor in left occipito anterior position.

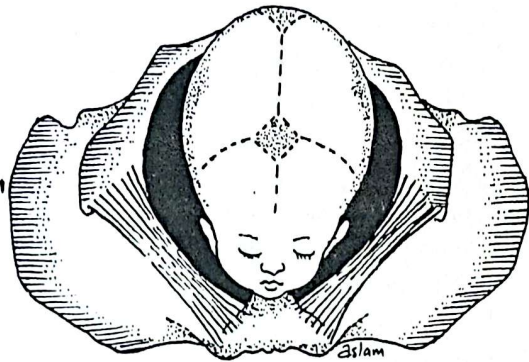


Fig.22.23: Extension.

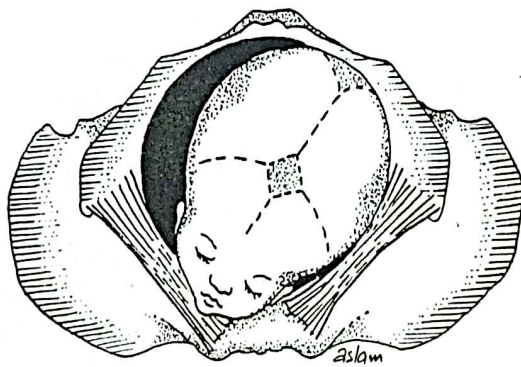
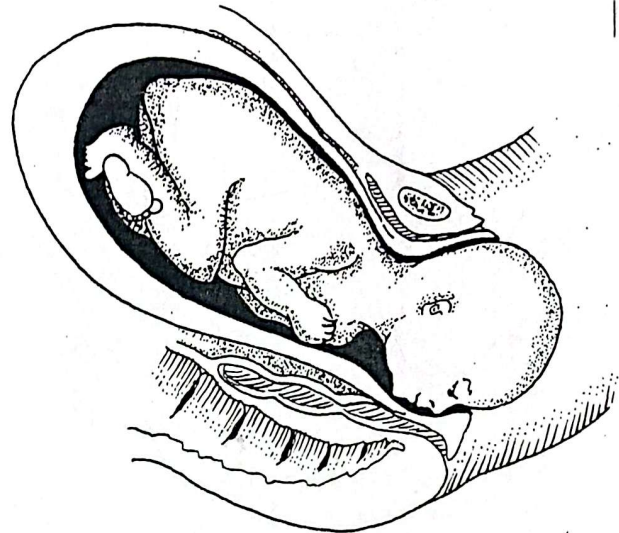


Fig.22.24: Restitution.

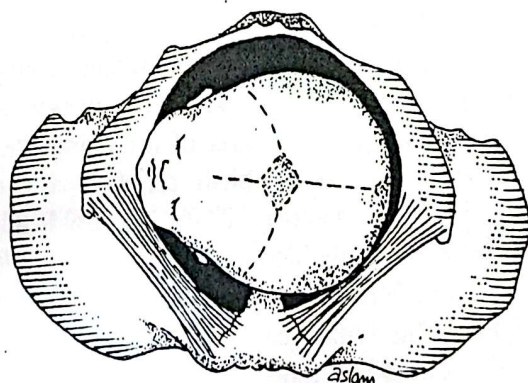
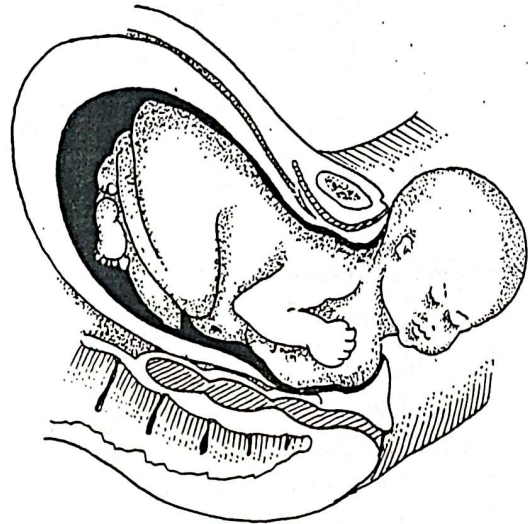


Fig.22.25: External rotation.



Illustrations showing mechanism of labor in left occipito anterior position.

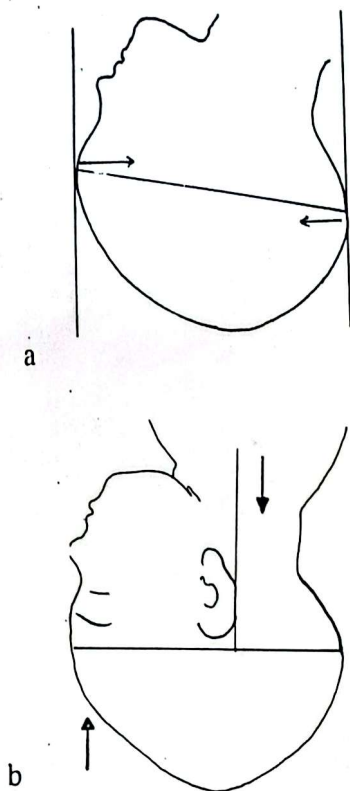


Fig.22.26: Coupling of forces due to the elastic resistance of passages.

the pubic arch the direction of least resistance.

2. The shape of lateral and posterior portions of the pelvic floor is such that they form a sort of gutter running downwards and forwards. The effect of this is to direct the advancing part forward.

3. One possible cause is to be found in the elastic recoil of the pelvic floor, the effective part of which is the levator ani. If the posterior or sacral segment of the floor be looked at from above, it is seen that it forms a sort of gutter, each side of which looks upwards, forwards, and towards the middle line. Now, as the leading part of the head is the occiput, the occiput will be the first part of the head to strike the pelvic floor. Further, as it is descending in the left half of the pelvis, it will come down upon the left lateral half of the sacral segment. During each contraction of the uterus the occiput will push this half of the sacral segment downwards, backwards, and outwards, but as soon as the uterine contra-

ction passes off, the resiliency of the levator ani will make the pelvic floor recoil. This recoil will act as a force pushing the occiput upwards, forwards, and inwards towards the middle line. Thus after each successive pain the occiput will be pushed a little more towards the middle line. When it actually reaches the middle line the head will be exposed to the recoil, not of one side of the pelvic floor merely, but of both sides equally. Therefore no further rotation can take place.

This concept offers a plausible reason for the rotation that occurs in posterior as well as anterior positions of the occiput. Indeed, it affords a rule which, if constantly borne in mind, simplifies the whole study of the mechanisms in other presentations and positions. This rule may be formulated as follows:

*Whatever part of the fetus first meets with the resistance of one lateral half of the posterior segment of the pelvic floor will be rotated to the front.*

This rule is accurate and of great practical value, but the theory on which it rests is open to criticism. A more satisfying explanation of the facts of rotation is found in "the theory of unequal fetal flexibilities". If a cylindrical body be constructed so that it can bend on its long axis with unequal degrees of ease in different directions, it will, when forced through a curved cylindrical canal rotate until it assumes the position in which it can bend with greatest ease. In other words, the cylinder rotates until the side which stretches most easily coincides with the convexity of the canal, where the greatest degree of stretching is necessary. The dilated birth canal (fig.22.28): the fetal head and trunk when molded by the process of labor form a cylinder with a blunt, rounded lower end. This cylindrical body has unequal flexibilities in different directions, for when the head is well flexed it is difficult to force it into fuller flexion but easy to bend it into extension. Lateral bending is of intermediate

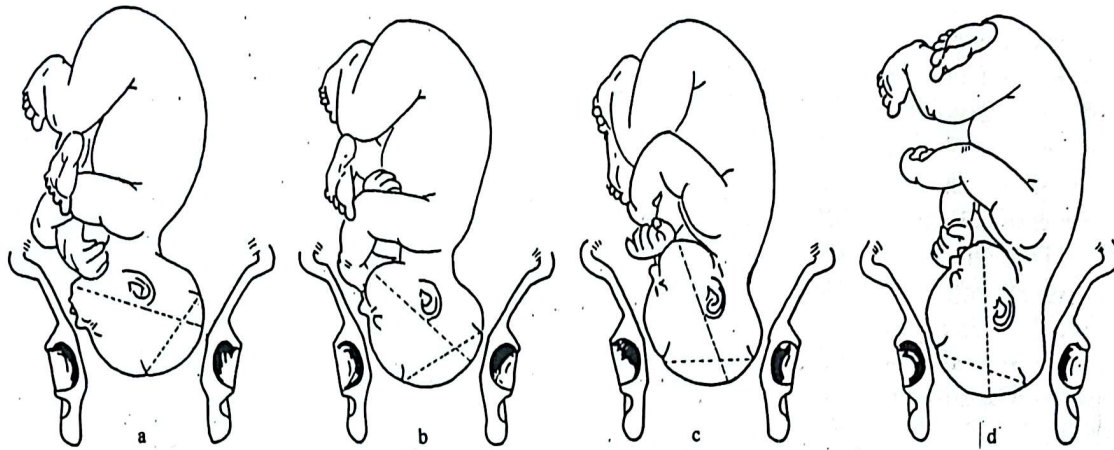


Fig.22.27: Four degrees of flexion of head and its relation to the fontanel. The dotted lines show occipito mental diameter and the line connecting the centre of anterior fontanel with the posterior fontanel. a. poor flexion of head. Anterior fontanel can be readily palpable on vaginal examination. b. moderate flexion of head. c. advanced flexion of head. d. complete flexion: posterior fontanel is lower and relatively easy to palpate on vaginal examination.

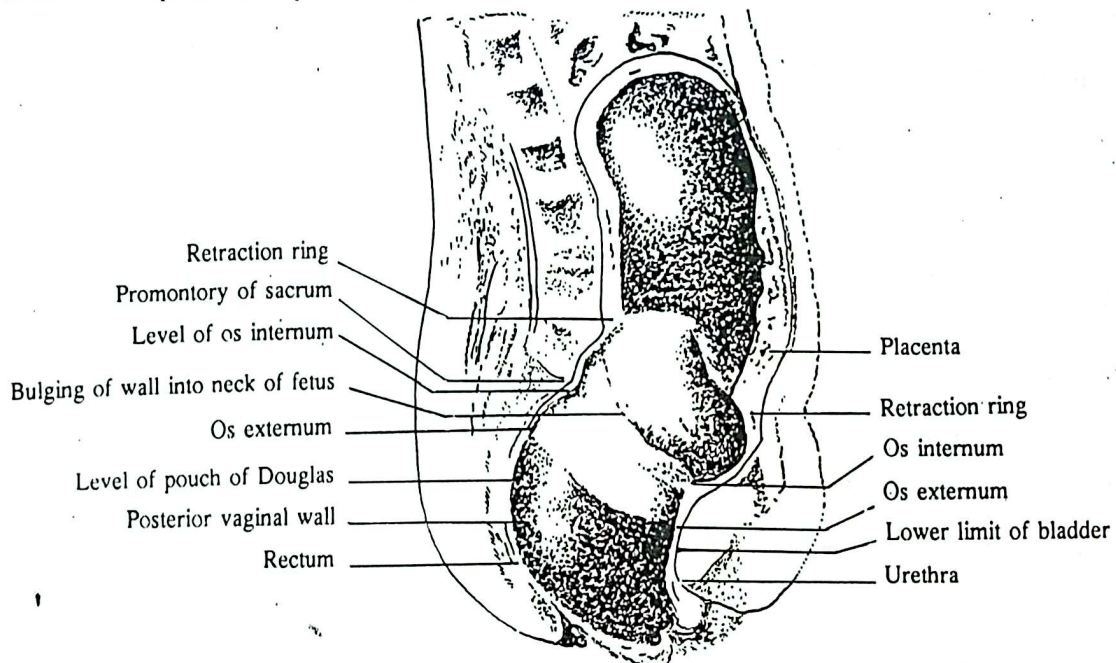


Fig.22.28: Actual cadaveric specimen showing a cut section through the lower part of abdomen and the pelvis of a primipara who was a cardiac patient and died during second stage of labor showing the birth canal as a curved cylinder.

difficulty. The fetus, therefore, when forced through the birth canal, obeys the same laws as the experimental cylinder. The occipital part of the skull rotates towards the pubes, and the anterior part of the head and neck (where stretching is easily accomplished) come to occupy the convexity of the birth canal (where the greatest degree of stretching is necessary).

"The mechanics of this action may be made more comprehensible to the student if he imagines that a strong elastic band is attached between his occipital bone and the spinous processes of the lower dorsal vertebrae. If the head is flexed (as happens during parturition) the action of the band is merely to oppose the flexing force. Now imagine that the head is

inclined towards one shoulder, as happens when the fetal head, lying obliquely transverse, descends to the curved portion of the birth canal. The band pulls on the head from a new direction and tends to make the occipital bone approach the shoulder towards which the head is inclined. In other words, the head undergoes rotation. If instead of one long band, a series of short bands connects up the spinous processes of the individual vertebrae, rotation will still take place, but the force will be distributed to each vertebra which is angled on its neighbor.

"Rotation of the shoulders and rotation of the breech can also be explained by the unequal fetal flexibilities. Anterior rotation of the chin in face presentation, and rotation of the after-coming head fall into line with the rotation seen in a vertex presentation".

The effect of internal rotation is to bring the long diameter of the head into the longest diameter of the outlet, namely, the antero-posterior.

**Extension.** While the occiput is passing slowly under the pubic arch, the sinciput, having a greater distance to travel, sweeps more rapidly over the perineum. As the bregma, forehead and face pass over perineum, the flexion is undone; hence this movement is termed extension. It occurs as the head is passing through the vulva (fig.22.29).

The vulvar outlet is directed upward and forward, extension must, therefore, occur before the head can pass through it. If this movement does not take place, the flexed head, on reaching the pelvic floor will continue to be driven downwards in the axis of superior strait and impinge upon the end of the sacrum and posterior portion of the perineum. In case of forceful thrust, the injury to perineum can occur. this is prevented by the extension. Two forces are responsible for it.

- a. The uterine force acting downwards.
- b. The resistance of the pelvic floor acting upwards.

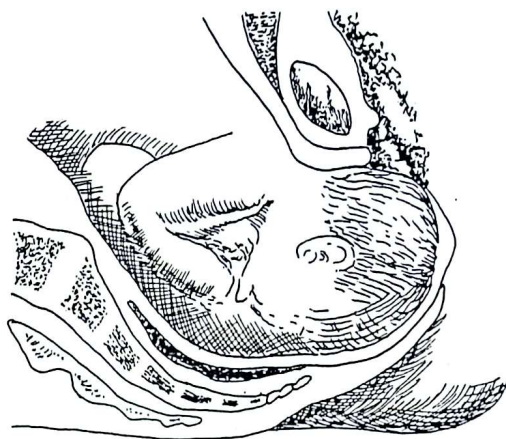


Fig.22.29: Delivery of head by extension.

The resultant of these two forces acts in a line directed downwards and forwards and the head thus passes in this line (fig.22.30).

The occiput has already passed through the vulva before extension occurs. The effect of the extension is the escape of the rest of the

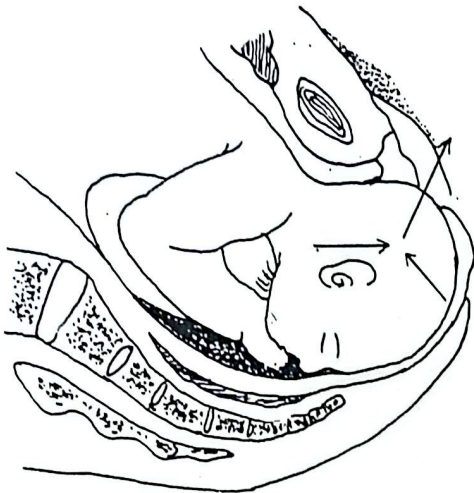


Fig.22.30: Cause of extension: uterine force acts downwards and the pelvic resistance upwards.

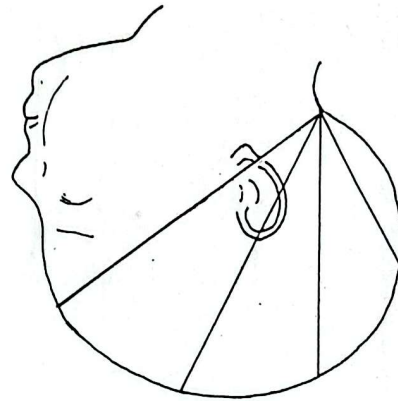


Fig.22.31: The diameters that pass through the outlet during extension.

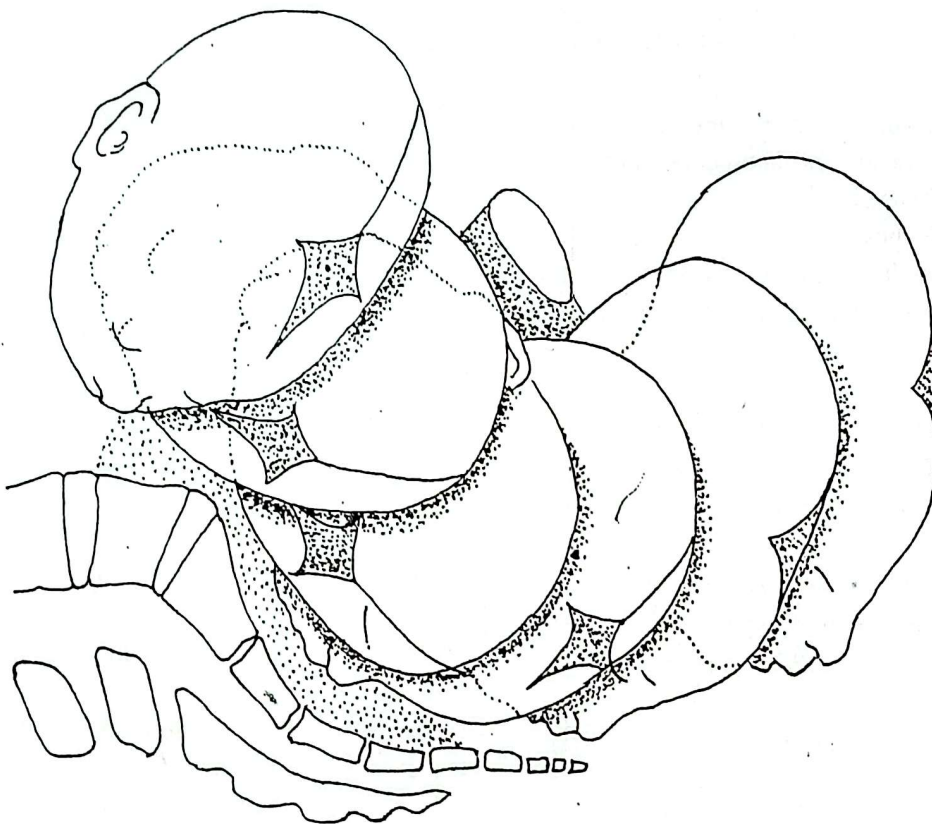


Fig.22.32: Normal mechanism of labor LOA from beginning to the end.

head through the vulvar outlet (fig.22.31&32).

After the subocciput comes in contact with the inferior margin of the symphysis pubis, the head can no longer be regarded as two-armed lever. The occiput acts as fulcrum with a single arm extending from it to the chin. Any force exerted upon the head leads to further

extensions. Immediately after the birth the head falls downwards and the chin comes into contact with the anus.

**Restitution.** When the head was lying in the right oblique diameter at the brim, the shoulders were in the left oblique; and while

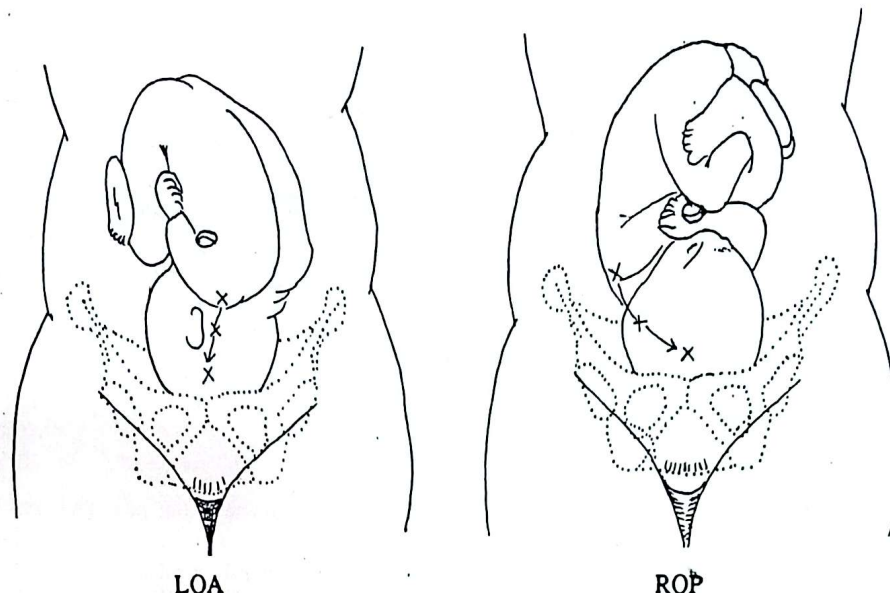


Fig.22.33: The position of shoulders in relation to the head as it descends.

the head has been rotating into the antero-posterior diameter, the shoulders have been unaffected. There is, therefore, at the moment of birth of the head, a slight twist of the neck. As soon as the head is born this is undone, the occiput passing with an almost imperceptible movement slightly towards the left side.

**External rotation.** This is really a movement of the shoulders and trunk, and not in any sense a part of the mechanism of the head which is now born. The movement of the shoulders is, however, indicated externally by the rotation of the occiput back towards that side of the pelvis which it originally occupied.

The shoulders and trunk rotate, the anterior shoulder passing to the front by a movement of internal rotation. The bisacromial diameter of the trunk is thus brought into the longest (antero-posterior) diameter of the outlet (fig.22.33).

**Expulsion.** The anterior shoulder appears under the symphysis pubis immediately after the external rotation. The anterior margin of the perineum distends by the posterior shoulder. After delivery of the shoulders, the body is quickly extruded along a curved line corresponding to the axis of the birth canal,

which is concave in its upper part and convex in its lower part.

#### Mechanism in Right Occipito-Anterior Position

The head lies approximately in the left oblique diameter of the brim. The movements are exactly the same as in the LOA, the word "right" being substituted for "left", and vice versa.

#### Diagnosis

First maneuver:	Breech is felt in fundus.
Second maneuver:	Back of the fetus is felt in the right and anterior portion of abdomen and the small part on the left side.
Third maneuver:	As in LOA.
Fourth maneuver:	Cephalic prominence is on the left side.

#### CHANGES IN THE SHAPE OF HEAD

##### *Molding of the Head*

In spite of the mechanism just described the



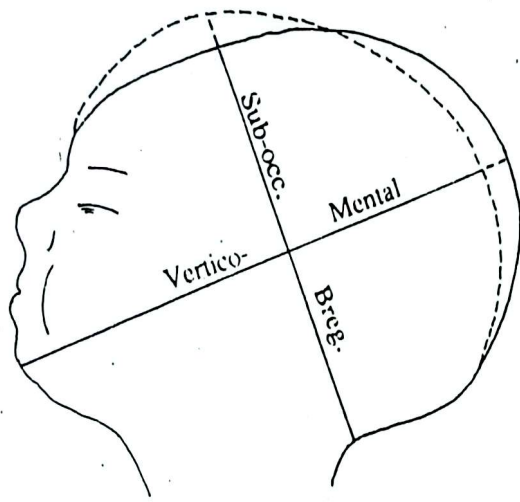


Fig.22.34: Molding of the head.

head is exposed to a good deal of pressure from both the hard and the soft passages during labor. This shows itself in some distortion of the natural shape of the head (fig.22.34). Molding occurs without permanently damaging the head. In all cases the molding occurs on the same principles. The tip of the occipital and the edges of the frontal bones dip under the parietal. Further, the posterior parietal is always exposed to greater pressure than the anterior, and accordingly it dips under the anterior parietal bone, which thus comes to override the edges of the posterior parietal, the frontalis and the occipital bone.

In addition, the suboccipito-bregmatic and occipito-frontal diameters are diminished, while the head is lengthened from the vertex to the chin, and in the occipitomental diameter. X-Rays show that molding and even some overlapping of the bones sometimes occur when the head becomes engaged.

**Caput succedaneum.** (Lat. succedaneous means secondary).

During labor the part of the scalp which lies within the circle of the girdle of contact of the soft passages becomes the seat of a swelling—after the rupture of the membranes. This is

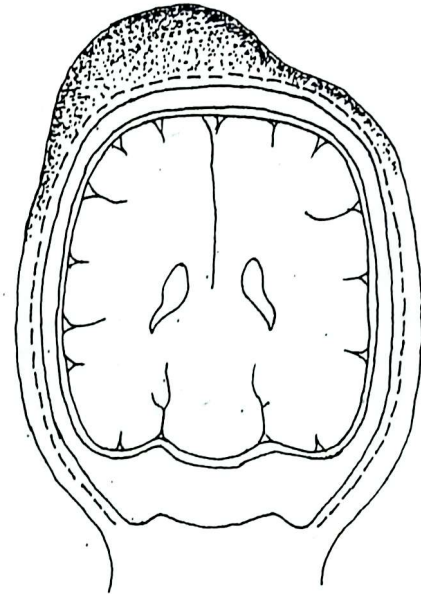


Fig.22.35: Caput succedaneum.

because it is exposed to less pressure than the surrounding areas of scalp which are pressed on by the soft passages. The swelling is a sero-sanguineous infiltration into the connective tissues of the scalp, and the position of the head (fig.22.35). In occipito-anterior positions the presenting part in the early stages of labor is the vertex. Therefore the caput first forms on the vertex—on the right of the sagittal suture in LOA, and on the left in ROA cases. As labor proceeds and flexion becomes more pronounced, the posterior fontanelle becomes the presenting part, hence the caput succedaneum is ultimately found in that region, a little to the right or left as before. It may therefore be said that in LOA cases it is on the upper posterior angle of the right parietal bone, and in ROA cases on the corresponding angle of the left parietal. The appearance of the caput is generally congested. The longer the labor lasts, the larger does the caput become, and in some cases it may obscure the landmarks of the head.

The caput succedaneum begins to disappear immediately after birth, and has usually quite vanished after twenty-four hours.