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CHAPTER

13

Normal Labor

Intrapartum Care for a Positive Child Birth Experience (WHO)

Chapter Outline

- Labor
  - Onset
  - Contractile System of the Myometrium
- Physiology of Normal Labor
- Events in First Stage of Labor
- Events in Second Stage of Labor
- Events in Third Stage of Labor
- Mechanism of Normal Labor
- Anatomy of Labor
- Clinical Course of First Stage of Labor
- Clinical Course of Second Stage of Labor
- Clinical Course of Third Stage of Labor
  - Place of Delivery
- Management of Normal Labor
- Management of First Stage of Labor
- Management of Second Stage of Labor
  - Immediate Care of the Newborn
- Management of Third Stage of Labor
  - Active Management of Third Stage of Labor (AMTSL)
  - Labor Care Guide (WHO)

LABOR

DEFINITION: Series of events that take place in the genital organs in an effort to expel the viable products of conception (fetus, placenta and the membranes) out of the womb through the vagina into the outer world is called 'labor'. It may occur prior to 37 completed weeks, when it is called the preterm labor. Labor is characterized by the presence of regular uterine contractions with effacement and dilatation of the cervix with fetal descent. A parturient is a patient in labor and parturition is the process of giving birth. **Delivery** is the expulsion or extraction of a viable fetus out of the womb. It is not synonymous with labor; delivery can take place without labor as in elective cesarean section. Delivery may be vaginal, either spontaneous or aided, or it may be abdominal.

NORMAL LABOR (EUTOCIA): Labor is called normal if it fulfils the following criteria:

1. Spontaneous in onset and at term
2. With vertex presentation
3. Without undue prolongation
4. Natural termination with minimal aids
5. Without having any complications affecting the health of the mother and/or the baby.

ABNORMAL LABOR (DYSTOCIA): Any deviation from the definition of normal labor is called abnormal labor. Thus, labor in a case with presentation other than vertex or having some complications even with vertex presentation affecting the course of labor or modifying the nature of termination or adversely affecting the maternal and/or fetal prognosis is called abnormal labor.

DATE OF ONSET OF LABOR: It is very much unpredictable to foretell precisely the exact date of onset of labor. It is not only varies from case to case but even in different pregnancies of the same individual. Calculation based on Naegele's formula can only give a rough guide. **Based on the formula, labor starts approximately on the expected date in 4%, 1 week on either side in 50%, 2 weeks earlier and 1 week later in 80%, at 42 weeks in 10%, and at 43 weeks plus in 4%.**

CAUSES OF ONSET OF LABOR

The precise mechanism of initiation of human labor is still obscure. Endocrine, biochemical and mechanical stretch pathways as obtained from animal experiments, however, put forth the following hypotheses.

- ***Uterine distension:*** Stretching effect on the myometrium by the growing fetus and liquor amnii can explain the onset of labor at least in twins or polyhydramnios. **Uterine stretch** increases gap junction proteins, receptors for oxytocin and specific Contraction Associated Proteins (CAPs).
- ***Fetoplacental contribution:*** Cascade of events activate **fetal hypothalamic-pituitary-adrenal axis** prior to onset of labor → increased CRH → increased release of ACTH → fetal adrenals → increased cortisol secretion → accelerated production of estrogen and prostaglandins from the placenta **(Fig. 13.1)**.
- ***Estrogen:*** The probable mechanisms are:
  - **Increases** the release of oxytocin from maternal pituitary.
  - **Promotes** the synthesis of myometrial receptors for oxytocin (by 100–200 folds), prostaglandins and increase in gap junctions in myometrial cells.
  - **Accelerates** lysosomal disintegration in the decidual and amnion cells resulting in increased prostaglandin ($PGF2\alpha$) synthesis.
  - **Stimulates** the synthesis of myometrial contractile protein—actomyosin through cAMP.

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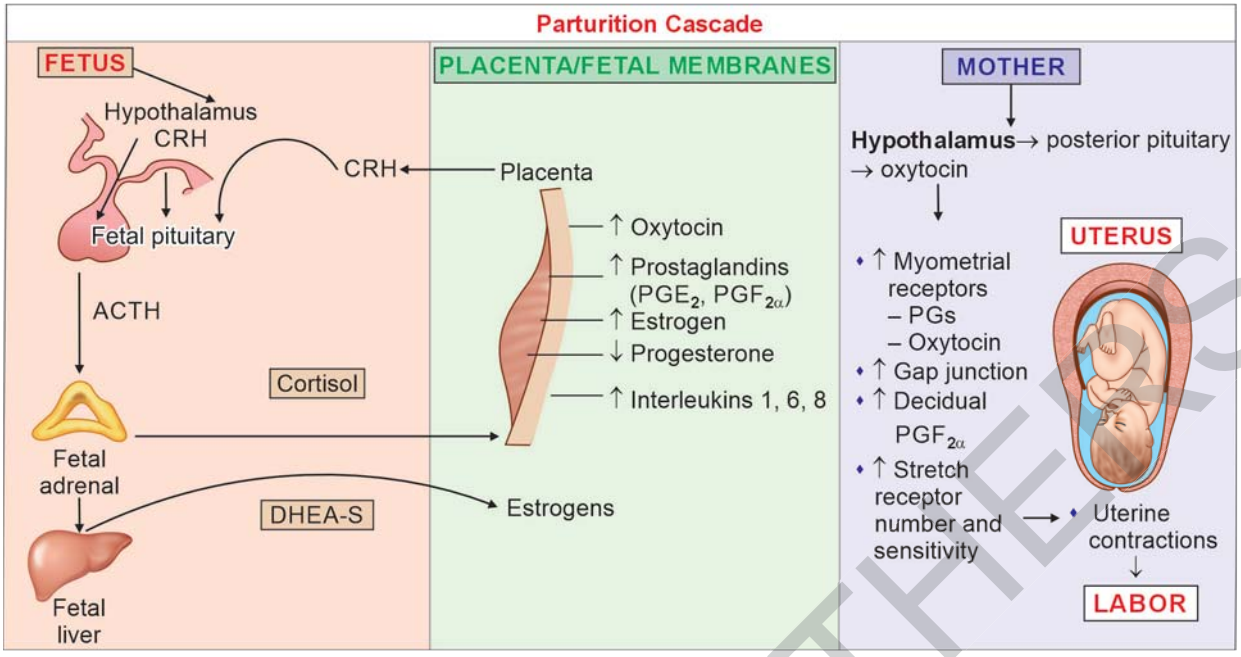

Fig. 13.1: Initiation of parturition and the parturition cascade.

- **Increases** the excitability of the myometrial cell membranes.

- ***Progesterone:*** Increased fetal production of Dehydroepiandrosterone Sulfate (DHEA-S) and cortisol inhibits the conversion of fetal pregnenolone to progesterone. Progesterone levels therefore fall before labor. **It is the alteration** in the estrogen-progesterone ratio rather than the fall in the absolute concentration of progesterone, which is linked with prostaglandin synthesis.
- ***Prostaglandins:*** They are the important factors, which initiate and maintain labor. **The major sites of synthesis of prostaglandins are**—amnion, chorion, decidual cells and myometrium. **Synthesis is triggered by**—rise in estrogen level, glucocorticoids, mechanical stretching in late pregnancy, increase in cytokines (IL-1, 6, TNF), infection, vaginal examination and separation or rupture of the membranes. Prostaglandins enhance gap junction (intramembranous gap between two cells through which stimulus flows) formation.

Biochemical Mechanisms Involved in the Synthesis of Prostaglandins (Flowchart 13.1)

Phospholipase A_2 in the lysosomes of the fetal membranes near term → esterified arachidonic acid → formation of free arachidonic acid → synthesis of prostaglandins through prostaglandin synthetase. Prostaglandins (E_2 and $F_{2\alpha}$) diffuse in the myometrium → act directly at the sarcoplasmic reticulum → inhibit intracellular cAMP generation → increase local free calcium ions → uterine contraction. Once the arachidonic acid cascade is initiated, prostaglandins themselves will activate lysosomal enzyme systems. **The prostaglandin synthesis reaches a peak** during the birth of placenta probably contributing to its expulsion and to the control of postpartum hemorrhage.

- ***Oxytocin and myometrial oxytocin receptors:***
  (i) Large number of oxytocin receptors are present in the fundus compared to the lower segment and the cervix.
  (ii) **Receptor number increases during pregnancy reaching maximum during labor.**
  (iii) Receptor sensitivity increases during labor.
  (iv) Oxytocin stimulate synthesis and release of PGs (E_2 and $F_{2\alpha}$) from amnion and decidua. Vaginal examination and amniotomy (stretching of the lower genital tract), cause rise in maternal plasma oxytocin level (Ferguson reflex). *Fetal plasma oxytocin* level is found increased during spontaneous labor compared to that of mother. Its role in human labor is not yet established.
- ***Neurological factor:*** **Although labor may start in denervated uterus, labor may be also initiated through nerve pathways. Both α and β adrenergic receptors are present in the myometrium; estrogen causing the α receptors and progesterone the β receptors to function predominantly**. The contractile response is initiated through the α receptors of the postganglionic nerve fibers in and around the cervix, and the lower part of the uterus. This is based on observation that onset of labor occurs following stripping or low rupture of the membranes.

CONTRACTILE SYSTEM OF THE MYOMETRIUM

The basic elements involved in the uterine contractile systems are: (a) Actin, **(b)** myosin, **(c)** adenosine triphosphate (ATP), **(d)** the enzyme myosin light chain kinase (MLCK) and **(e)** Ca^{++}.

Structural unit of a myometrial cell is myofibril which contains the proteins—**actin and myosin.** The interaction of myosin and actin is essential for muscle contraction. The key process in actin-myosin interaction is myosin light chain phosphorylation. This reaction is controlled by **Myosin Light Chain Kinase (MLCK).** Oxytocin acts on myometrial receptors and activates phospholipase C, which increases intracellular calcium level. Calcium is essential for the activation of MLCK and binds to the

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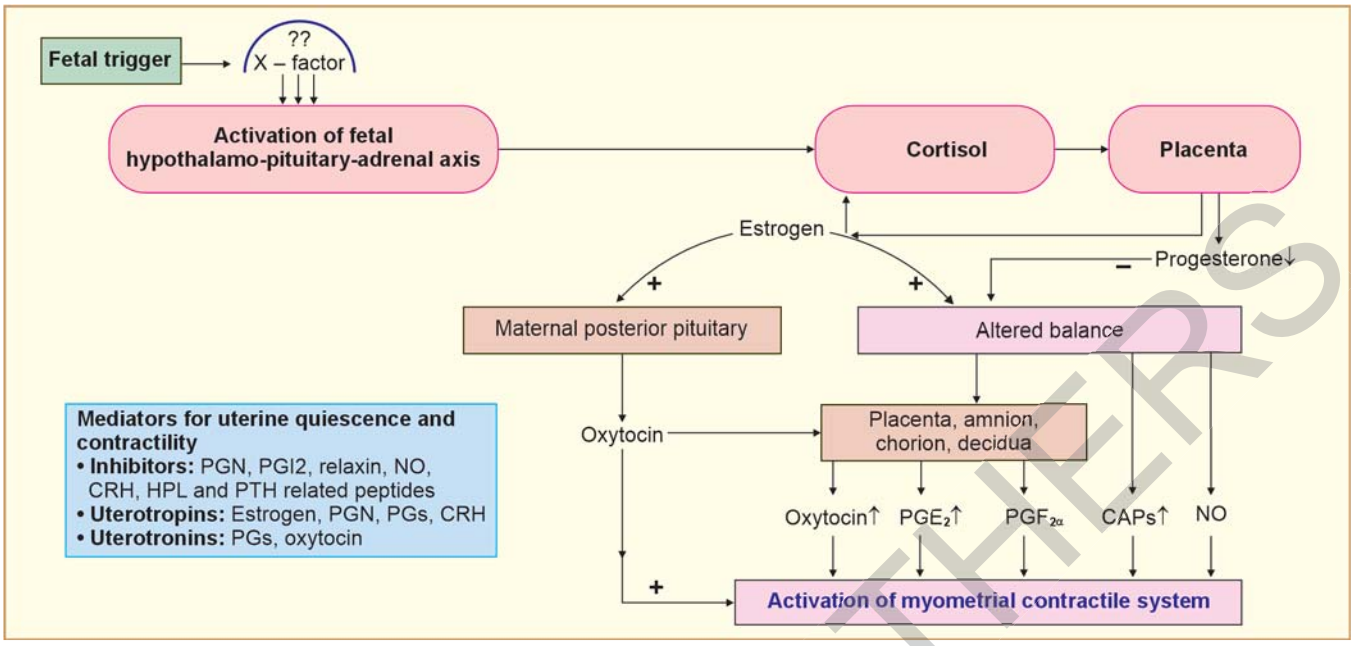
Flowchart 13.1: Possible mechanism in initiation of labor.



(CAPs: Contraction Associated Proteins; NO: Nitric Oxide; PGE_2: Prostaglandin E_2; PGN: Progesterone; CRH: Corticotropin Releasing Hormone; PTH: Parathyroid Hormone)

kinase as **calmodulin–calcium** complex. Intracellular calcium levels are regulated by two general mechanisms: **(1)** Influx across the cell membrane and **(2)** release from intracellular storage sites. Calcium is stored within the cells in the sarcoplasmic reticulum and in mitochondria. Progesterone and cAMP promote calcium storage at these sites. $PGF_{2\alpha}$, E_2 and oxytocin on the other hand stimulate its release.

- Intracellular Ca^{++} → calmodulin Ca^{++} → MLCK → phosphorylated myosin + actin → myometrial contraction.
- Decrease of intracellular Ca^{++} (or its shift to the storage sites) → dephosphorylation of myosin light chain → inactivation of myosin light chain kinase → myometrial relaxation.

Uterine muscles have two types of adrenergic receptors—(1) ***α receptors***, which on stimulation, produce a decrease in cyclic AMP (adenosine monophosphate) and result in contraction of the uterus and **(2)** ***β receptors***, which on stimulation, produce rise in cyclic AMP and result in inhibition of uterine contraction.

FALSE PAIN *(Synonym: false labor, spurious labor):* It is found more in primigravidae than in parous women. **It usually appears prior to the onset of true labor pain by 1 or 2 weeks in primigravidae and by a few days in multiparae.** Such pains are probably due to stretching of the cervix and lower uterine segment with consequent irritation of the neighboring ganglia.

PRELABOR *(Synonym: premonitory stage)*: The premonitory stage may begin 2–3 weeks before the onset of true labor in primigravidae and a few days before in multiparae. **The features are inconsistent and may consist of the following:**

- ***Lightening:*** A few weeks prior to the onset of labor especially in primigravidae, the presenting part sinks into the true pelvis. It is due to active pulling up of the lower pole of the uterus around the presenting part. It signifies incorporation of the lower uterine segment into the wall of the uterus. This diminishes the fundal height and hence minimizes the pressure on the diaphragm **(Figs. 13.2A and B)**. The mother experiences a sense of relief from the mechanical cardiorespiratory embarrassment. There may be frequency of micturition or constipation due to mechanical factor—pressure by the engaged presenting part. **It is a welcome sign** as it rules out cephalopelvic disproportion and other conditions preventing the head from entering the pelvic inlet.
- ***Cervical changes:*** A few days prior to the onset of labor, cervix becomes ripe. **A ripe cervix is (a)** soft, **(b)** 80% effaced (<1.5 cm in length), **(c)** admits one finger easily, and **(d)** cervical canal is dilatable.
- ***Appearance of false pain***

True labor pain is characterized by:

(i) Painful uterine contractions at regular intervals.
(ii) Frequency of contractions increase gradually.
(iii) Intensity and duration of contractions increase progressively.
(iv) Associated with 'show'.
(v) Progressive effacement and dilatation of the cervix.
(vi) Descent of the presenting part.
(vii) Formation of the 'bag of forewaters'.
(viii) Not relieved by enema or sedatives.

False labor pain is characterized by:

(i) Dull in nature.
(ii) Confined to lower abdomen and groin.
(iii) May be associated with hardening of the uterus.
(iv) They have no other features of true labor pain as discussed above.
(v) Usually relieved by analgesic.

Labor pain: Throughout pregnancy, painless Braxton-Hicks contractions with simultaneous hardening of the

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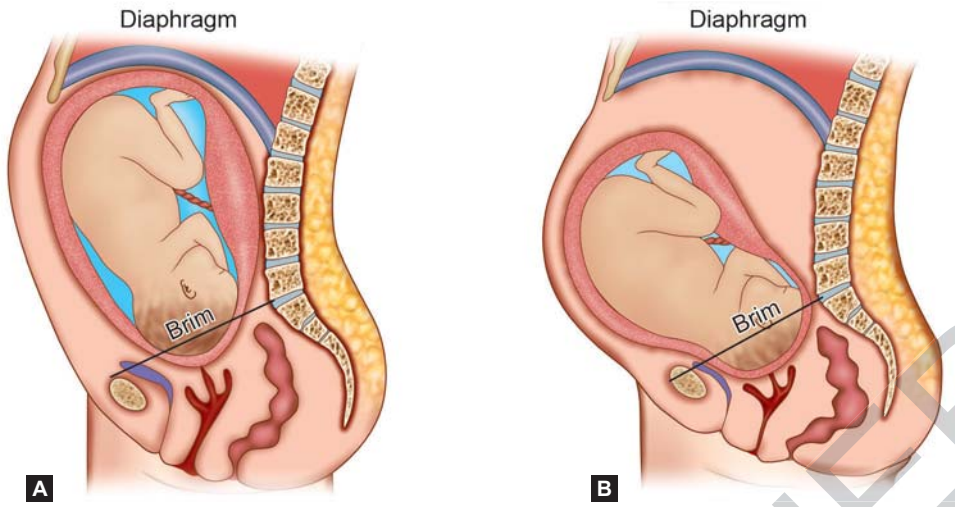

Figs. 13.2A and B: Showing phenomenon of 'lightening': **(A)** Before; **(B)** After lightening.

uterus occur. The contractions are irregular and do not increase in frequency or regularity. These contractions change their character, become more powerful, intermittent and are associated with pain. Pain more often felt in front of the abdomen or radiating toward the thighs.

Show: With the onset of labor, there is profuse cervical mucoid discharge. Simultaneously, there is slight oozing of blood from rupture of capillary vessels of the cervix and from the raw decidual surface caused by separation of the membranes due to stretching of the lower uterine segment. **Expulsion of cervical mucus plug mixed with blood is called 'show'.**

Dilatation of internal os: With the onset of labor pain, the cervical canal begins to dilate more in the upper part than in the lower, the former being accompanied by corresponding stretching of the lower uterine segment.

Formation of 'bag of waters': Due to stretching of the lower uterine segment, the membranes are detached easily because of its loose attachment to the poorly formed decidua. With the dilatation of the cervical canal, the lower pole of the fetal membranes becomes unsupported and tends to bulge into the cervical canal. As it contains liquor, which has passed below the presenting part, it is called 'bag of waters'. During uterine contraction with consequent rise of intra-amniotic pressure, this bag becomes tense and convex. After the contractions pass off, the bulging may disappear completely. **This in association with regular contractions and cervical changes are signs of onset of labor.** However, in some cases the membranes are so well applied to the head that the finding may not be detected.

STAGES OF LABOR: Conventionally, events of labor are divided into three stages:

- ***First stage:*** It starts from the onset of true labor pain and ends with full dilatation of the cervix. It is, in other words, the 'cervical stage' of labor. Its average duration is 12 hours (WHO) in primigravidae and 6 hours (WHO-10 hours) in multiparae.
- ***Second stage:*** It starts from the full dilatation of the cervix (not from the rupture of the membranes) and ends with expulsion of the fetus from the birth canal. It has got two phases: **(1) The propulsive or passive phase**—starts from full dilatation up to the descent of the presenting part to the pelvic floor. **(2) The expulsive or active phase** is distinguished by maternal bearing down efforts and ends with delivery of the baby. Its average duration is 2 hours (WHO-3 hours) in primigravidae and 30 minutes (WHO-2 hours) in multiparae.
- ***Third stage:*** It begins after expulsion of the fetus and ends with expulsion of the placenta and membranes (afterbirths). Its average duration is about 15 minutes in both primigravidae and multiparae. The duration is, however, reduced to 5 minutes in active management.
- ***Fourth stage:*** It is the stage of observation for at least 1 hour after expulsion of the afterbirths. During this period maternal vitals, uterine retraction and any vaginal bleeding are monitored. Baby is examined. These are done to ensure that both the mother and baby are well.

PHYSIOLOGY OF NORMAL LABOR

During pregnancy there is marked **hypertrophy** and **hyperplasia** of the uterine muscle and the enlargement of the uterus. At term, the length of the uterus measures about 35 cm including cervix. The fundus is wider both transversely and anteroposteriorly than the lower segment. The uterus assumes pyriform or ovoid shape. The cervical canal is occluded by a thick, tenacious and mucus plug.

UTERINE CONTRACTION IN LABOR: Throughout pregnancy there is irregular involuntary spasmodic uterine contractions which are painless (Braxton-Hicks) and have no effect on dilatation of the cervix (p. 42). The character of the contractions changes with the onset of labor. The **pacemaker of the uterine contractions** is situated in the region of the tubal ostia from where waves of contractions spread downward. While there are wide variations in

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frequency, intensity and duration of contractions, they remain usually within normal limits in the following patterns.

- There is good synchronization of the contraction waves from both halves of the uterus and also between upper and lower uterine segments.
- There is fundal dominance of contractions that diminish gradually in duration and intensity through midzone down to lower segment. It takes about 10–20 seconds.
- The waves of contraction follow a regular pattern.
- The upper segment of the uterus contracts more strongly and for a longer time than the lower part.
- Intra-amniotic pressure rises beyond 20 mm Hg during uterine contraction.
- Good relaxation occurs in between contractions to bring down the intra-amniotic pressure to less than 8 mm Hg. Contractions of the fundus last longer than that of the midzone.

During contraction, uterus becomes hard and somewhat pushed anteriorly to make the long axis of the uterus in line with that of pelvic axis. Simultaneously, the patient experiences pain which is situated more on the hypogastric region, often radiating to the thighs. **Probable causes of pain are: (a)** Myometrial hypoxia during contractions (as in angina), **(b)** stretching of the peritoneum over the fundus, **(c)** stretching of the cervix during dilatation, **(d)** stretching of the ligaments surrounding the uterus and **(e)** compression of the nerve ganglion. **Pain of uterine contractions is distributed along the cutaneous nerve distribution of T_{10} to L_1.** Pain of cervical dilatation and stretching is referred to the back through the sacral plexus.

Tonus: **It is the intrauterine pressure in between contractions.** During pregnancy, as the uterus is quiescent (inactive), the tonus is of 2–3 mm Hg. During the first stage of labor, it varies from 8 to 10 mm Hg. It is inversely proportional to relaxation. **The factors which govern the tonus are: (i)** Contractility of uterine muscles, **(ii)** intra-abdominal pressure, and **(iii)** overdistension of uterus as in twins and hydramnios.

Intensity: **The intensity of uterine contraction describes the degree of uterine systole.** The intensity gradually increases with advancement of labor until it becomes maximum in the second stage during delivery of the baby. **Intrauterine pressure is raised to 40–50 mm Hg during first stage and about 100–120 mm Hg in second stage of labor during contractions. In spite of diminished pain in third stage, the intrauterine pressure is probably the same as that in the second stage.** The diminished pain is due to lack of stretching effect.

Duration: In the first stage, the contractions last for about 30 seconds initially but gradually increase in duration with the progress of labor. **Thus in the second stage, the contractions last longer than in the first stage.**

Frequency: In the early stage of labor, the contractions come at intervals of 10–15 minutes. The intervals gradually shorten with advancement of labor until in the second stage, when it comes every 2–3 minutes.

It is important to note that all the features of uterine contractions mentioned are very effective only when they are in combination.

RETRACTION: It is a phenomenon of the uterus in labor in which the muscle fibers are permanently shortened. Unlike any other muscles of the body, **the uterine muscles have this property to become shortened once and for all.** Contraction is a temporary reduction in length of the fibers, which attain their full length during relaxation. In contrast, retraction results in permanent shortening and the fibers are shortened once and for all **(Fig. 13.3)**.

The net effects of retraction in normal labor are:

- Essential property in the formation of lower uterine segment and dilatation and effacement of the cervix.
- To maintain the descent of the presenting part made by the uterine contractions and to help in ultimate expulsion of the fetus.
- To reduce the surface area of the uterus favoring separation of placenta.
- Effective hemostasis after the separation of the placenta.

EVENTS IN FIRST STAGE OF LABOR

The first stage is chiefly concerned with the preparation of the birth canal so as to facilitate expulsion of the fetus in

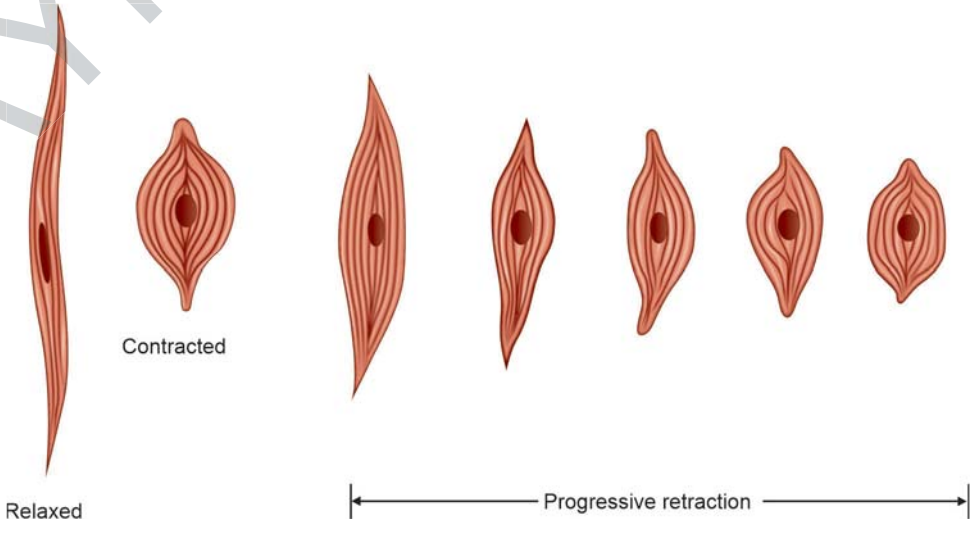

Fig. 13.3: Showing phenomenon of contraction and retraction of uterine muscle fibers during labor.

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the second stage. **The main events that occur in the first stage are—(a)** dilatation and effacement of the cervix and **(b)** full formation of lower uterine segment.

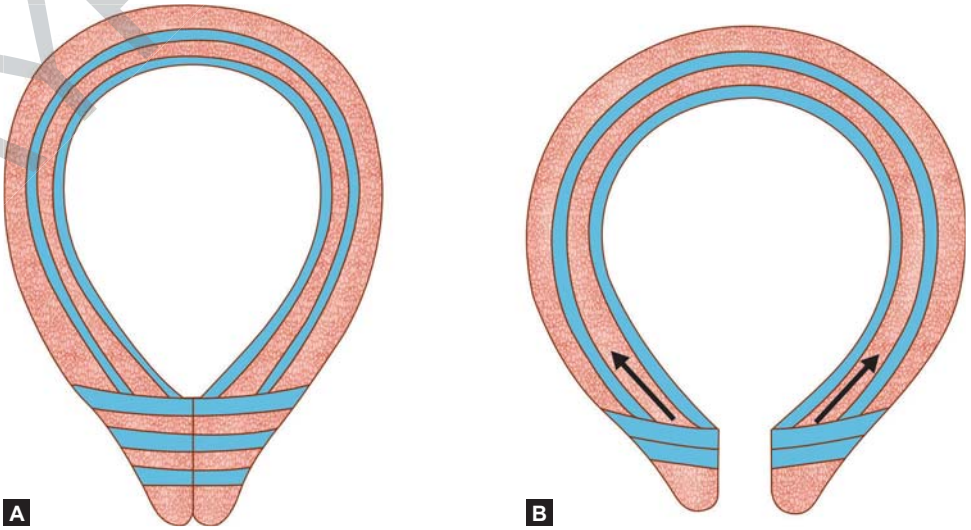
DILATATION OF THE CERVIX: Prior to the onset of labor, in the prelabor phase (phase-1) there may be a certain amount of dilatation of cervix, especially in multiparae and in some primigravidae. **Important structural components of the cervix are—(a)** smooth muscle (5–20%), **(b)** collagen and **(c)** the ground substance. **Predisposing factors which favor smooth dilatation are:**

a. Softening of the cervix.
b. Fibromusculoglandular hypertrophy.
c. Increased vascularity.
d. Accumulation of fluid in between collagen fibers.
e. Breaking down of collagen fibrils by enzymes collagenase and elastase.
f. Change in the various glycosaminoglycans (e.g., increase in hyaluronic acid, decrease in dermatan sulfate) in the matrix of the cervix.

These are under the action of hormones—estrogen, progesterone and relaxin. Too much fibrosis as in chronic cervicitis or prolapse or organic lesion in the cervix as in carcinoma, results in deficiency of these factors. As a result, cervix may fail to dilate.

Actual Factors Responsible are:

- ***Uterine contraction and retraction:*** The longitudinal muscle fibers of the upper segment are attached with circular muscle fibers of the lower segment and upper part of the cervix in a bucket-holding fashion **(Figs. 13.4A and B)**. Thus, with each uterine contraction, not only the canal is opened up from above down but also it becomes shortened and retracted. There is some coordination between fundal contraction and cervical dilatation called **'polarity of uterus'.** While the upper segment contracts, retracts and pushes the fetus, the lower segment and the cervix dilate in response to the forces of contraction of upper segment.
- ***Fetal axis pressure:*** In labor with longitudinal lie and with well-fitted (flexed) fetal head on the cervix, fetal vertebral column is straightened by the contractions of the circular muscle fibers of the body of the uterus. This allows the fundal strong contraction force to be transmitted through the fetal podalic pole and vertebral column to the well-fitted fetal head. This causes mechanical stretching of the lower segment and opening up (dilatation) of the cervical canal. With each uterine contraction, there is elongation of the uterine ovoid and decrease in the transverse diameter. In transverse lie fetal axis pressure is absent. With progressive contraction and retraction, the upper segment becomes shorter and thicker while the lower segment becomes thinner and wider. The cervical canal starts dilating.
- ***Bag of membranes:*** The membranes (amnion and chorion) are attached loosely to the decidua lining the uterine cavity except over the internal os. In vertex presentation, the girdle of contact of the head (that part of the circumference of the head which first comes in contact with the pelvic brim) being spherical, may well fit with the wall of the lower uterine segment. Thus, the amniotic cavity is divided into two compartments **(Figs. 13.5A to C)**. The part above the girdle of contact contains the fetus with bulk of the liquor called **hindwaters**, and the one below it containing small amount of liquor called **forewaters**. With the onset of labor, the membranes attached to the lower uterine segment are detached and with the rise of intrauterine pressure during contractions there is herniation of the membranes through the cervical canal. **There is ball-valve like action** by the well-flexed head. Uterine contractions generate hydrostatic pressure in the forewaters that in turn dilate the cervical canal like a wedge. When the bag of forewaters is absent (PROM) the pressure of the presenting part pushes the cervix centrifugally.
- ***Vis-a-tergo*:** The final phase of dilatation and retraction of the cervix is achieved by downward thrust of the presenting part of the fetus and upward pull of the cervix



Figs. 13.4A and B: Diagrammatic representation showing dilatation of the cervix by the pull of the longitudinal muscles of the uterus: **(A)** Before labor; **(B)** After labor.

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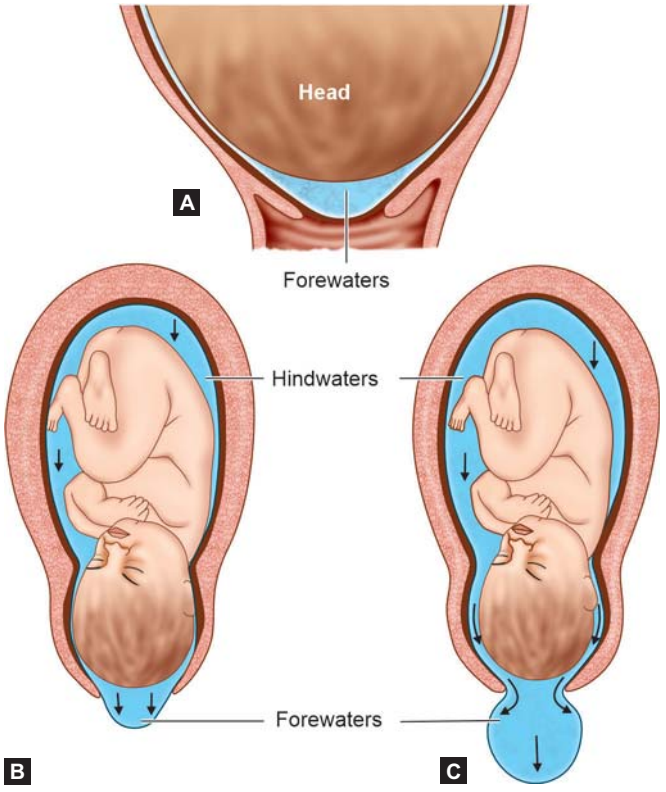


Figs. 13.5A to C: **(A)** Formation of bag of membranes and forewaters; **(B)** Well-fitting presenting part dividing the forewaters from hindwater; **(C)** Ill-fitting presenting part allows the hindwaters to force into the bag of membranes during contraction which may lead to its early rupture.

over the lower segment. This phenomenon is lacking in transverse lie where a thin cervical rim fails to disappear.

EFFACEMENT OR TAKING UP OF CERVIX: Effacement is the process by which the muscular fibers of the cervix are pulled upward and merges with the fibers of the lower uterine segment. The cervix becomes thin during first stage of labor or even before that in primigravidae. **In primigravidae**, effacement precedes dilatation of the cervix, **whereas in multiparae**, both occur simultaneously **(Figs. 13.6A and B)**. Expulsion of mucus plug is caused by effacement.

LOWER UTERINE SEGMENT: Before the onset of labor, there is no complete anatomical or functional division of the uterus. During labor the demarcation of an active upper segment and a relatively passive lower segment is more pronounced. The wall of the upper segment becomes progressively thickened with progressive thinning of the lower segment **(Figs. 13.7A to C)**. This is pronounced in late first stage, especially after rupture of the membranes and attains its maximum in second stage. A distinct ridge is produced at the junction of the two, called **physiological retraction ring** which should not be confused with the **pathological retraction ring**—a feature of obstructed labor (p. 332). Lower segment of uterus is characterized by following features **(Table 13.1)**.

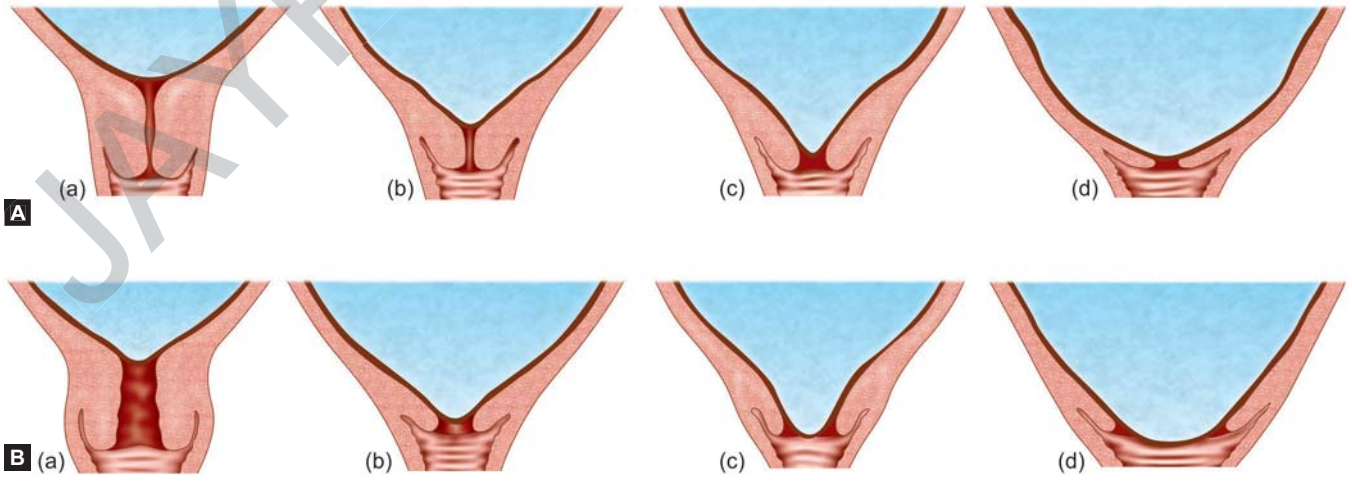
EVENTS IN SECOND STAGE OF LABOR

The second stage begins with the complete dilatation of the cervix and ends with the expulsion of the fetus. **This stage is concerned with the descent and delivery of the fetus through the birth canal.**

Second stage has two phases:

1. ***Propulsive***—from full dilatation until head touches the pelvic floor.
2. ***Expulsive***—since the time mother has irresistible desire to *'bear down'* and push until the baby is delivered.

With the full dilatation of the cervix, the membranes usually rupture and there is escape of good amount of liquor amnii. The volume of the uterine cavity is thereby reduced. Simultaneously, uterine contraction and retraction become stronger. The uterus becomes elongated during contraction, while the anteroposterior and transverse diameters are reduced. **The elongation**



Figs. 13.6A and B: Diagrammatic representation of the dilatation and 'taking up' of the cervix in—**(A)** Primigravida; **(B)** Multipara: **(A)**—(a) cervix before labor; (b and c) progressive 'taking up' of the cervix without much dilatation; (d) cervix completely taken up with external os still remaining undilated; **(B)**—(a) cervix before labor, to note the patulous cervix; (b and c) progressive and simultaneous dilatation and 'taking up' of the cervix; (d) taking up and dilatation of the external os occur simultaneously.

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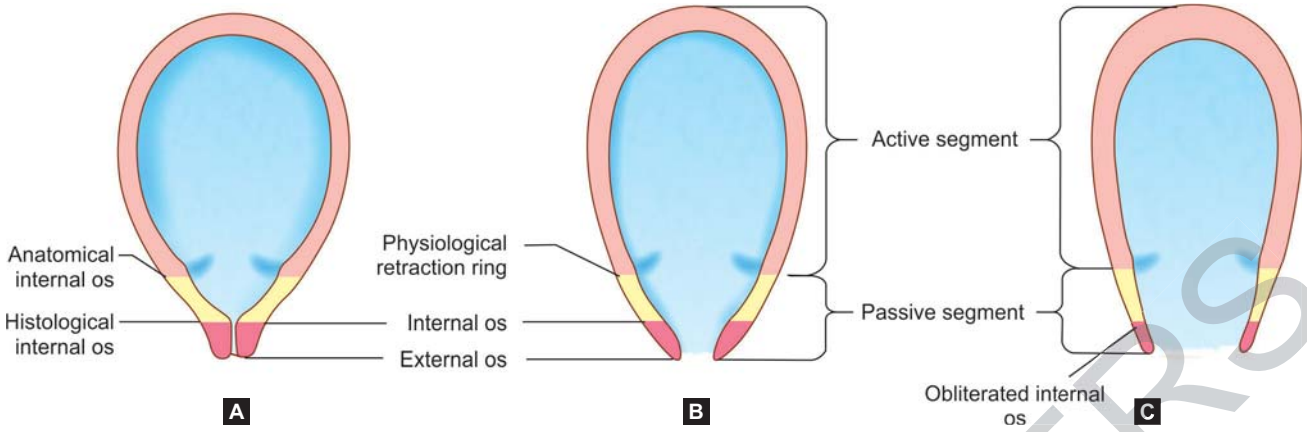

Figs. 13.7A to C: Sequence of development of the active and passive segments of the uterus: **(A)** Uterus at term; **(B)** In early labor; **(C)** Late second stage.

Table 13.1 Lower Segment (LS) of uterus and the clinical significance.

Anatomical features	*Clinical significance*
▪ **LS is developed from the isthmus** of the (nonpregnant) uterus, which is bounded above anatomical and below by histological internal os. ▪ **In labor, LS is bounded** above by the physiological retraction ring and below by the fibromuscular junction of cervix and uterus. ▪ This segment is formed **maximally during labor** and the **peritoneum is loosely attached anteriorly.** ▪ **It measures 7.5–10 cm** when fully formed and becomes cylindrical during the second stage of labor **(Figs. 13.7B and C)**. ▪ **The wall becomes gradually thin** due to: (i) Relaxation of the muscle fibers to allow elongation, (ii) the muscle fibers are drawn up by the muscle fibers of the upper uterine segment by contraction and retraction during labor and (iii) descent of the presenting part causes further stretching and thinning out of wall. ▪ **This segment has got poor retractile property** compared to the upper segment.	▪ The phenomenon of receptive relaxation enables expulsion of the fetus by **formation of complete birth canal** along with the fully dilated cervix **(Fig. 13.17)**. ▪ **Implantation of placenta** in lower segment is known as **placenta previa**. ▪ **It is through this segment** that **cesarean section** is performed. ▪ Poor decidual reaction in this segment facilitates **morbid adherent placenta**, once the placenta is implanted here. ▪ **In obstructed labor,** the lower segment is very much stretched and thinned out and ultimately **gives way (ruptures)** especially in multiparae. ▪ **It is entirely the passive segment** of the uterus. Because of poor retractile property, there is chance of postpartum hemorrhage if placenta is implanted over the area.

is partly due to the contractions of the circular muscle fibers of the uterus to keep the fetal axis straight.

Delivery of the fetus is accomplished by the downward thrust offered by uterine contractions supplemented by voluntary contraction of abdominal muscles **(Fig. 13.8)** against the resistance offered by bony and soft tissues of the birth canal. There is always a tendency to push the fetus back into the uterine cavity by the elastic recoil of the tissue of the vagina and the pelvic floor. **This is effectively counterbalanced by the power of retraction**. Thus, with increasing contraction and retraction, the upper segment becomes more and more thicker with corresponding thinning of lower segment. **Endowed with power of retraction, the fetus is gradually expelled from the uterus against the resistance offered by the pelvic floor**. After the expulsion of the fetus, the uterine cavity is permanently reduced in size only to accommodate the afterbirths.

The expulsive force of uterine contractions is added by voluntary contraction of the abdominal muscles called '**bearing down**' **efforts**. For details, see p. 120.

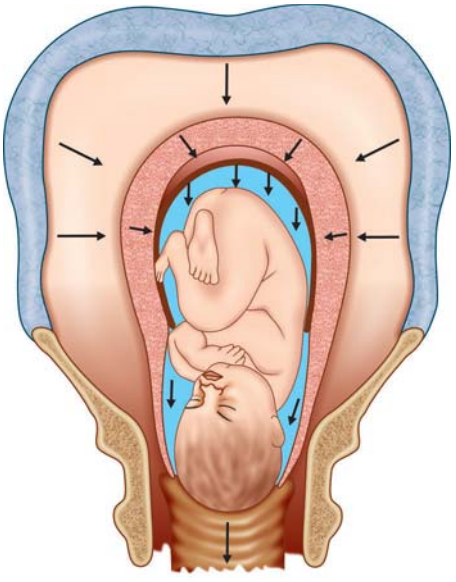

Fig. 13.8: Diagram showing the expulsive forces in the second stage. Increased intra-abdominal pressure augments the downward expulsive force of uterine contraction.

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EVENTS IN THIRD STAGE OF LABOR

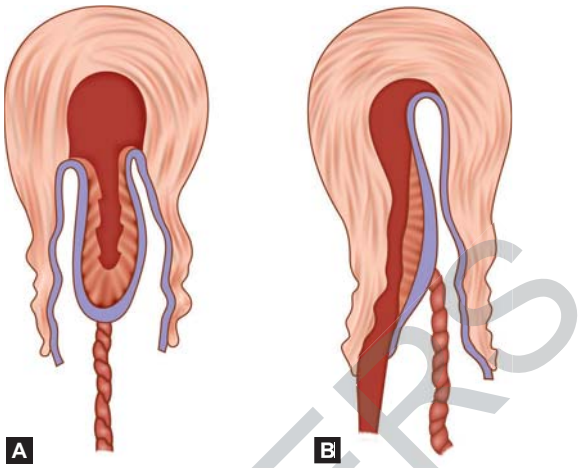
The third stage of labor comprises the phase of **placental separation**; its descent to the lower segment and finally its **expulsion** with the membranes.

PLACENTAL SEPARATION: At the beginning of labor, the placental attachment roughly corresponds to an area of 20 cm (8") in diameter. There is no appreciable diminution of the surface area of the placental attachment during first stage. During the second stage, there is slight but progressive diminution of the area following successive retractions, which attains its peak immediately following the birth of the baby.

After the birth of the baby, the uterus measures about 20 cm (8") vertically and 10 cm (4") anteroposteriorly, the shape becomes discoid. The wall of the upper segment is much thickened while thin and flabby lower segment is thrown into folds. The cavity is much reduced to accommodate only the afterbirths.

Mechanism of separation: Marked retraction reduces effectively the surface area at the placental site to about its half. But as the placenta is inelastic, it cannot keep pace with such an extent of diminution resulting in its buckling **(Figs. 13.9A and B)**. A shearing force is instituted between the placenta and the placental site which brings about its ultimate separation. **The plane of separation runs through deep spongy layer of decidua basalis** so that a variable thickness of decidua covers the maternal surface of the separated placenta. **There are two ways of separation of placenta (Figs. 13.10A and B).**

(1) **Central separation (Schultze):** Detachment of placenta from its uterine attachment starts at the center resulting in opening up of few uterine sinuses and accumulation of blood behind the placenta (retroplacental hematoma). With increasing contraction, more and more detachment occurs facilitated by weight of the placenta and retroplacental blood until whole of the placenta gets detached.

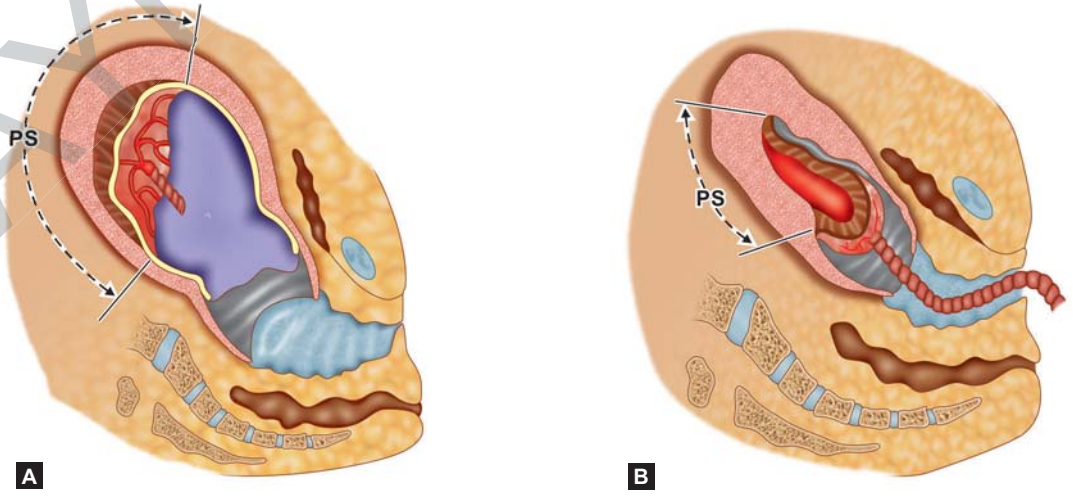


Figs. 13.10A and B: Types of separation of the placenta: **(A)** Schultze method; **(B)** Mathews-Duncan method.

(2) **Marginal separation (Mathews-Duncan):** Separation starts at the margin as it is mostly unsupported. With progressive uterine contraction, more and more areas of the placenta get separated. Marginal separation is found more frequently.

SEPARATION OF THE MEMBRANES: The membranes, which are attached loosely in the active part, are thrown into multiple folds. Those attached to the lower segment are already separated during its stretching. **The separation is facilitated partly** by uterine contraction and mostly by weight of the placenta as it descends down from the active part. The membranes so separated carry with them remnants of decidua vera giving the outer surface of the chorion its characteristic roughness.

EXPULSION OF PLACENTA: After complete separation of the placenta, it is forced down into the flabby lower uterine segment or upper part of the vagina by effective contraction and retraction of the uterus. Thereafter, it is expelled out either by voluntary contraction of abdominal muscles (bearing down efforts) or by manual procedure (p. 129).



Figs. 13.9A and B: Diagram showing area of placental site: **(A)** Before the delivery of the baby; **(B)** After the delivery of the baby. ***Note:*** The reduction of the surface area of the placental site resulting in buckling of the placenta.
(PS: Placental Surface)

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***Mechanism of control of bleeding*:** After placental separation, innumerable torn sinuses which have free circulation of blood from uterine and ovarian vessels have to be obliterated. **The occlusion is affected by complete retraction** whereby the arterioles, as they pass tortuously through the interlacing intermediate layer of the myometrium, are literally clamped **(Figs. 13.11A and B)**. **It (living ligature) is the principal mechanism of hemostasis**. However, **thrombosis** occurs to occlude the torn sinuses, a phenomenon, which is facilitated by hypercoagulable state of pregnancy. **Apposition of the walls of the uterus** following expulsion of the placenta (myotamponade) also contributes to minimize blood loss.

MECHANISM OF NORMAL LABOR

DEFINITION: The series of movements that occur on the head in the process of adaptation during its journey through the pelvis is called mechanism of labor (Flowchart 13.2). It should be borne in mind that while the principal movements are taking place in the head, the rest of the fetal trunk is also involved in it, either participating in or initiating the movement.

MECHANISM: In normal labor, the head enters the brim more commonly through the available transverse diameter (70%) and to a lesser extent through one of the oblique diameters. Accordingly, the position is either occipitolateral or oblique occipitoanterior. Left occipitoanterior is little more common than right occipitoanterior as the left oblique diameter is encroached by the rectum. **The engaging anteroposterior diameter** of the head is either suboccipitobregmatic 9.5 cm (3¾") or in slight deflexion—the suboccipitofrontal 10 cm (4"). **The engaging transverse diameter is biparietal 9.5 cm (3.74"). As the occipitolateral position is the most common, the mechanism of labor in such position will be described. The principal movements are: (1)** Engagement, **(2)** descent, **(3)** flexion, **(4)** internal rotation, **(5)** crowning, **(6)** extension, **(7)** restitution, **(8)** external rotation and **(9)** expulsion of the trunk. Although the various movements are described separately but in reality, the movements at least some, may be going on simultaneously.

Engagement: Head brim relation prior to the engagement as revealed by imaging studies shows that due to lateral inclination of the head, the sagittal suture does not strictly correspond with the available transverse diameter of the inlet. Instead, it is either deflected anteriorly toward the symphysis pubis or posteriorly toward the sacral promontory **(Figs. 13.12A to C)**. Such deflection of the head in relation to the pelvis is called **asynclitism**.

When the sagittal suture lies anteriorly, the posterior parietal bone becomes the leading presenting part and is called **posterior asynclitism or posterior parietal presentation (Lizman obliquity)**. This is more frequently found in primigravidae because of good uterine tone and a tight abdominal wall.

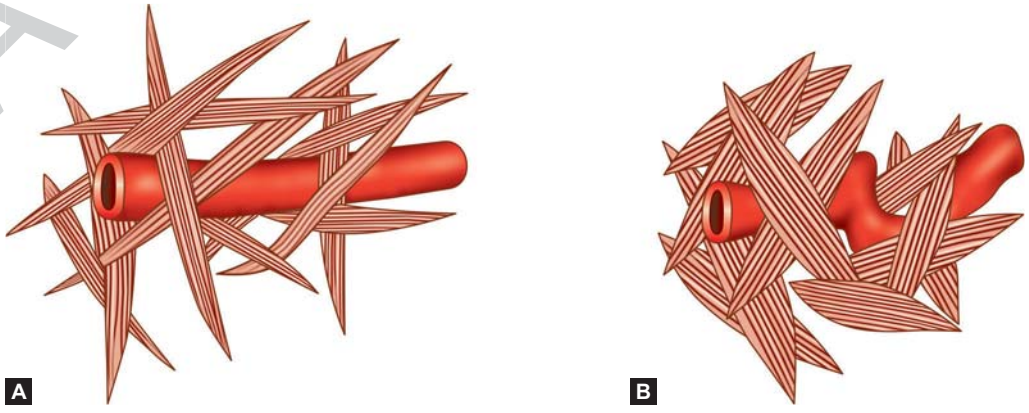
In others, the sagittal suture lies more posteriorly with the result that the anterior parietal bone becomes the leading presenting part and is then called **anterior parietal presentation or anterior asynclitism (Negele's obliquity)**. It is more commonly found in multiparae.

Mild degrees of asynclitism are common but severe degrees indicate cephalopelvic disproportion (Box 13.1).

Posterior lateral flexion of the head occurs to glide the anterior parietal bone past the symphysis pubis in posterior parietal presentation. Lateral flexion in the reverse direction occurs to glide the posterior parietal bone past the sacral promontory in anterior parietal presentation. **After this movement which occurs early in labor, not only the head enters the brim but also synclitism occurs**. However, in about 25% of cases, the head enters the brim in synclitism, i.e., the sagittal suture corresponds to the diameter of engagement.

In primigravidae, engagement occurs in a significant number of cases before the onset of labor **while in multiparae**, the same may occur in late first stage with rupture of the membranes.

Descent: **Provided there is no undue bony or soft tissue obstruction, descent is a continuous process**. It is slow or insignificant in first stage but pronounced in second stage. It is completed with the expulsion of the fetus. In



Figs. 13.11A and B: Blood vessels: **(A)** Running through the interlacing muscle fibers; **(B)** Literally clamped due to effective retraction of the uterine muscles.

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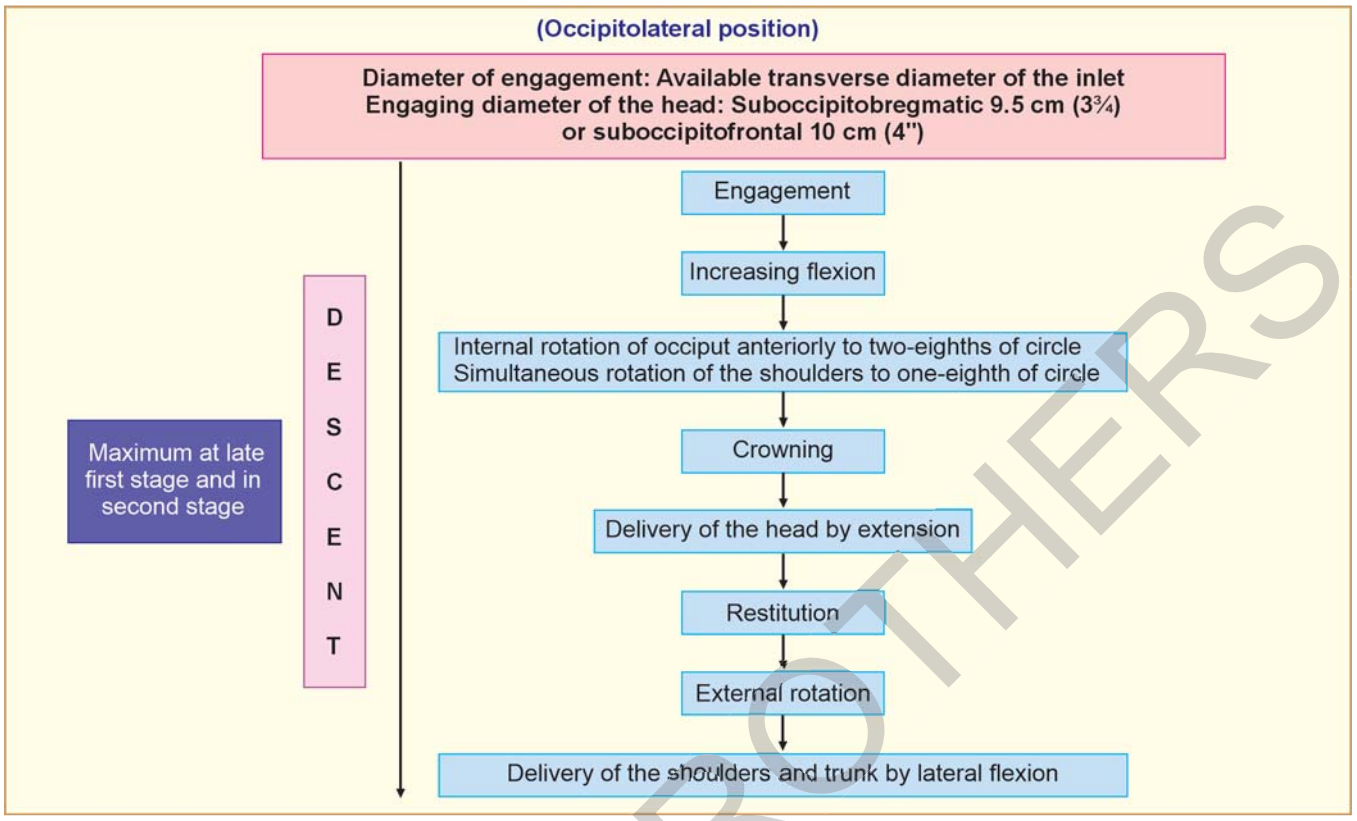
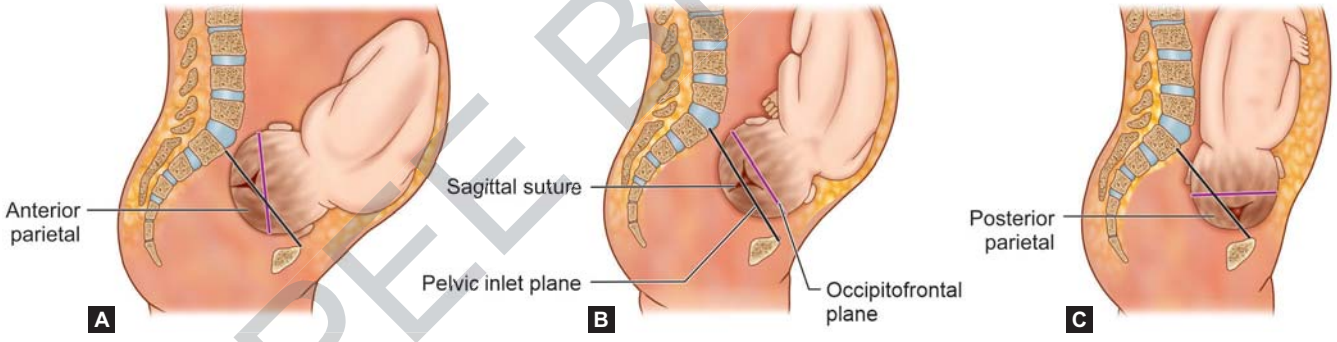
Flowchart 13.2: Summary of mechanism of labor.





Figs. 13.12A to C: Head brim relation prior to engagement: **(A)** Anterior parietal presentation; **(B)** Head in synclitism; **(C)** Posterior parietal presentation.

Box 13.1: Advantages of asynclitism.

- Engagement of head with asynclitism, the two parietal eminences cross the brim one at a time. This helps lesser diameter (super subparietal: 8.5 cm), to cross the pelvic brim instead of larger biparietal diameter (9.5 cm) for engagement in synclitism.
- Asynclitism is beneficial in the mechanism of engagement of head.
- Marked and persistent asynclitism is abnormal and indicates cephalopelvic disproportion.

primigravidae, with prior engagement of the head, there is practically no descent in first stage; while in multiparae, descent starts with engagement. Head is expected to reach the pelvic floor by the time the cervix is fully dilated. **Factors facilitating descent are**—**(1)** uterine contraction and retraction, **(2)** bearing down efforts and **(3)** straightening of the fetal ovoid especially after rupture of the membranes.

Flexion: While some degree of flexion of the head is noticeable at the beginning of labor but complete flexion is rather uncommon. As the head meets the resistance of the birth canal during descent, full flexion is achieved. Thus, if the pelvis is adequate, **flexion is achieved either due to the resistance offered by the unfolding cervix, the walls of the pelvis or by the pelvic floor**. It has been seen that flexion precedes internal rotation or at least coincides with it. Flexion is essential for descent, since it reduces the shape and size of the plane of the advancing diameter of the head.

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Flexion is explained by the two-arm lever theory— the fulcrum represented by the occipitoallantoid joint of the head, the short arm extends from the condyles to the occipital protuberance, and the long arm extends from condyles to the chin. When resistance is encountered, by ordinary law of mechanics, the short arm descends and the long arm ascends resulting in flexion of the head **(Figs. 13.13A and B)**.

Internal rotation: It is a movement of great importance without which there will be no further descent. The mechanism of internal rotation is very complex, although easy to describe. **The theories which explain the anterior rotation of the occiput are:**

- ***Slope of pelvic floor:*** Two halves of levator ani form a gutter and viewed from above, the direction **of the fibers is backward and toward the midline**. Thus, during each contraction, the head, occiput in particular, in well-flexed position, stretches the levator ani, particularly that half which is in relation to the occiput. After the contraction passes off, elastic recoil of the levator ani occurs bringing the occiput forward toward the midline. The process is repeated until the occiput is placed anteriorly. **This is called rotation by law of pelvic floor (Hart's rule)**.
- ***Pelvic shape:*** Forward inclination of the side walls of the cavity, narrow bispinous diameter and long anteroposterior diameter of the outlet result in putting the long axis of the head to accommodate in the maximum available diameter, i.e., anteroposterior diameter of the outlet leaving behind the smallest bispinous diameter.
- ***Law of unequal flexibility (Sellheim and Moir):*** The internal rotation is primarily due to inequalities in the flexibility of the component parts of the fetus.

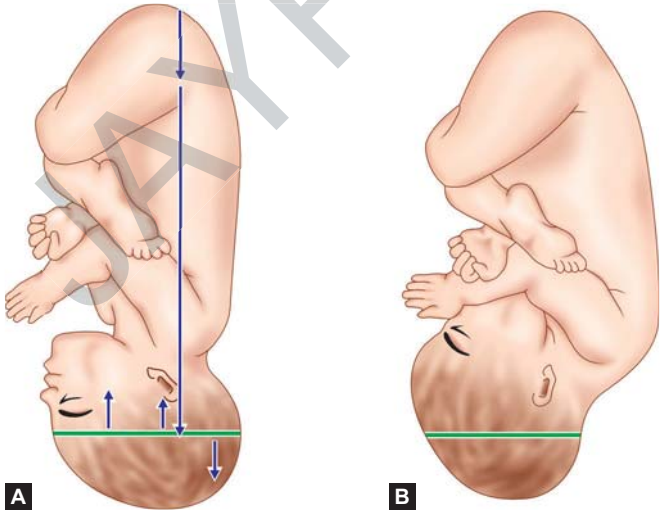
In occipitolateral position, there will be anterior rotation by two-eighths of a circle of the occiput **(Fig. 13.14)** whereas in oblique anterior position, rotation will be one-eighth of a circle forward, placing the occiput behind the symphysis pubis. There is always an accompanying movement of descent with internal rotation. **Thus, prerequisites of anterior internal rotation of the head are** well-flexed head, efficient uterine contraction, favorable shape at the midpelvic plane, and tone of the levator ani muscles.

The level at which internal rotation occurs is variable. Rotation in the cervix although favorable is a less frequent occurrence. **In majority of cases, rotation occurs at the pelvic floor**. Rarely, it occurs as late as crowning of the head.

Torsion of the neck: It is an inevitable phenomenon during internal rotation of the head. If the shoulders remain in the anteroposterior diameter, the neck has to sustain a torsion of two-eighths of a circle corresponding with the same degree of anterior rotation of the occiput. But the neck fails to withstand such major degree of torsion and as such there will be some amount of simultaneous rotation of the shoulders in the same direction to the extent of one-eighth of a circle placing the shoulders to lie in the oblique diameter with one-eighth of torsion still left behind. **Thus, the shoulders move to occupy the left oblique diameter in left occipitolateral position and right oblique diameter in right occipitolateral position. In oblique occipitoanterior position,** there is no movement of the shoulders from the oblique diameter as the neck sustains a torsion of only one-eighth of a circle.

Crowning: After internal rotation of the head, further descent occurs until the suboccipute lies underneath the pubic arch. At this stage, **the maximum diameter of the head (biparietal diameter) stretches the vulval outlet without any recession of the head even after the contraction is over called 'crowning of the head'.**

Extension: **Delivery of the head takes place by extension through 'couple of force' theory**. The driving force pushes the head in a downward direction while the pelvic floor offers a resistance in the upward and forward direction. The downward and upward forces



Figs. 13.13A and B: Lever action producing flexion of the head reducing the engaging diameter of the head from occipitofrontal **(A)** to suboccipitobregmatic **(B)**.

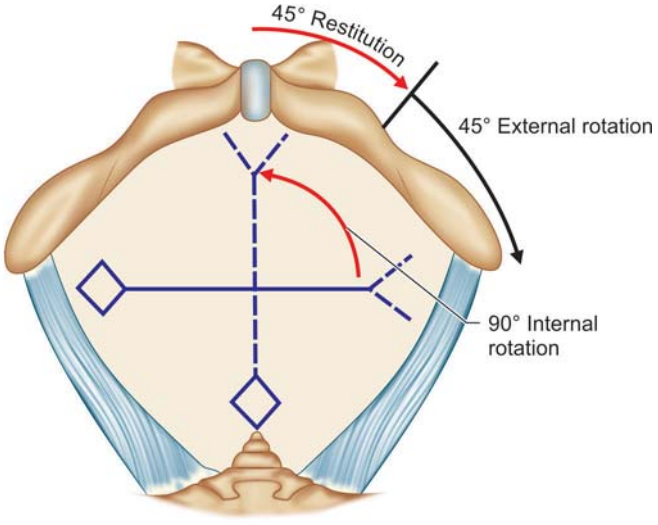


Fig. 13.14: Degree of internal rotation, restitution and external rotation of the head in left occipitolateral position.

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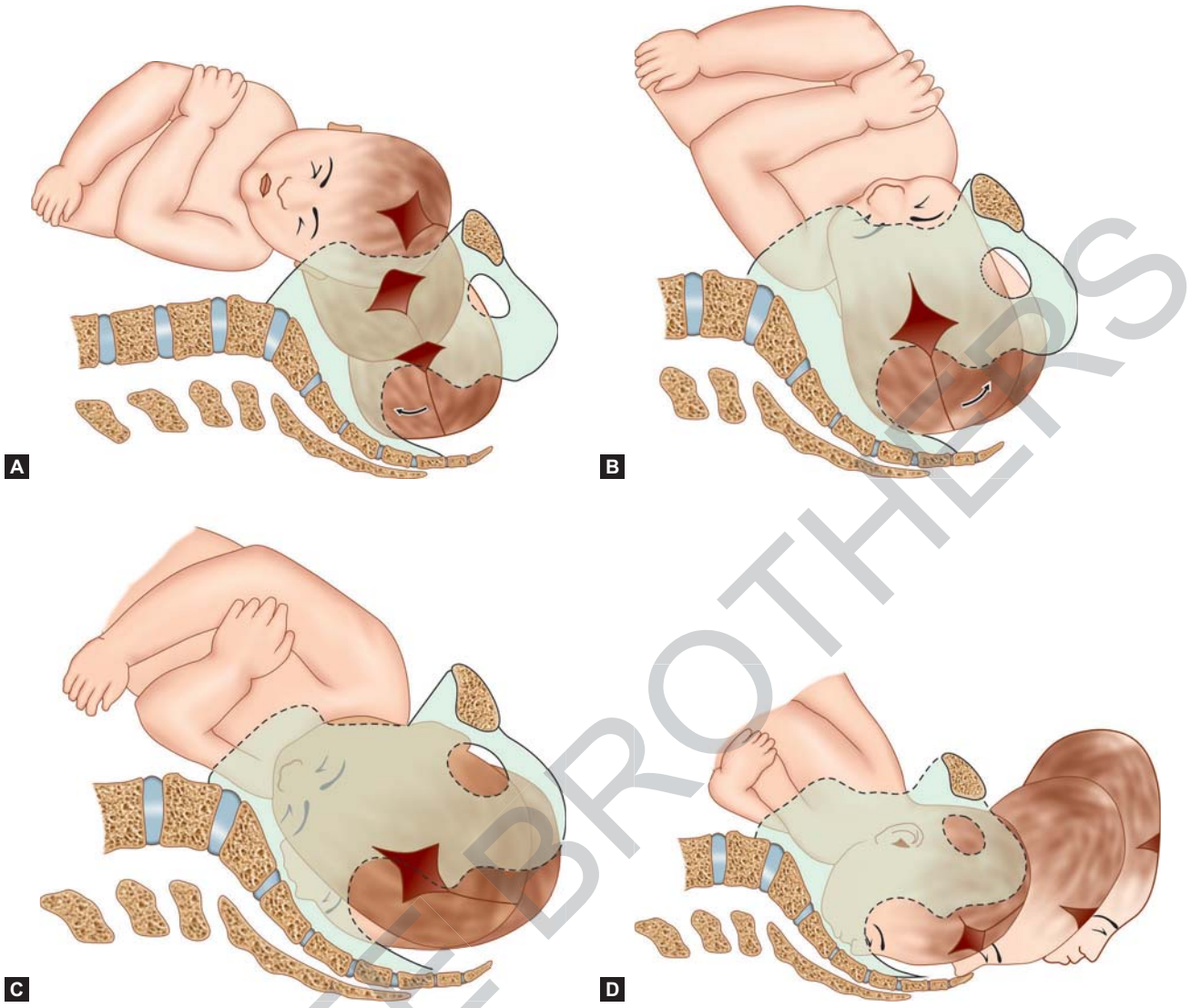

Figs. 13.15A to D: Lateral view showing mechanism of labor in left occipitolateral position: **(A and B)** Posterior parietal presentation, posterior lateral flexion of the head and engagement; **(C and D)** Internal rotation of the head with movement of the shoulders; descent and delivery of the head by extension.

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neutralize and remaining forward thrust helping in extension **(Figs. 13.15A to D)**. **The successive parts of the fetal head to be born** through the stretched vulval outlet are: vertex, brow and face. Immediately following the release of the chin through the anterior margin of the stretched perineum, the head drops down, bringing the chin in close proximity to the maternal anal opening.

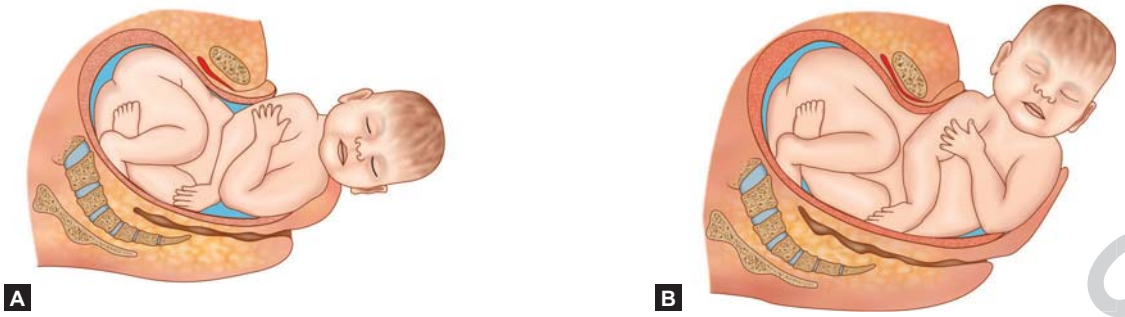
***Restitution*: It is the visible passive movement of the head due to untwisting of the neck sustained during internal rotation**. Movement of restitution occurs rotating the head through one-eighth of a circle in the direction opposite to that of internal rotation **(Fig. 13.14)**. **The occiput thus points to the maternal thigh of the corresponding side to which it originally lay (Fig. 13.26)**.

***External rotation*: It is the movement of rotation of the head visible externally due to internal rotation of the shoulders**. As the anterior shoulder rotates toward the symphysis pubis from the oblique diameter, it carries the head in a movement of external rotation through one-eighth of a circle in the same direction as restitution. The shoulders now lie in the anteroposterior diameter. **The occiput points directly toward the maternal thigh corresponding to the side to which it originally directed at the time of engagement (Figs. 13.14 and 13.26)**.

Birth of shoulders and trunk (Figs. 13.16A and B, Flowchart 13.2): After the shoulders are positioned in anteroposterior diameter of the outlet, further descent takes place until the anterior shoulder escapes below the symphysis pubis first. By a movement of lateral flexion of the spine, the posterior shoulder sweeps over the perineum. Rest of the trunk is then expelled out by lateral flexion.

ANATOMY OF LABOR

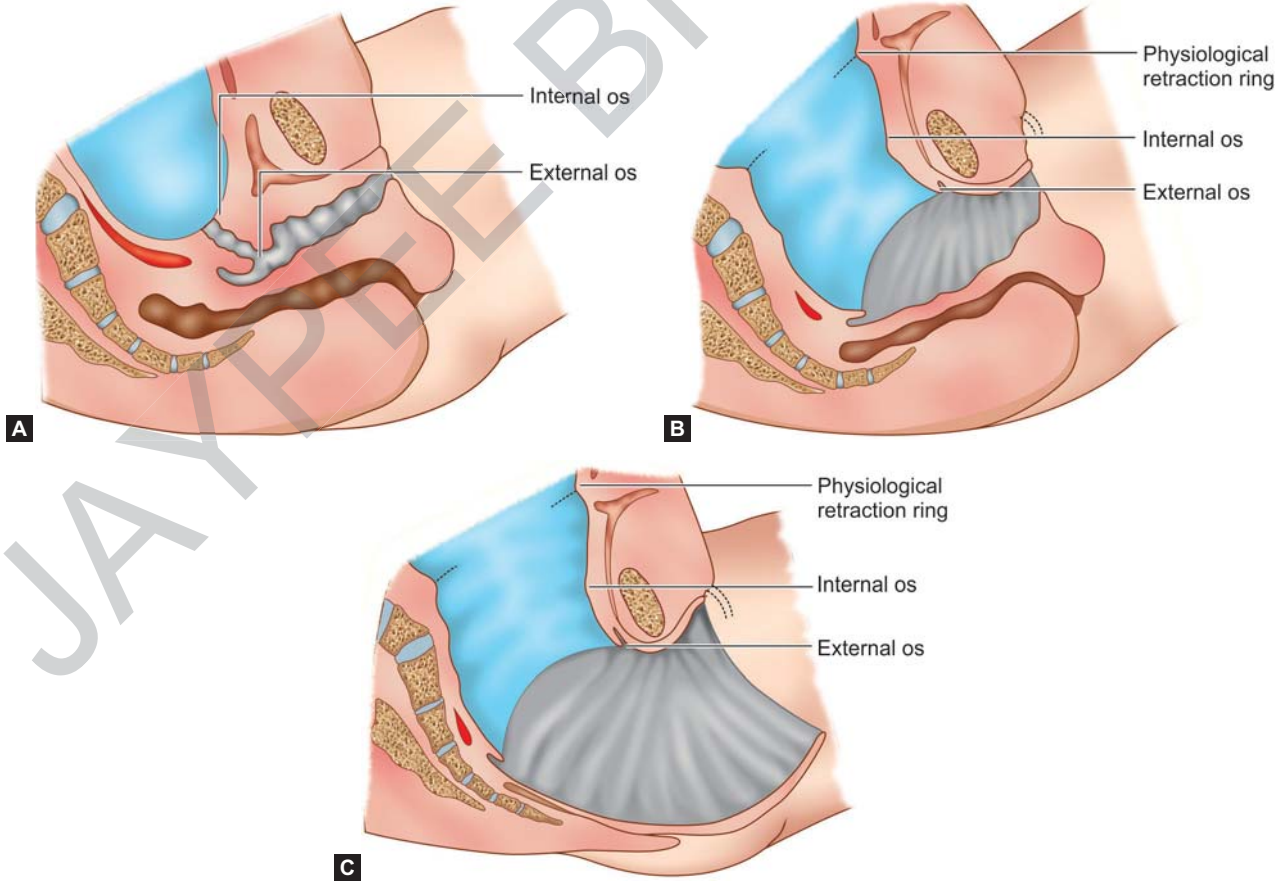
As labor advances, the body of uterus, cervix and vagina together form a uniformly curved canal called the **birth**



Figs. 13.16A and B: Delivery of the shoulders by lateral flexion: **(A)** Anterior shoulder; **(B)** Posterior shoulder.

canal. Normally, at the onset of labor when the head is not engaged, the pelvic structures anterior to the vagina are urethra and bladder, and those posterior to the vagina are the pouch of Douglas with coils of intestine, rectum, anal canal, perineum and anococcygeal raphe.

As the head descends down with progressive dilatation of the vagina, it displaces the anterior structures upward and forward, and the posterior structures downward and backward, as if the head is passing through a swing door **(Figs. 13.17A to C)**. The bladder which remains a pelvic organ throughout the first stage becomes an abdominal organ in the second stage of labor. **However, there is no stretching of the urethra** as was previously thought. **Rather, the urethra is pushed anteriorly** with the neck of the bladder still lying in the vulnerable position behind the symphysis pubis. The changes in the posterior structures due to downward and backward displacement are marked when the head is sufficiently low down and in the stage of 'crowning'. The perineum which is a triangular area of about 4 cm thickness becomes a thinned out, membranous structure of less than 1 cm thickness. The anus, from being a closed opening, becomes dilated to the extent of 2–3 cm. The anococcygeal raphe is also thinned and stretched. Thus, the posterior wall of the birth canal becomes about 23 cm (9") in length, 11.5 cm (4½") for the depth of the sacrum, and 11.5 cm (4½") for the stretched soft tissue, while its anterior wall remains the



Figs. 13.17A to C: **(A)** The relative position of the bladder, urethra and the genital organs at the beginning of labor; **(B)** Formation of birth canal with the cervix fully dilated. **Note the forward displacement of the urethra and bladder neck behind the pubis**; **(C)** Marked stretching with downward and backward displacement of the posterior wall of the canal as the head descends down.

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same 4 cm (1½") in length. The canal becomes almost a semicircle.

CLINICAL COURSE OF FIRST STAGE OF LABOR

The first symptom to appear is intermittent painful uterine contractions followed by expulsion of blood-stained mucus (show) per vaginam. Only few drops of blood mixed with mucus is expelled and any excess should be considered abnormal.

PAIN: Pains are felt more anteriorly with simultaneous hardening of the uterus. Initially, pains are not strong enough to cause discomfort and come at varying intervals of 15–30 minutes with duration of about 30 seconds. But gradually the interval becomes shortened with increasing intensity and duration so that in late first stage the contraction comes at intervals of 3–5 minutes and lasts for about 45 seconds. The relation of pain with uterine contraction is of great clinical significance. **In normal labor,** pains are usually felt shortly after the uterine contractions begin and pass off before complete relaxation of the uterus. **Clinically pains are said to be good** if they come at intervals of 3–5 minutes and at the height of contraction the uterine wall cannot be indented by the fingers.

DILATATION AND EFFACEMENT OF THE CERVIX: Progressive anatomical changes in the cervix, such as dilatation and effacement, are recorded following each vaginal examination. **Cervical dilatation relates** with dilatation of the external os and **effacement is determined by** the length of the cervical canal in the vagina. In primigravidae, the cervix may be completely effaced, feeling like a paper although not dilated enough to admit a fingertip. It may be mistaken for one that is fully dilated. While in multiparae, dilatation and taking up occur simultaneously which are more abrupt following rupture of the membranes. **The anterior lip of the cervix is the last to be effaced**. The first stage is said to be completed only when the cervix is completely retracted over the presenting part during contractions.

Cervical dilatation is expressed either in terms of fingers—1, 2, 3 or fully dilated or better in terms of centimeters (10 cm when fully dilated). It is usually measured with fingers but recorded in centimeters. One finger equals to 1.6 cm on average. Simultaneously, effacement of the cervix is expressed in terms of percentage, i.e., 25%, 50% or 100% (cervix less than 0.25 cm thick). **The term 'rim' is used** when the depth of the cervical tissue surrounding the os is about 0.5–1 cm.

Partograph (Fig. 35.6): Friedman (1954) first devised it. Partograph is a composite graphical record of cervical dilatation and descent of head against duration of labor in hours. It also gives information about fetal and maternal condition, which are all recorded on a single sheet of paper (for details, Ch. 35). **Cervical dilatation is a sigmoid curve and the first stage of labor has got two phases—(1) latent phase and (2) active phase (Fig. 13.18)**.

First stage of labor (Friedman 1971) is divided into a relatively flat latent phase and a rapidly progressive

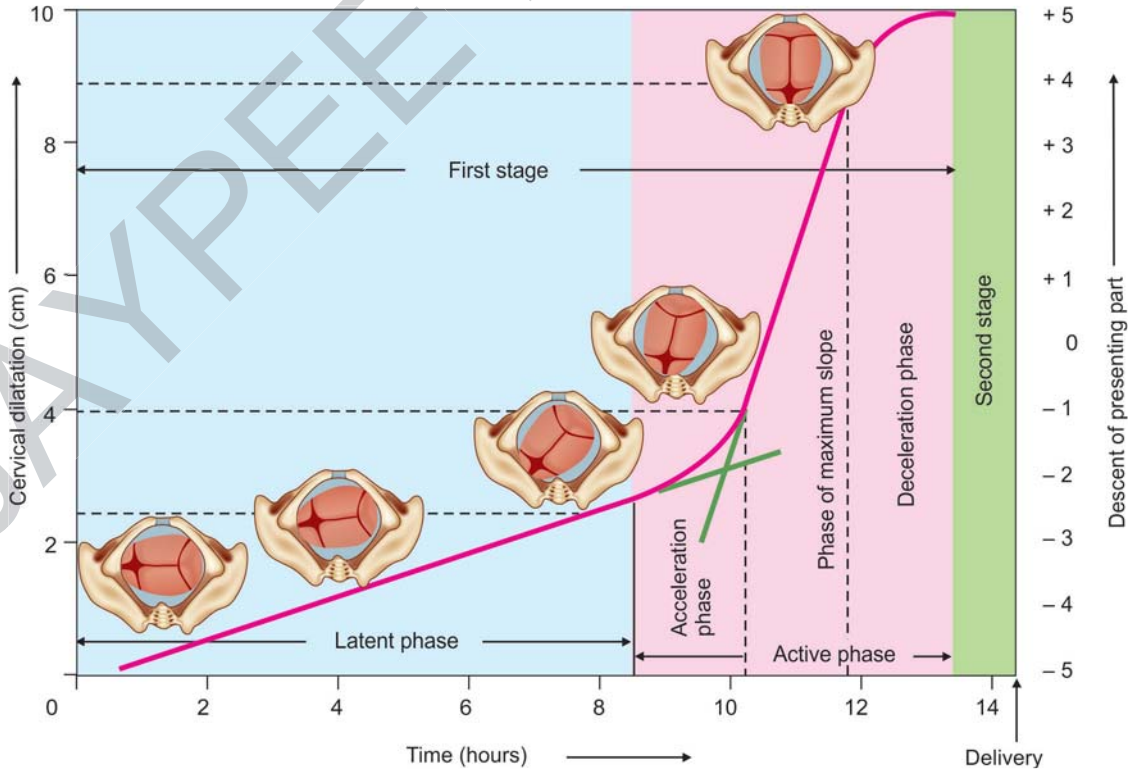

Fig. 13.18: Composite partographic representation of different phases of labor showing progressive cervical dilatation, descent and rotation of the head.

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active phase **(Fig. 13.18)**. The active phase has three compartments. **Presently active phase is defined to start with 5 cm (WHO) or 6 cm (ACOG, SFMM).**

Latent phase of labor is defined as the period between the onset of true labor pain and the point when the cervical dilatation becomes 5 cm (WHO)/6 cm (ACOG). **Normal duration of latent phase of labor in a primigravida is about 20 hours (average 8.6 hours) and 14 hours (average 5.3 hours) in a multipara (Fig. 13.18)**.

Prolonged latent phase does not endanger the mother or the fetus. No intervention is needed.

The active phase has got three components:

i. Acceleration phase with cervical dilatation of 3–4 cm.
ii. Phase of maximum slope of 4–9 cm dilatation.
iii. Phase of deceleration of 9–10 cm dilatation.

The rate of cervical dilatation is <0.5 cm/h in a primi and 0.5 to 1.3 cm/h in a multi. The rate of descent of the presenting part is <1 cm/h in a primi and <2 cm/h in a multi. It is much slower compared to Friedman's graph. The consortium on safe labor data highlights maximum slope in cervical dilatation usually starts with 6 cm. So diagnosis of protracted active phase or arrest of labor should not be made before 6 cm of dilatation. **In a partograph** (WHO-2020), the labor process is divided into: **(i)** Latent phase that ends when the cervix is 5 cm dilated, **(ii)** Active phase that starts with cervical dilatation of 5 cm. Currently, **consortium on safe labor** suggest a revision of the definition of normal and protracted labor. It suggests a slower rate of cervical change than Friedman's work **(Fig. 13.8)**.

The active phase did not start until 6 cm of cervical dilatation. The consortium on Safe Labor did not specifically address the duration for diagnosis of arrest of labor.

Labor care guide (WHO): Active phase starts from 5 cm of cervical dilatation. **Fixed 1 cm/hour 'alert line' and the corresponding 'action line' has been removed.** Based on evidence, the time limits at each cm of cervical dilatation during the active first stage of labor varies. There is variability in the rate of progress of labor between women. The lines have been removed but the parameters remain same. There is a section for intensified monitoring for the **second stage of labor**.

STATUS OF THE MEMBRANES: Membranes usually remain intact until full dilatation of the cervix or sometimes even beyond in the second stage. However, it may rupture any time after the onset of labor but before full dilatation of cervix—when it is called **early rupture**. When the membranes rupture before the onset of labor, it is called **premature rupture (p. 292)**. As it has got some influence on the obstetric outcome, it is discussed elsewhere (Ch. 22).

An intact membrane is best felt with fingers during uterine contraction when it becomes tense and bulges out through the cervical opening. In between contractions, the membranes get relaxed and lies in contact with the head. With the rupture of the membranes, variable amounts of liquor escape out through the vagina and often there is acceleration of uterine contractions.

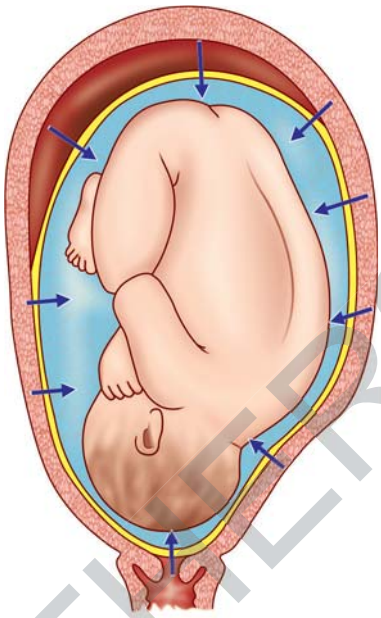

Fig. 13.19: Generalized intra-amniotic pressure with intact membranes. Placental circulation is almost unaffected during uterine contraction.

MATERNAL SYSTEM: General condition remains unaffected; although, a feeling of transient fatigue appears following a strong contraction. Pulse rate is increased by 10–15 beats per minute during contraction, which settles down to its previous rate in between contractions. Systolic blood pressure is raised by about 10 mm Hg during contraction. Temperature remains unchanged.

FETAL EFFECT: As long as the membranes are intact, there is hardly any adverse effect on the fetus **(Fig. 13.19)**. However, during contraction, there may be slowing of fetal heart rate by 10–20 beats per minute which soon returns to its normal rate of about 140 per minute as the intensity of contraction diminishes provided the fetus is not compromised.

CLINICAL COURSE OF SECOND STAGE OF LABOR

Second stage begins with full dilatation of the cervix and ends with expulsion of the fetus.

PAIN: The intensity of the pain increases. The pain comes at intervals of 2–3 minutes and lasts for about 1–1½ minutes. It becomes successive with increasing intensity in the second stage.

BEARING DOWN EFFORTS: It is the additional voluntary expulsive efforts that appear during the second stage of labor (expulsive phase). It is initiated by nerve reflex

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(Ferguson reflex) set up due to stretching of the vagina by the presenting part. In majority, this expulsive effort start spontaneously with full dilatation of the cervix. Along with uterine contraction, the woman is instructed to exert downward pressure as done during straining at stool. **Sustained pushing beyond the uterine contraction is discouraged**. **Premature** (in the first stage) **bearing down efforts** may suggest uterine dysfunction. There may be slowing of the FHR during pushing and it should come back to normal once the contraction is over.

MEMBRANES STATUS: Membranes may rupture with a gush of liquor per vaginam. Rupture may occasionally be delayed till the head bulges out through the introitus. Rarely, spontaneous rupture may not take place at all, allowing the baby to be 'born in a caul'.

DESCENT OF THE FETUS: Features of descent of the fetus are evident from abdominal and vaginal examinations. **Abdominal findings are**—progressive descent of the head, assessed in relation to the brim **(Fig. 13.20)**, rotation of the anterior shoulder to the midline and change in position of the fetal heart rate—shifted downward and medially. **Internal examination reveals descent of the head in relation to ischial spines** and gradual rotation of the head evidenced by position of the sagittal suture, and the occiput in relation to the quadrants of the pelvis **(Fig. 13.22)**.

Abdominal assessment of progressive descent of the head (using fifth formula)

Progressive descent of the head can be usefully assessed abdominally by estimating the number of 'fifths' of the head above the pelvic brim (Crichton). The amount of head felt suprapubically in finger breadth is assessed by placing the radial margin of the index finger above the symphysis pubis successively until the groove of the neck is reached **(Figs. 13.21A and B)**. **When one-fifth above, only the sinciput can be felt abdominally and nought-fifth represents a head entirely in the pelvis with no poles felt abdominally (Fig. 13.20).**

Advantages over 'station of the head' in relation to ischial spines:

- It excludes the variability due to caput and molding or by a different depth of the pelvis.
- The assessment is quantitative and can be easily reproduced.
- Repeated vaginal examinations are avoided.

VAGINAL SIGNS: As the head descends down, it distends the perineum, the vulval opening looks like a slit through which the scalp hair is visible. During each contraction,

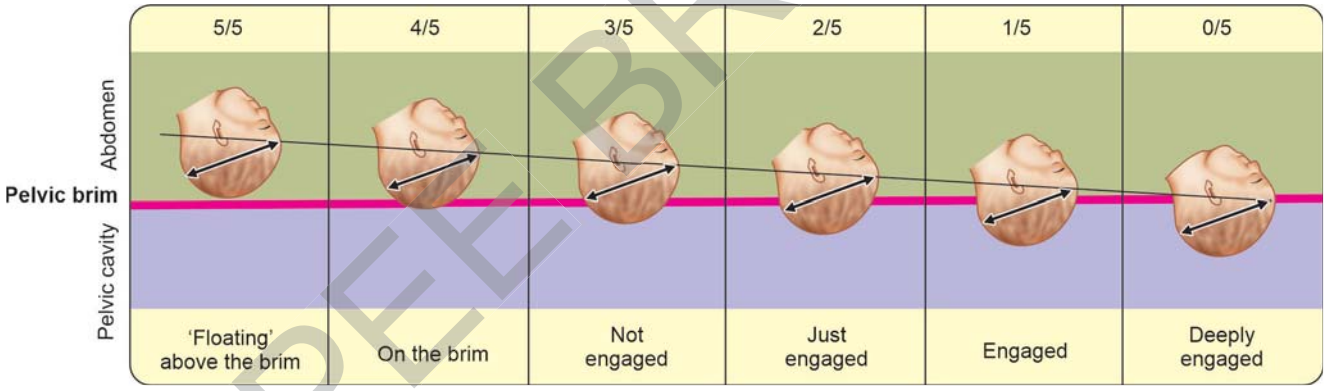
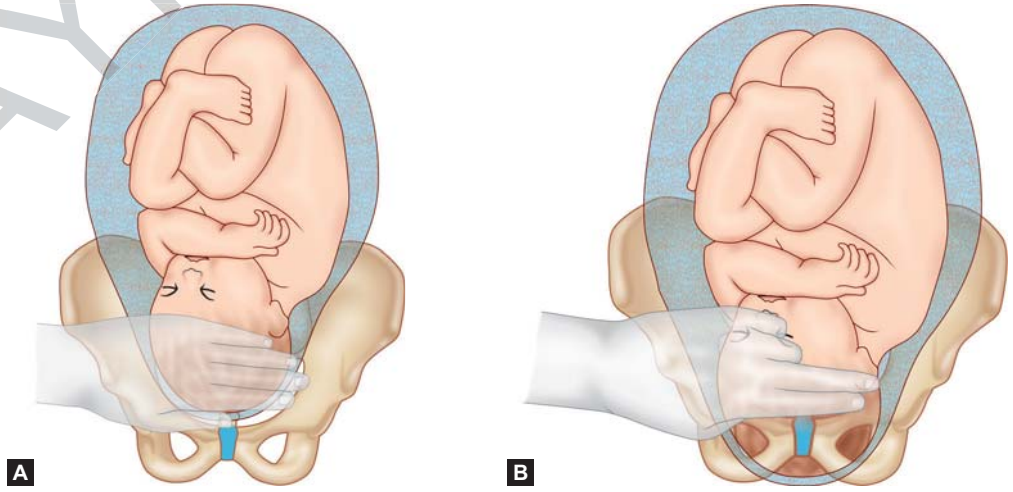


Fig. 13.20: Progressive descent of the head, assessed 'in fifths' palpable above the brim **(Figs. 13.20A and B)**.



Figs. 13.21A and B: **(A)** Head is palpable one-fifth above the symphysis pubis. Head is mobile, free and not engaged; **(B)** Head is palpable two-fifths above and three-fifths has gone down the brim. Head is engaged **(Fig. 13.20)**.

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the perineum is markedly distended with the overlying skin tense and glistening and the vulval opening becomes circular (expulsive phase). The adjoining anal sphincter is stretched and stool comes out during contraction. The head recedes after the contraction passes off but is held up a little in advance because of retraction. Ultimately, the maximum diameter of the head (biparietal) stretches the vulval outlet and there is no recession even after the contraction passes off. **This is called 'crowning' of the head. The head is born by extension.** After a little pause, the mother experiences further pain and bearing-down efforts to expel the shoulders and the trunk. Immediately thereafter, a gush of liquor (hindwaters) follows, often tinged with blood.

MATERNAL SIGNS: There are features of exhaustion. Respiration is, however, slowed down with increased perspiration. During the bearing-down efforts, the face becomes congested with neck veins prominent. Immediately following the expulsion of the fetus, the mother heaves a sigh of relief.

FETAL EFFECTS: Slowing of FHR during contractions is observed, which comes back to normal before the next contraction.

CLINICAL COURSE OF THIRD STAGE OF LABOR

Third stage includes separation, descent and expulsion of the placenta with its membranes.

PAIN: For a short time, the patient experiences no pain. However, intermittent discomfort in the lower abdomen reappears, corresponding with the uterine contractions.

BEFORE SEPARATION: *Per abdomen*—uterus becomes discoid in shape, firm in feel and non-ballottable. Fundal height reaches slightly below the umbilicus.

Per vaginam: There may be slight trickling of blood. Length of the umbilical cord as visible from outside remains static.

AFTER SEPARATION: It takes about 5 minutes in conventional management for the placenta to separate.

Per abdomen:

1. **Uterus becomes globular, firm, and ballottable.**
2. **The fundal height is slightly raised** as the separated placenta comes down in the lower segment and the contracted uterus rests on top of it.
3. **Slight bulging in the suprapubic region** due to distension of the lower segment by the separated placenta.

Per vaginam:

4. **Slight gush of vaginal bleeding.**
5. **Permanent lengthening of the cord is established.** This can be elicited by pushing down the fundus when a length of cord comes outside the vulva, which remains permanent even after the pressure is released. Alternatively, on suprapubic pressure upward by the fingers, there is no indrawing of the cord and the same lies unchanged outside the vulva.

EXPULSION OF PLACENTA AND MEMBRANES: The expulsion is achieved either by voluntary bearing-down efforts or more commonly aided by manipulative procedure. The afterbirth delivery is soon followed by slight to moderate bleeding amounting to 100–250 mL.

MATERNAL SIGNS: There may be chills and occasional shivering. Slight transient hypotension is not unusual.

PLACE OF DELIVERY

Although in about 85% of cases, the delivery remains uncomplicated and uneventful but in the remaining, unforeseen complications may arise which require urgent and skilled management. Effective antenatal care reduces the hazards of delivery significantly but to get an optimum outcome, adequate supervised **intranatal care is mandatory. Thus, all women should have institutional delivery. The national sociodemographic goals and the Sustainable Development Goals (SDGs) aim by 2030 to achieve 100% deliveries conducted by Skilled Birth Attendant (SBA) and to reduce maternal mortality ratio 70 per 100,000 live births and perinatal death rate 12 per 1,000 live births (Ch. 38).**

In the developed countries, there is a growing demand to have delivery at home (in low-risk cases) with minimal intervention (natural birth). **Every woman should have one birth companion and one midwife (named midwife) for the continuity of care during pregnancy and labor, e.g., community-based care.**

Changing childbirth stressed the importance of **community-based care** with the integration of community and hospital. There should be agreed protocols for referral and ease of transport between community and hospital.

Screening of high-risk mothers (Ch. 38) need careful checkup at regular interval. However, in under privileged sector the vast majority are forced to have home delivery either on choice or by compulsion. They are delivered by *'dais'* or even by their relatives. Thus, the teaching hospitals and the district or subdivisional hospitals are mostly being utilized as referral hospitals where most of the neglected cases are rushed late and in a bad shape.

In India, currently, there is significant rise in institutional delivery with the support of Janani Suraksha Yojana (JSY) scheme of National Rural Health Mission (2007).

FLYING SQUAD: The squad consists of a team of experienced obstetrician, anesthetist and nursing staff, equipped with sterilized packs of equipment and containers with stored blood. Ambulance car with the squad is rushed to the spot on call, mostly in the nature of antepartum hemorrhage or postpartum hemorrhage or eclampsia. Manual removal of placenta and resuscitation of the patient at home or during transport to the referral hospital are the common procedures employed.

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MANAGEMENT OF NORMAL LABOR

General considerations: Labor events **have got great psychological, emotional and social impact** to the woman and her family. She experiences stress, physical pain and fear of dangers. The caregiver should be tactful, sensitive and respectful to her. The woman is **allowed to have her chosen companion (family member). Continuous emotional support during labor** may reduce the need for analgesia and decrease the rate of operative delivery. Privacy must be maintained. She is explained about the events from time to time. Comfortable environment, skill and confidence of the caregiver and appropriate support are all essential so that a **woman can give birth with dignity (Table 13.2).**

Respectful maternity care:

- No induction or augmentation of labor without sound clinical indication.
- Freedom to choose a comfortable position during birthing.
- To follow strictly the protocols of management of labor.
- No verbal, physical abuse to pregnant women.
- No out of pocket expenditures on drugs, diagnostics or gratuitous payment.

Management of normal labor aims at maximal observation with minimal active intervention. **The idea** is to maintain the normalcy and to detect any deviation from the normal at the earliest possible moment.

ANTISEPTICS AND ASEPSIS: Scrupulous surgical cleanliness and asepsis on the part of the patients and the attendants involved in the delivery process are to be maintained.

Patient care: Pubic hair clipping is done. The vulva and the perineum are washed liberally with soap and water and then with 10% Dettol solution or chlorhexidine 1 in 2,000.

The woman should take a shower or bath, wear laundered gown and stay mobile. Throughout labor she is given continued encouragement and emotional support. **Antiseptic and aseptic precautions are to be taken during vaginal examination and during conduction of delivery.**

VAGINAL EXAMINATION IN LABOR: First vaginal examination should be done by a senior doctor to be more reliable and informative. The examination is done with the patient lying in dorsal position.

PRELIMINARIES

1. ***Cleaning***—hands and forearms should be washed with soap and running water, a scrubbing brush be used for the finger nails. The procedure should take at least 3 minutes.
2. ***Sterile pair of gloves*** is donned.
3. ***Vulval cleaning*** is performed. Vulva should once more be swabbed from before backward with antiseptic lotion like 10% Dettol or Hibitane 1 in 2,000. The same solution is poured over the vulva by separating the labia minora by the fingers of left hand.
4. ***Gloved middle and index fingers of the right hand*** smeared liberally with antiseptic cream like Cetavlon (cetrimide IP 0.5% W/W and hibitane 0.1% W/W) are introduced into the vagina after separating the labia by two fingers of the left hand.
5. ***Complete examination*** should be done before fingers are withdrawn.
6. ***Vaginal examination*** should be kept as minimum as possible to avoid risks of infection.
   In active labor, it may be done at an interval of 2–3 hours.

The following information is to be noted and recorded carefully:

- **Degree of cervical dilatation in centimeters.** It is marked with a cross (×) on the partograph at 5 cm dilatation.
- **Degree of effacement** of cervix.
- **Status of membranes and if ruptured color of the liquor.** Color of the liquor in the partograph is recorded as—**I:** membranes intact; **R:** membranes ruptured; **C:** liquor clear; **M:** liquor meconium stained; **B:** liquor blood stained.
- **Presenting part and its position** by noting the fontanels and sagittal suture in relation to the quadrants of the pelvis.
- **Lambda or posterior fontanel** is recognized by the big **'Y'** shaped **three suture lines. Bregma or anterior fontanel** is recognized by diamond-shaped area and the presence of **four suture lines.** In case of flexed head occiput is felt at a lower level than the sinciput.
- **Caput or molding of the head** and if present, to note its degree. Molding 1: Sutures apposed; 2: Sutures overlapped but reducible; 3: Sutures overlapped but not reducible.
- **Station of the head** in relation to ischial spines **(Fig. 13.22).**
  Spines are the most prominent bony projections felt on internal examination and the bispinous diameter is the shortest diameter of the pelvis in transverse plane being 10.5 cm. The level of ischial spines **(Fig. 13.22)** is the halfway between the pelvic inlet and outlet. **This level is known as station zero (0).** The levels above and below the spines are divided into fifths to represent centimeters. **The station is said to be 'O' if**

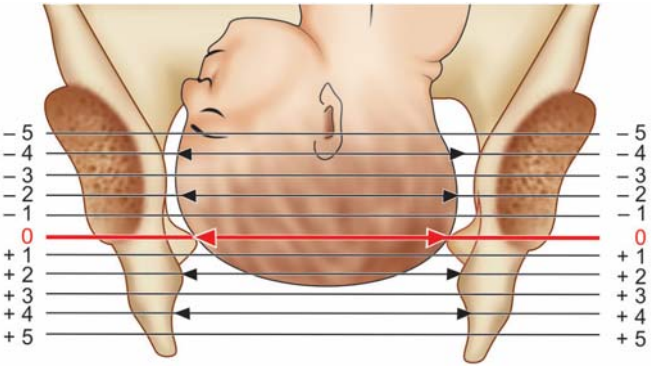

Fig. 13.22: Station of the head in relation to ischial spines.

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the presenting part is at the level of the spines. The station is stated in minus figures, if it is above the spines (–1 cm, –2 cm, –3 cm, –4 cm and –5 cm) and in plus figures if it is below the spines (+1 cm, +2 cm, +3 cm, +4 cm and +5 cm).

- **Assessment of the pelvis** especially in primigravidae is to be done, and elasticity of the pelvic floor and presence of vulval varicosity, if any, are to be noted.

INDICATIONS OF VAGINAL EXAMINATION: Whatever aseptic technique is employed, there is always some chance of introducing infection especially after rupture of the membranes. **Hence vaginal examination should be restricted to a minimum**.

- ***At the onset of labor:*** Confirm the onset of labor, to detect precisely the presenting part and its position. **Pelvic assessment especially in primigravidae should be done during the initial examination**.
- ***The progress of labor*** can be judged on periodic examinations to note the dilatation of the cervix and descent of the head in relation to the spines (station). Generally, it is done at an interval of 3–4 hours.
- ***Following rupture of the membranes*** to exclude cord prolapse especially where the head is not yet engaged.
- ***Whenever any interference is contemplated.***
- To confirm the actual coincidence of bearing down efforts with complete dilatation of the cervix and **to diagnose precisely the beginning of second stage**.

MANAGEMENT OF FIRST STAGE OF LABOR

PRINCIPLES: (1) Noninterference with watchful expectancy so as to prepare the patient for **natural birth**. **(2) To monitor carefully** the progress of labor, maternal conditions and fetal behavior so as to detect any intrapartum complication early.

PRELIMINARIES: This consists of basic evaluation of the current clinical condition. Enquiry is to be made about the onset of labor pains or leakage of liquor, if any. Thorough general and obstetrical examinations including vaginal examination are to be carried out and recorded. Records of antenatal visits, investigation reports and any specific treatment given, if available, are to be reviewed.

ACTUAL MANAGEMENT:

- ***General:*** **(a) Antiseptic dressing** is as described before (p. 126). **(b) Encouragement, emotional support and assurance** are given to keep up the morale. **(c) Constant supervision** is ensured.
  Position: Generally, a woman in early normal labor may not be confined to bed. While in bed she may take the **position** most comfortable to her. She should avoid dorsal supine position to avoid aortocaval compression.
- ***Bowel:*** An enema is not recommended. Enema neither shortens the duration of labor nor reduces the infection rate.
- ***Maternal rest and ambulation:*** If the membranes are intact, the patient is allowed to walk about. This attitude prevents venacaval compression and encourages descent of the head. Ambulation can reduce the duration of labor, need of analgesia and improve maternal comfort.
- ***Diet:*** There is delayed emptying of the stomach in labor. Low pH of the gastric contents is a real danger if aspirated following general anesthesia when needed unexpectedly. So **food is withheld during active labor**. Fluids in the form of plain water, ice chips or fruit juice may be given in early labor. Intravenous fluid with Ringer's solution is started where any intervention is anticipated or the patient is under regional anesthesia.
- ***Bladder care:*** Patient is encouraged to pass urine by herself as full bladder often inhibits uterine contraction and may lead to infection. If the woman cannot go to the toilet, she is given a bed pan. Privacy must be maintained and comfort must be ensured. If the patient fails to pass urine especially in late first stage, catheterization is to be done with strict aseptic precautions.
- ***Relief of pain:*** The detail of analgesia in labor is discussed in Ch. 34. Epidural analgesia is recommended if she asks for pain (WHO). Common analgesic drug used is pethidine 50–100 mg or meperidine intramuscularly when the pain is well established in the active phase of labor. If necessary, it is repeated after 4 hours. Pethidine is an effective analgesic as well as a sedative. Metoclopramide 10 mg IM is commonly given to combat vomiting due to pethidine. Pethidine crosses the placenta and is a respiratory depressant to the neonate. **The drug should not be given if delivery is anticipated within 2 hours.**
- ***Assessment of progress of labor and partograph recording***.

Pulse is recorded every 30 minutes and the rate is marked in the partograph. **Blood pressure** is recorded at every 1 hour and is marked with as systolic and diastolic. **Temperature** is recorded at every 2 hours. **Urine output** is recorded for volume, protein or acetone. **Any drug** (oxytocin or other) when given is recorded in the partograph.

Abdominal palpation: **(a)** Uterine contractions as regard the frequency, intensity and duration are assessed. **The number of contractions in 10 minutes and duration of each contraction in seconds are recorded in the partograph**. Partograph is charted every half an hour as: ■ Mild—contraction duration <20 seconds; ■ Moderate—contraction duration between 20 and 60 seconds; ■ Strong—contraction duration >60 seconds and ■ Labor progress—cervical dilatation [Plot X] since 5 cm to 10 cm.

(b) *Pelvic grip*: Gradual disappearance of poles of the head (sinciput and occiput) which were felt previously (usually occur in labor). **Abdominal palpation** for descent of the fetal head in terms of fifths felt above the brim is to be used **(Figs. 13.21A and B)**.

(c) Shifting of the maximal intensity of the fetal heart-beat downward and medially.

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To note the fetal wellbeing:

- **Fetal Heart Rate** (FHR) along with its rhythm and intensity should be noted every half hour in the first stage and every 15 minutes in second stage or following rupture of the membranes. **To be of value, the observation should be made immediately following uterine contraction. The count should be made for 60 seconds.** For routine clinical observation, ordinary stethoscope is quite suitable. Doppler ultrasonic cardiography (Dopplex), however, is helpful in the case of obesity and polyhydramnios **(Fig. 42.36)**. **To avoid confusion of maternal and fetal heart rates, maternal pulse should be counted.** Otherwise maternal tachycardia may be wrongly treated as fetal heart rate. **Normal fetal heart rate ranges from 110 to 160 per minute**.

CONTINUOUS ELECTRONIC FETAL MONITORING (FIG. 35.5): The device consists of simultaneous recording of fetal heart action by fetal electrocardiography and uterine contraction by tocography (Ch. 39). **It is commonly used for high-risk pregnancies and not as a routine**.

Vaginal examination: **(a)** Dilatation of the cervix in centimeters in relation to hours of labor is recorded. **(b)** Position of the head and degree of flexion. **(c) Station of the head** (degree of descent) in relation to the ischial spines. **(d) Color of the liquor** (clear or meconium stained) if the membranes are ruptured. **(e) Degree of molding of the head**—molding occurs first at the junction of occipitoparietal bones and then between the parietal bones (p. 74). **(f) Caput formation**—progressive increase is more important than its mere presence.

EVIDENCES OF FETAL DISTRESS (intrapartum fetal monitoring, Ch. 39).

TO WATCH THE MATERNAL CONDITION: Routine checkup includes: **(a)** To record 2 hourly pulse, blood pressure and temperature; **(b)** to observe the tongue periodically for hydration; **(c)** to note the urine output, urine for acetone, glucose and **(d)** IV fluids, drugs.

Evidence of maternal distress are:

- Anxious look, dry tongue.
- Rising pulse rate of 100 per minute or more.
- Dehydration, dry tongue.
- Hot, dry vagina.
- Acetone smell in breath.
- Scanty high colored urine with presence of acetone.

MANAGEMENT OF SECOND STAGE OF LABOR

The transition from the first stage to the second stage is evidenced by the following features:

- Increasing intensity of uterine contractions.
- Bearing-down efforts.
- Urge to push or defecate with descent of the presenting part.
- Complete dilatation of the cervix as evidenced on vaginal examination.

PRINCIPLES: (1) ***To assist*** in the natural expulsion of the fetus slowly and steadily, **(2)** ***To prevent*** perineal injuries.

GENERAL MEASURES:

- The patient should be **in bed**.
- **Constant supervision is mandatory and the FHR is recorded at every 5 minutes**.
- **To administer inhalation analgesics**, if available, in the form of gas N_2O and O_2 to relieve pain during contractions.
- **Vaginal examination** is done at the beginning of the second stage not only to confirm its onset but to detect any accidental cord prolapse. The position and the station of the head are once more to be reviewed and the progressive descent of the head is ensured.

PREPARATION FOR DELIVERY

- ***Position:*** Positions of the woman during delivery may be lateral, squatting or partial sitting (45°). **Dorsal position with 15° left lateral tilt** is commonly favored as it avoids aortocaval compression and facilitates pushing effort. Leg holders or stirrups may be used. Upright position (sitting, kneeling, squatting) or dorsal had no advantage over the recumbent one. **Upright position** increases blood loss (>500 mL) and second degree perineal lacerations. However, it is associated with less episiotomy, less OVD, less FHR pattern abnormalities, less pain, reduction in duration of 2nd stage of labor. **Prolonged sitting position** in second stage may cause neuropathy (common perineal nerve).
- ***The accoucheur scrubs up*** and puts on sterile gown, mask and gloves and stands on the right side of the table.
- ***Toileting the external genitalia*** and inner side of the thighs is done with cotton swabs soaked in Savlon or Dettol solution. One sterile sheet is placed beneath the buttocks of the patient and one over the abdomen. Sterilized leggings are to be used. **Essential aseptic procedures are remembered as three Cs: (a) Clean hands, (b) Clean surface and (c) Clean cutting and ligaturing of the cord.**
- ***To catheterize the bladder,*** if it is full.

CONDUCTION OF DELIVERY: The assistance required in spontaneous delivery is divided into three phases:

1. **Delivery of the head**
2. **Delivery of the shoulders**
3. **Delivery of the trunk**

Delivery of the head: **The principles to be followed are** to maintain flexion of the head, to prevent its early extension and to regulate its slow escape out of the vulval outlet.

- The patient is encouraged for the bearing-down efforts during uterine contractions. This facilitates descent of the head.
- When the scalp is visible for about 5 cm in diameter, flexion of the head is maintained during contractions. This is achieved by pushing the occiput downward and backward by using thumb and index fingers of the left hand while pressing the perineum by the right palm with a sterile vulval pad. If the patient passes stool, it should be cleaned and the region is washed with antiseptic lotion.

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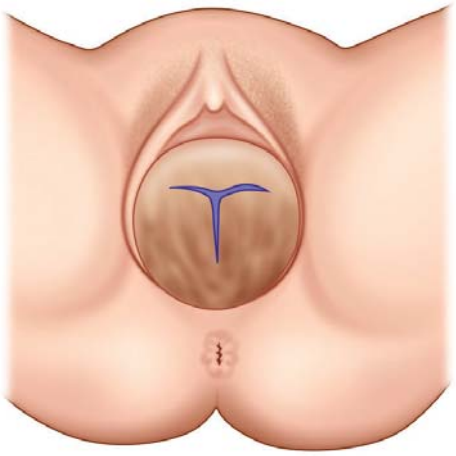

Fig. 13.23: Crowning of the head.

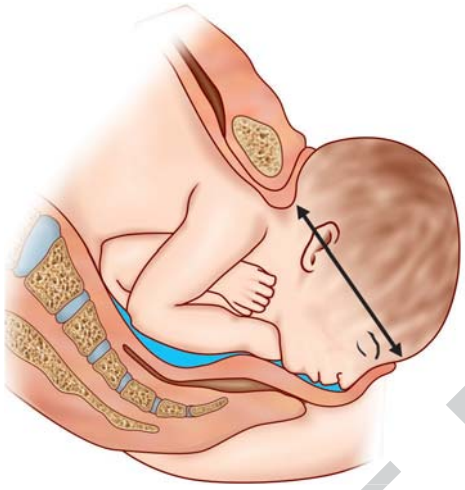

Fig. 13.24: Suboccipitofrontal diameter distending the vulval outlet.

- The process is repeated during subsequent contractions until the suboccput is placed under the symphysis pubis. Guarding the perineum "hands on" (perineal massage) is recommended (WHO). At this stage, the maximum diameter of the head (biparietal diameter) stretches the vulval outlet without any recession of the head even after the contraction is over, and it is called **'crowning of the head' (Fig. 13.23). The purpose of increasing the flexion of the head is to ensure** that the small suboccipitofrontal diameter 10 cm (4") distends the vulval outlet instead of larger occipitofrontal diameter 11.5 cm (4½") **(Fig. 13.24)**.
- When the perineum is fully stretched and threatens to tear especially in primigravidae, episiotomy is done at this stage after prior infiltration with 10 mL of 1% lignocaine. **Bulging thinned out perineum is a better criterion** than the visibility of 4–5 cm of scalp to decide the time of performing episiotomy. Episiotomy is done selectively and not as a routine.
- **Slow delivery of the head in between the contractions is to be regulated**. This is done when the **suboccipitofrontal diameter** emerges out. This is accomplished by pushing the chin with a sterile towel covered fingers of the right hand placed over the anococcygeal region while the left hand exerts pressure on the occiput **(Ritgen's maneuver, Fig. 13.25). The forehead, nose, mouth and the chin are thus born successively over the stretched perineum by extension**.

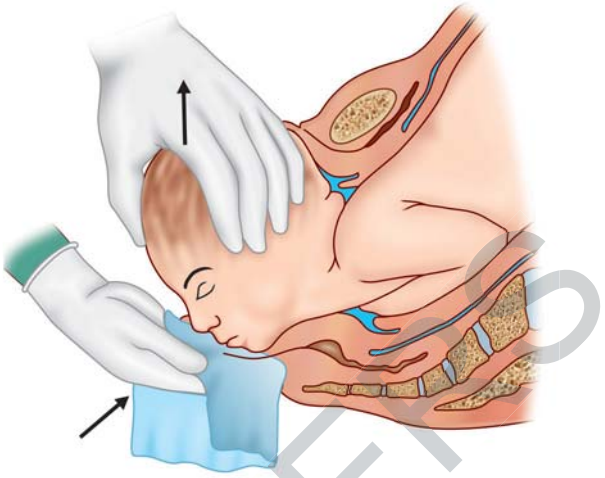

Fig. 13.25: Assisted delivery of the head by extension, exerting an upward pressure to the chin by the right hand placed over the anococcygeal raphe (Ritgen's maneuver).

- ***Care following delivery of the head:***
  - Immediately following delivery of the head, **the mucus and blood in mouth and pharynx are to be wiped** with sterile gauze piece on a little finger. Alternatively, mechanical or electrical sucker may be used. This simple procedure prevents the serious consequence of mucus blocking the air passage during vigorous inspiratory efforts.
  - **The eyelids are then wiped with sterile dry cotton swabs** using one for each eye starting from the medial to the lateral canthus to minimize contamination of the conjunctival sac.
  - **The neck is then palpated to exclude the presence of any loop of cord (20–25%)**. If it is found and if loose enough, it should be slipped over the head or over the shoulders as the baby is being born. **But if it is sufficiently tight enough**, it is cut in between two pairs of Kocher's forceps placed 1 inch apart.

PREVENTION OF PERINEAL LACERATION: More attention should be paid not to the perineum but to the controlled delivery of the head.

- **Delivery by early extension is to be avoided**. Flexion of the suboccput comes under the symphysis pubis so that lesser suboccipitofrontal 10 cm (4") diameter emerges out of the introitus.
- **Spontaneous forcible delivery of the head is to be avoided** by assuring the patient not to bear down during contractions.
- **To deliver the head in between contractions**.
- **To perform timely episiotomy** (when indicated).
- **To take care during delivery of the shoulders** as the wider bisacromial diameter (12 cm) emerges out of the introitus.

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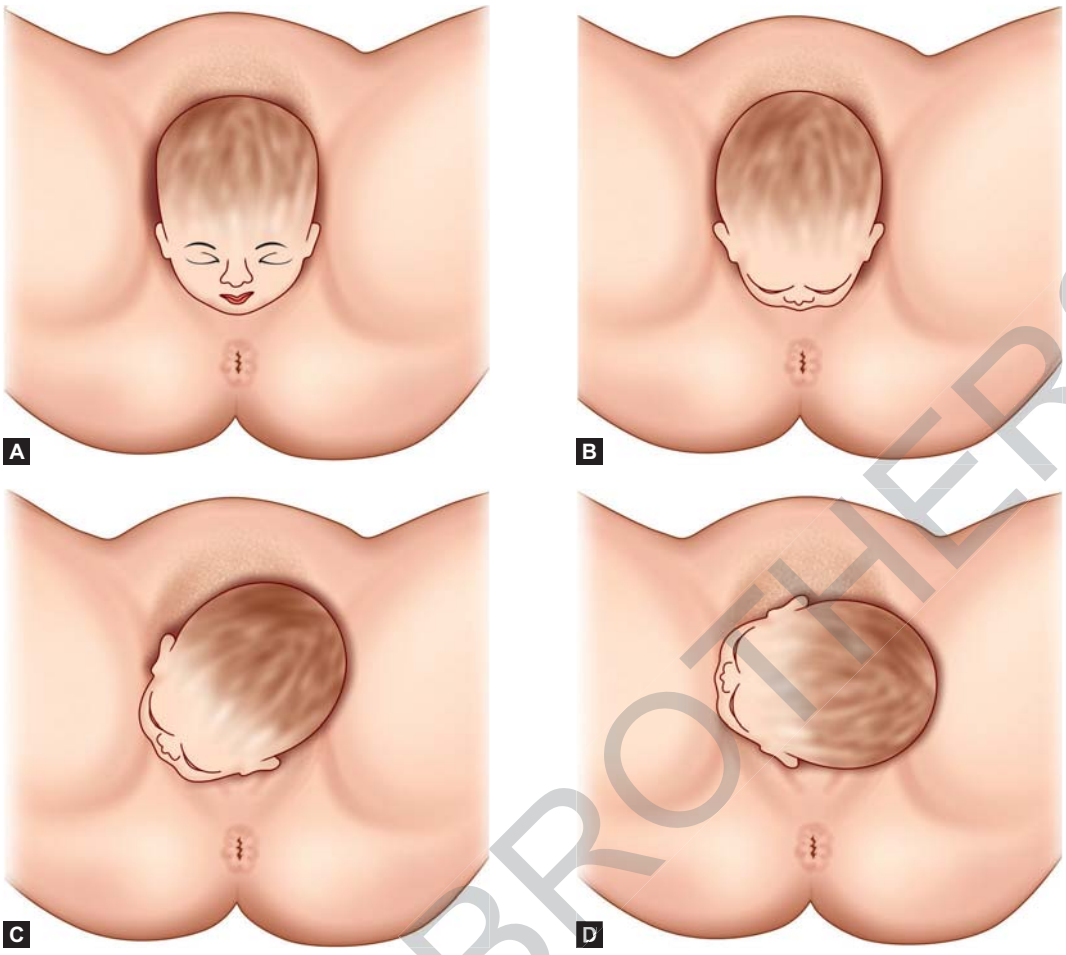
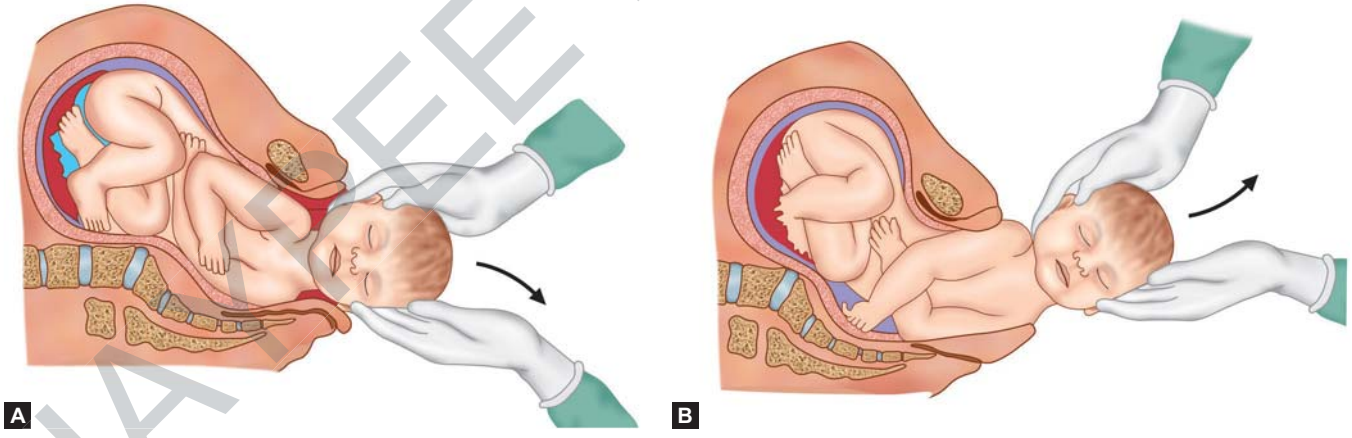


Figs. 13.26A to D: **(A)** Head is born by extension; **(B)** Head drops down with the face close to the anus; **(C)** Restitution; **(D)** External rotation.



Figs. 13.27A and B: Assisted delivery of the shoulders: **(A)** Anterior shoulder; **(B)** Posterior shoulder.

Delivery of the shoulders: **Not to be hasty in delivery of the shoulders**. Wait for the uterine contractions to come and for the movements of restitution and external rotation of the head to occur **(Figs. 13.26A to D)**. This indirectly signifies that the bisacromial diameter is placed in the anteroposterior diameter of the pelvis. During the next contraction, the anterior shoulder is born spontaneously behind the symphysis. If there is delay, the head is grasped by both hands and is gently drawn posteriorly until the anterior shoulder is released from under the pubis. By drawing the head in upward direction, the posterior shoulder is delivered out of the perineum **(Figs. 13.27A and B)**. **Traction on the head should be gentle** to avoid excessive stretching of the neck causing injury to the brachial plexus, hematoma of the neck or fracture of the clavicle. Hooking the fingers in the axilla should not be done to avoid the injury of brachial plexus.

Delivery of the trunk: After the delivery of the shoulders, the forefinger of each hand are inserted under the axillae and the **trunk is delivered gently by lateral flexion**.

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IMMEDIATE CARE OF THE NEWBORN

- ***Soon after the delivery of the baby,*** it should be placed on a tray covered with clean dry linen with the head slightly downward (15°). It facilitates drainage of the mucus accumulated in the tracheobronchial tree by gravity. The tray is placed between the legs of the mother and **should be at a lower level than the uterus** to facilitate gravitation of blood from the placenta to the infant.
- ***Air passage (oropharynx) may be cleared*** of mucus and liquor. Bulb syringe or suction catheter aspiration may be used.
- ***Apgar rating*** at 1 minute and at 5 minutes is to be recorded.
- ***Clamping and ligature of the cord:*** The cord is clamped by two Kocher's forceps, the near one is placed 6–10 cm away from the umbilicus and is cut in between. Two separate cord ligatures are applied with sterile cotton threads 1 cm apart using reef-knot, **the proximal one being placed 3 cm away from the navel. Squeezing the cord with fingers prior to applying ligatures** or plastic cord clamps **(Fig. 42.31)**, prevents accidental inclusion of embryonic remnants. **Leaving behind a length of the cord attached to the navel** not only prevents inclusion of the embryonic structure, if present, but also facilitates control of primary hemorrhage due to a slipped ligature. The cord is divided with scissors about 1 cm beyond the ligatures taking aseptic precautions so as to prevent cord sepsis. **Presence of any abnormality** in cord vessels (single umbilical artery) is to be noted. The cut end is then covered with sterile gauze piece after making sure that there is no bleeding. **The purpose of clamping the cord on the maternal end** is to prevent soiling of the bed with blood and to prevent fetal blood loss of the second baby in undiagnosed monozygotic twin.

Delay in clamping for 2–3 minutes or till cessation of the cord pulsation facilitates transfer of 80–100 mL blood from the compressed placenta to a baby when placed below the level of uterus. This is beneficial to a term baby. ***Benefits of delayed cord clamping:*** Increases total body iron stores, the blood volume and reduces anemia of the newborn (WHO-2014). Delayed cord clamping in preterm neonate is also helpful. This increases total red cell mass, reduces the need for blood transfusion, low and reduced rates of IVH, NEC. But **early clamping** should be done in cases of Rh-incompatibility (to prevent antibody transfer from the mother to the baby) or babies born asphyxiated or one of a diabetic mother.

- **Quick check is made to** detect any gross abnormality and the baby is wrapped with a dry warm towel. The identification tape is tied both on the wrist of the baby and the mother. Once the management of third stage is over (usually 10–20 minutes), baby is given to the mother or to the nurse.

MANAGEMENT OF THIRD STAGE OF LABOR

Third stage is the most crucial stage of labor. Previously uneventful first and second stage can become abnormal within a minute with disastrous consequences.

The principles underlying the management of third stage are **to ensure strict vigilance and to follow the management guidelines strictly in practice** so as to prevent the complications, the important one being postpartum hemorrhage.

STEPS OF MANAGEMENT: Two methods of management are currently in practice **(Flowchart 13.3)**.

1. **Active management (preferred)**
2. **Expectant management**

ACTIVE MANAGEMENT OF THIRD STAGE OF LABOR (AMTSL)

The underlying principle in active management is to excite powerful uterine contractions within 1 minute of delivery of the baby (WHO) by giving parenteral oxytocic. This facilitates not only early separation of the placenta but also produces effective uterine contractions following its separation.

***The advantages are*—(a) to minimize blood loss in third stage approximately to one-fifth; (b) to shorten the duration of third stage to half; (c) reduce maternal anemia; (d) less need for blood transfusion; (e) less need to manage PPH. The only disadvantage** is slight increased incidence of retained placenta (1–2%) and consequent increased incidence of manual removal. Accidental administration following delivery of the first baby in undiagnosed twins, produces danger to the unborn second baby caused by asphyxia due to tetanic contraction of the uterus. **Thus, it is essential to limit its use in twins only following delivery of the second baby. Use of oxytocin decreases PPH by 60%, reduces need of other therapeutic oxytocics by 50%. AMTSL as such reduces PPH by 60%.**

Procedures: Injection oxytocin 10 units IM (preferred) or misoprostol 600 µg or methergine 0.2 mg IM is given to the mother within 1 minute of delivery of the baby (WHO). The placenta is expected to be delivered soon following delivery of the baby. If the placenta is not delivered thereafter, it should be delivered forthwith by controlled cord traction (Brandt-Andrews) technique after clamping the cord while the uterus still remains contracted. **If the administration is mistimed as might happen in a busy labor room, one should not be panicky but conduct the third stage with conventional watchful expectancy.**

Active management is certainly of value, for cases likely to develop postpartum hemorrhage. These high risk cases are: anemia, hydramnios, twins, multiparae and previous history of PPH. **Tablet misoprostol** 600 µg, can be given, orally or rectally in cases with home delivery. It can be given by a community health worker (WHO-2012) also. **Methergine should not be used** in cardiac cases or severe pre-eclampsia, for the risk of precipitating cardiac overload and failure in the former and aggravation of blood pressure or eclampsia in the latter.

Assisted delivery of the placenta: (a) *Controlled cord traction (modified Brandt-Andrews method):* The palmar surface of the fingers of the left hand is placed (above the symphysis pubis) approximately

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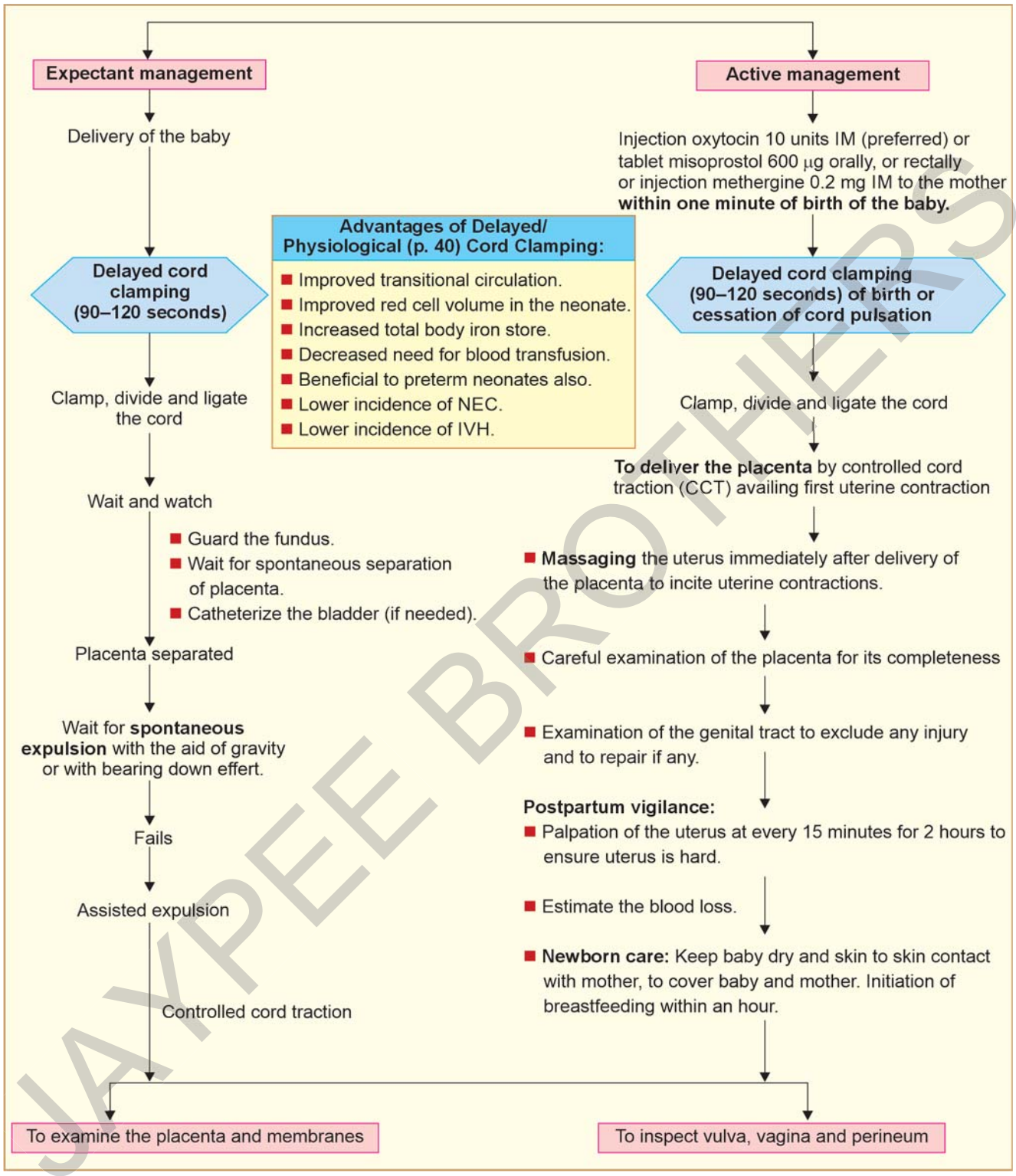
Flowchart 13.3: Scheme of management of third stage of labor.



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at the junction of upper and lower uterine segment **(Fig. 13.28)**. The body of the uterus is pushed upward and backward, towards the umbilicus while by the right hand steady tension (but not too strong traction) is given in downward and backward direction holding the clamp until the placenta comes outside the introitus. It is thus more an uterine elevation which facilitates expulsion of the placenta. **The procedure is to be adopted only when the uterus is hard and contracted.**

(b) ***Fundal pressure:*** **The fundus is pushed downward and backward** after placing four fingers behind the fundus and the thumb in front using the uterus as a sort of piston **(Fig. 13.29)**. **Pressure must be given only when the uterus becomes hard.** If it is not, then make it hard by gentle rubbing. The pressure is to be withdrawn as soon as the placenta passes through the introitus. **If the baby is macerated or premature, this method is preferable to cord traction** as the tensile strength of the cord is much reduced in both the instances.

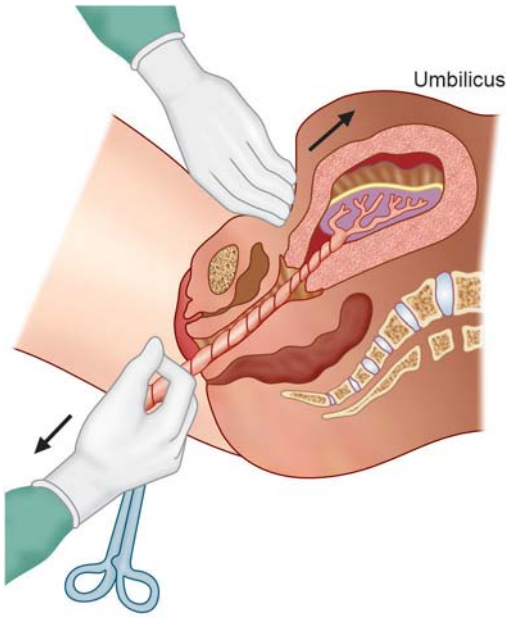

Fig. 13.28: Expression of the placenta by controlled cord traction.

The cord may be accidentally torn which is not likely to cause any problem. The sterile gloved hand should be introduced, and the placenta is to be grasped and extracted.

- ***The uterus is massaged*** to stimulate uterine contractions and to make it hard. This also facilitates expulsion of retained clots if any.
- ***Examination of the placenta membranes and cord:*** The placenta is placed on a tray and is washed out in running tap water to remove the blood and clots. The maternal surface is first inspected for its **completeness** and anomalies. **The maternal surface** is covered with grayish decidua (spongy layer of the decidua basalis). Normally the cotyledons are placed in close approximation and any gap indicates a missing cotyledon. **The membranes**—chorion and amnion are to be examined carefully for completeness and presence of abnormal vessels indicative of succenturiate lobe. **The amnion is shiny but the chorion is shaggy**. The cut end of the cord is inspected for number of blood vessels. **Normally, there are two umbilical arteries and one umbilical vein. An oval gap in the chorion with torn ends of blood vessels running up to the margin of the gap indicates a missing succenturiate lobe**. The absence of a cotyledon or evidence of a missing succenturiate lobe or evidence of significant missing membranes demands exploration of the uterus urgently.
- ***Vulva, vagina and perineum are inspected*** carefully for injuries and to be repaired, if any. The episiotomy wound is now sutured. The vulva and adjoining part are cleaned with cotton swabs soaked in antiseptic solution. A sterile pad is placed over the vulva.

EXPECTANT MANAGEMENT OF THIRD STAGE (PHYSIOLOGICAL)

- In this management, **the placental separation and its descent into the vagina are allowed to occur spontaneously**. Minimal assistance may be given for the placental expulsion if it needed.
- **Constant watch** is mandatory and the patient should not be left alone.
- **If the mother is delivered in the lateral position**, she should be changed to dorsal position to note features of placental separation and to assess the amount of blood loss.
- **A hand is placed over the fundus—(a) to recognize** the signs of separation of placenta, **(b)** to note the state of uterine activity—contraction and relaxation and **(c) to detect**, though rare, cupping of the fundus which is an early evidence of inversion of the uterus.

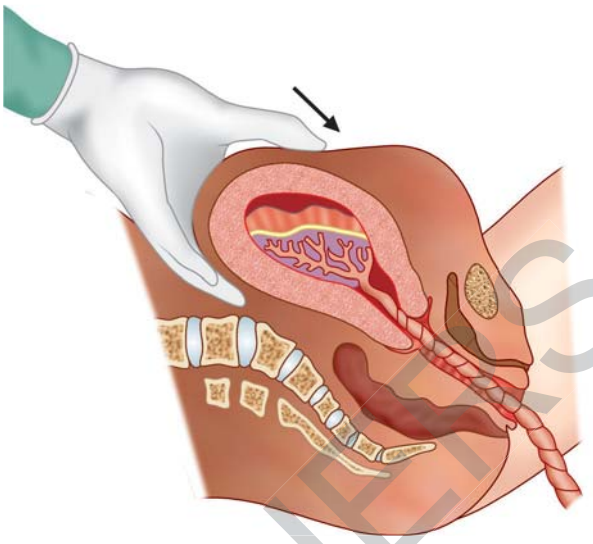

Fig. 13.29: Expression of the placenta by fundal pressure.

Desire to fiddle with the fundus or massage the uterus is to be strongly condemned. Placenta is separated within minutes following the birth of the baby. A watchful expectancy can be extended up to 15–20 minutes. In some institutions, 'no touch' or 'hands off' policy is employed. The patient is expected to expel the placenta within 20 minutes with the aid of gravity.

- **Expulsion of the placenta: Only when the features of placental separation and its descent into the lower segment are confirmed**, the patient is asked to bear down simultaneously with the hardening of the uterus. The raised intra-abdominal pressure is often adequate to expel the placenta. If the patient fails to expel, one can wait safely up to 10 minutes if there is no bleeding. As soon as the placenta passes through the introitus, it is grasped by the hands and twisted round and round with gentle traction so that the membranes are stripped intact. If the membranes threaten to tear, they are caught hold of by sponge-holding forceps and in similar twisting movements the rest of the membranes are delivered. **Gentleness, patience and care are prerequisites for** complete delivery of the membranes. If the spontaneous expulsion fails or is not practicable, because of delivery under anesthesia, anyone of the following methods can be used to expedite expulsion.

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Difference between Active and Passive Third Stage of Labor.		
	Active stage	***Passive stage***
Duration of third stage of labor	Shortened	Not shortened
Incidence of nausea and vomiting	10%	5%
	Active stage	***Passive stage***
Postpartum hemorrhage incidence	1.5%	3%
Blood transfusion	15%	40%

MANAGEMENT OF FOURTH STAGE: Pulse, blood pressure, tone of the uterus (well retracted) and any abnormal vaginal bleeding are to be watched at least for 1 hour after delivery. When fully satisfied that the general condition is good, pulse and blood pressure are steady, the uterus is well retracted and there is no abnormal vaginal bleeding, the patient is sent to the ward.

SUMMARY

First Stage of Labor

First stage of labor starts from the onset of true labor pain and **ends with** full dilatation of the cervix. **Its average duration** is about 12 hours in primigravidae and 6 hours (WHO-10 hours) in multiparae. **First stage consists** of *latent phase* (up to 5 cm of cervical dilatation) and *active phase* (up to 10 cm). The stage is chiefly concerned with dilatation and effacement of the cervix.

This stage is clinically manifested by progressive uterine contraction, dilatation and 'effacement' of the cervix and ultimate rupture of the membranes. **Maternal and fetal conditions** remain unaffected except during uterine contraction. **Management consists of: (1)** Noninterference with watchful expectancy. **(2)** Women is given **encouragement, emotional support and adequate pain relief** during the entire course of labor. **(3)** To monitor carefully the progress of labor, maternal condition and fetal behavior so as to detect any deviation from the normal. **(4) Partograph is maintained**.

Second Stage of Labor

The **second stage of labor starts** from full dilatation of the cervix and **ends with** expulsion of the fetus. **Its average duration** is 2 hours (WHO-3 hours) in primigravidae and 30 minutes (WHO-2 hours) in multiparae. **This stage concerns** with the descent and delivery of the fetus through the birth canal. **This stage is** clinically manifested by increased frequency and intensity of uterine contractions with appearance of 'bearing-down' efforts which result in expulsion of the fetus. The mother may show features of exhaustion. The **principles in management are: (1)** To assist the natural expulsion of the fetus slowly and steadily. **(2)** To prevent perineal injuries. **During conduction of delivery,** head is delivered slowly in between contractions. Flexion is maintained so that smaller diameter of the head stretches the perineum. Thus, timely performed episiotomy (selective), prevents perineal laceration. Shoulders are delivered slowly with next contraction. **Immediate care of the newborn** includes clearing of the air passage and eyes, delayed clamping and ligaturing of the umbilical cord and Apgar scoring.

Third Stage of Labor

The third stage begins after the expulsion of the fetus and ends with expulsion of the placenta and membranes. Its **average duration is 15 minutes**. This stage concerns with placental separation and its expulsion. **The separation is** achieved by marked reduction in the uterine surface area of the placental site following delivery due to retraction. **The placenta being** inelastic, shears off its attachment through the deep spongy decidual layer. There are **two ways of separation**—central (Schultze) and marginal (Mathews-Duncan). **The bleeding is** controlled by effective myometrial contraction and retraction (living ligature) and by thrombosis. **The expulsion may occur** through 'bearing-down' efforts or more commonly with assistance. **The management is** either by employing watchful expectancy or **by active management (WHO)** in cases where oxytocin 10 units IV (slowly) or IM/methergine 0.2 mg IV is administered within 1 minute following the delivery of the baby.

Tablet misoprostol 600 µg, can be given orally or rectally in cases with home delivery. It can be given by a community health worker. Placenta is delivered by CCT soon following delivery of the baby. Uterine massage may be given to make it hard. The placenta and the membranes should be examined following their expulsion.

Fourth Stage of Labor

It is the stage of observation for at least 1 hour after the delivery of the baby, placenta and the membranes to ensure that both the mother and the baby are well.

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- **Labor** involves a series of changes in the genital organs associated with regular painful uterine contractions with effacement and dilatation of the cervix. **Delivery** is not synonymous with labor as it can take place without labor. Normal labor should fulfil some defined criteria.
- **Onset of labor** is difficult to understand. Role of estrogen, progesterone, prostaglandins, oxytocin, and the fetus have been explained.
- **Active phase of labor** begins when the cervix is 5 cm dilated. Management of latent phase (observation) and active phase of labor are different.
- **Labor events** are conventionally divided into two phases (latent phase and active phase) and three stages.

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- **Main events in the first stage of labor** are: (a) **dilatation** and (b) **effacement** of the cervix. **Second stage** events are: (a) **descent** and (b) **delivery** of the fetus. **Second stage** is characterized by two phases: **(a) propulsive and (b) expulsive (bear down)** to deliver the fetus. **Third stage events** are **separation** of placenta and **expulsion** of placenta.
- **Lower uterine segment** is formed mainly during the first stage of labor. Clinical importance of lower uterine segment is very much.
- **Mechanism of normal labor** involves a series of movements on the head in the process of adaptation during its passage through the pelvis.
- **The principal movements are:** Engagement → Descent with increasing flexion of the head → Internal rotation → Crowning → Delivery of the head by extension → Restitution → External rotation → Delivery of the shoulders (anterior first followed by the posterior) → Delivery of the trunk by lateral flexion. **Descent and increasing flexion of the head are the continued process throughout the course of labor**.
- **Diagnosis of labor** (true labor pains) includes regular painful uterine contractions, progressive cervical dilatation and effacement and presence of show.
- **Progressive descent of fetal head** is assessed abdominally in terms of 'fifths' (Crichton) **(Figs. 13.20 and 13.21)** and also on vaginal examination by noting the station.
- **Successful labor and delivery** are dependent on complex interactions of three variables (three 'Ps'): the Power (uterine contractions), the Passenger (fetus), and the Passage (pelvis).
- **Partograph** is used to record labor events. Electronic fetal monitoring is used for high-risk cases.
- **Presence of a labor companion** (family member) is helpful for her emotional support. This reduces the need of analgesia, oxytocin and also the need of instrumental vaginal or cesarean delivery.
- **Upright position during labor** significantly reduces the duration of first stage and also the risk of cesarean delivery.
- **Active management of third stage of labor** mainly consists of giving oxytocin immediately after the baby is born and delayed cord clamping (90–120 seconds) after the birth.

INTRAPARTUM CARE FOR A POSITIVE CHILD BIRTH EXPERIENCE (WHO)

Table 13.2 **Intrapartum care for a positive child birth experience (WHO).**

Care option (selected)	*Recommendation status*
Care throughout labor and birth	
Respectful maternity care	1. Respectful maternity care—is the care provided to all women that maintains their dignity, privacy and confidentiality. This also ensures freedom from harm and mistreatment and enables informed choice and continuous support during labor and childbirth. This is **recommended**.
Effective communication	2. Effective communication between maternity care providers and women in labor, using simple and culturally acceptable methods is **recommended.**
Companionship	3. A companion of choice for all women throughout labor and childbirth is **recommended**.
Continuity of care	4. Midwife-lead continuity-of-care models, in which a known midwife or small group of midwives supports a woman throughout the antenatal, intrapartum and postnatal continuum, are **recommended** in settings with well-functioning midwifery programs. This is **context specific recommendation**.
First stage of labor	
Definitions of the latent and active first stages of labor	5. The use of the following definitions of the latent and active first stages of labor is **recommended:** • The latent, first stage is a period of time characterized by painful uterine contractions and variable changes of the cervix, including some degree of effacement and slower progression of dilatation **up to 5 cm** for first and subsequent labors. • The active first stage is a period of time characterized by regular painful uterine contractions, a substantial degree of cervical effacement and more rapid cervical dilatation **from 5 cm until full dilatation** for first and subsequent labors.
Duration of the first stage of labor	6. Women should be informed that a standard duration of the latent first stage can vary widely from one woman to another. However, the duration of active first stage (from 5 cm until full cervical dilatation) usually does not extend beyond 12 hours in first labors, and 10 hours in subsequent labors. This is **recommended**.
Progress of the first stage of labor	7. Labor may not naturally accelerate until a cervical dilatation threshold of 5 cm is reached. Therefore, the use of medical interventions to accelerate labor and birth (such as oxytocin augmentation or cesarean section) before this threshold is **not recommended**, provided that fetal and maternal conditions are reassuring.

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Care option (selected)	***Recommendation status***
Clinical pelvimetry on admission	8. Routine clinical pelvimetry on admission in labor is **not recommended** for healthy pregnant women.
Routine assessment of fetal wellbeing on labor admission	9. Auscultation using a Doppler ultrasound device or Pinard fetal stethoscope is **recommended** for the assessment of fetal wellbeing on labor admission.
Perineal/pubic shaving	10. Routine perineal/pubic shaving prior to giving vaginal birth is **not recommended**.
Enema on admission	11. Administration of an enema for reducing the use of labor augmentation is **not recommended**.
Digital vaginal examination	12. Digital vaginal examination at interval of 4 hours is **recommended** for routine assessment of active first stage of labor in low-risk women.
Continuous cardiotocography during labor	13. Continuous cardiotocography is **not recommended** for assessment of fetal wellbeing in healthy pregnant women undergoing spontaneous labor.
Intermittent fetal heart rate auscultation	14. Intermittent auscultation of the fetal heart rate with either a Doppler ultrasound device or Pinard fetal stethoscope is **recommended** for healthy pregnant women in labor.
Epidural analgesia for pain relief	15. Epidural analgesia is **recommended** for healthy pregnant women requesting pain relief during labor. This depends on a woman's preferences.
Opioid analgesia for pain relief	16. Parenteral opioids, such as fentanyl, diamorphine and pethidine, are **recommended** options for healthy pregnant women requesting pain relief during labor. This depends on a woman's preferences.
Relaxation techniques for pain management	17. Relaxation techniques such as including progressive muscle relaxation, breathings, music, mindfulness and other techniques are **recommended** for healthy pregnant women requesting pain relief during labor. This depends on a woman's preferences.
Manual techniques for pain management	18. Manual techniques, such as massage or application of warm packs, are **recommended** for healthy pregnant women requesting pain relief during labor. This depends on a woman's preferences.
Oral fluid and food	19. For women at low risk, oral fluid and food intake during labor are **recommended**.
Maternal morbidity and position	20. Encouraging the adoption of mobility and an upright position during labor in women at low risk is **recommended**.
Early amniotomy and oxytocin	21. The use of early amniotomy with early oxytocin augmentation for prevention of delay in labor is **not recommended**.
Antispasmodic agents	22. The use of antispasmodic agents for prevention of delay prevention of delay in labor is **not recommended**.
Second stage of labor	
Definition and duration of the second stage of labor	23. The use of the following definition and duration of the second stage of labor is **recommended** for practice: • The second stage is the period of time between full cervical dilatation and birth of the baby, during which the woman has an involuntary urge to bear down, as a result of expulsive uterine contractions. • Women should be informed that the duration of the second stage varies from one woman to another. In first labors, birth is usually completed within 3 hours whereas in subsequent labors, birth is usually completed within 2 hours.
Birth position (for women with or without epidural)	24. For women with or without epidural analgesia, encouraging the adoption of a birth position of the individual woman choice, including upright positions, is **recommended**.
Method of pushing	25. Women in the expulsive phase of the second stage of labor should **be encouraged and supported** to follow their own urge to push. This is **recommended**.
Techniques for preventing perineal trauma	26. For women in the second stage of labor, techniques to reduce perineal trauma and facilitate spontaneous birth (including perineal massage, warm compresses and a "hands on" guarding of the perineum) are **recommended**, based on a woman's preferences and options available to her.
Episiotomy policy	27. Routine or liberal use of episiotomy is **not recommended** for women undergoing spontaneous vaginal birth.
Fundal pressure	28. Application of manual fundal pressure to facilitate childbirth during the second stage of labor is **not recommended.**

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Care option (selected)	*Recommendation status*
Third stage of labor	
Prophylactic uterotonics	29. The use of uterotonics for the prevention of postpartum hemorrhage (PPH) during the third stage of labor is **recommended** for all births.
	30. Oxytocin (10 IU, IM/IV) is the **recommended** uterotonic drug for the prevention of postpartum hemorrhage (PPH).
	31. In settings where oxytocin is unavailable, the use of other injectable uterotonics (if appropriate, ergometrine/methylergometrine, or the fixed drug combination of oxytocin and ergometrine) or oral misoprostol (600 μg) is **recommended**.
Delayed umbilical cord clamping	32. Delayed umbilical cord clamping (not earlier than 1 minute after birth) is **recommended** for improved maternal and infant health and nutrition outcomes.
Controlled cord traction (CCT)	33. In settings where skilled birth attendants are available, CCT is **recommended.**
Uterine massage	34. Sustained uterine massage is **not recommended** as an intervention to prevent postpartum hemorrhage in women who have received prophylactic oxytocin.
Care of the newborn	
Routine nasal or oral suction	35. Suctioning of the mouth and nose should not be performed in the case of neonates born through clear amniotic fluid who start breathing on their own after birth. It is **not recommended**.
Skin-to-skin contact	36. Newborns without complications should be kept in skin-to-skin contact with their mothers during the first hour after birth to prevent hypothermia and promote breastfeeding. This is **recommended**.
Breastfeeding	37. All newborns, including low birth-weight babies who are able to breastfed, should be put to the breast as soon as possible after birth when they are both clinically stable, and the mother and baby are ready. This is **recommended**.
Care of the women after birth	
Uterine tonus assessment	38. Postpartum abdominal uterine tonus assessment for early identification of uterine atony is **recommended** for all women.
Routine postpartum maternal assessment	39. All postpartum women should have regular assessment of vaginal bleeding, uterine contraction, fundal height, temperature and heart rate (pulse) routinely during the first 24 hours starting from the first hour after birth. Blood pressure should be measured shortly after birth, if normal, the second blood pressure measurement should be taken within 6 hours. Urine void should be documented within 6 hours. This is **recommended**.
Discharge following uncomplicated vaginal birth	40. After an uncomplicated vaginal birth in a healthcare facility, healthy mothers and newborns should receive care in the facility for at least 24 hours after birth. This is **recommended**.
Source: World Health Organization; 2020	

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—***The Journal of Obstetrics and Gynecology of India. August 2016; 66(4):303-4.***

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