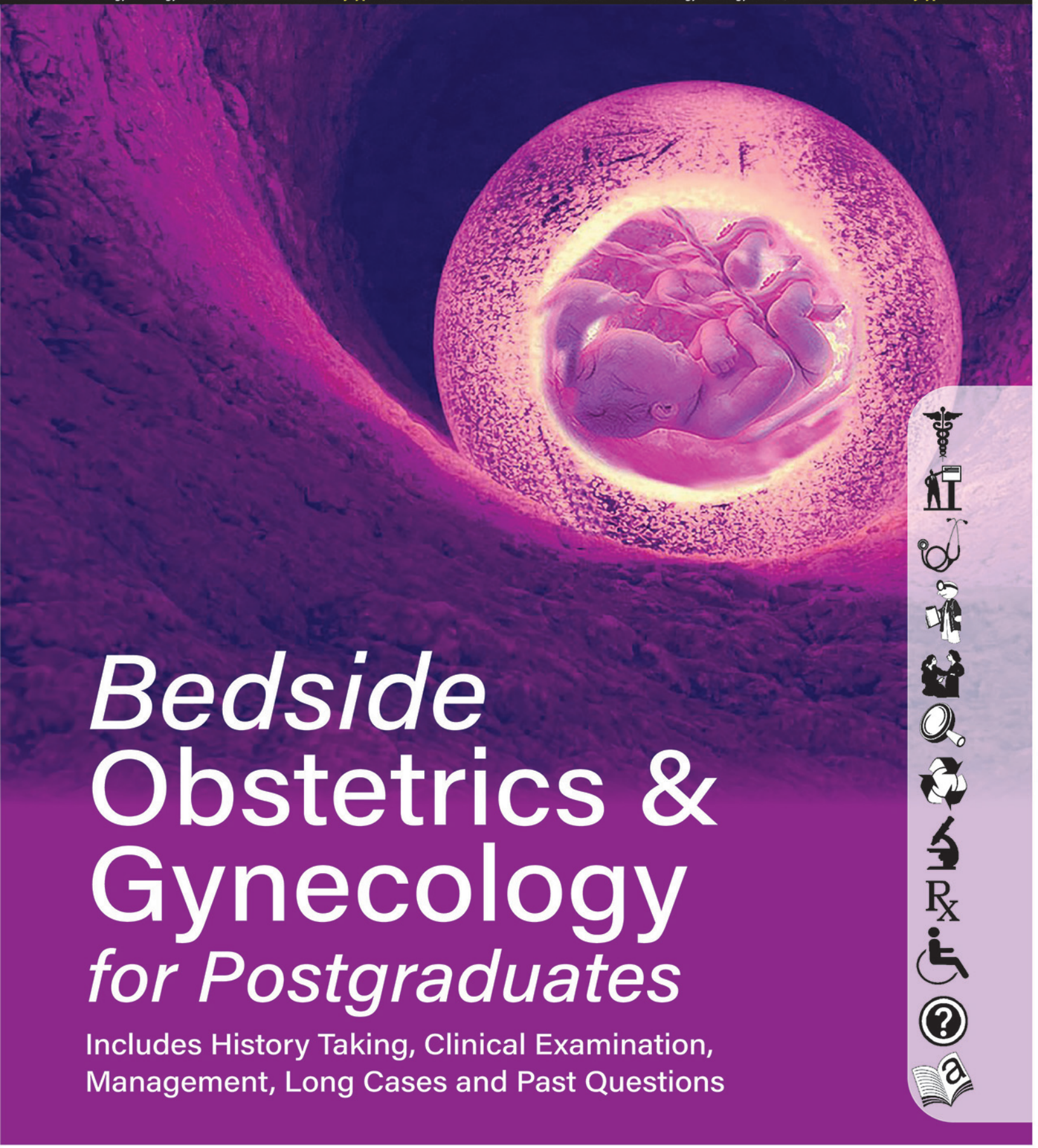

Bedside Obstetrics & Gynecology *for Postgraduates*

Includes History Taking, Clinical Examination, Management, Long Cases and Past Questions

Richa Saxena

3rd Edition

JAYPEE

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CHAPTER

2

Normal Labor in Occipitolateral Position

CASE STUDY

A 27-year-old primigravida patient with 38 weeks of gestation presents to the obstetrics and gynecology clinic with complaints of experiencing abdominal cramps since past 2 hours. She is not sure if these are uterine contractions. There is no history of any vaginal bleeding or ROM. She can feel the normal fetal movements. Her antenatal period had been otherwise uneventful, and she had been having regular antenatal checkups.

INTRODUCTION

Q. Write a long essay on the first stage of labor.

Q. Write a short essay on the third stage of labor.

Labor comprises a series of events taking place in the genital organs, which help to expel the fetus and other products of conception outside the uterine cavity into the outer world. It can be defined as the onset of painful uterine contractions accompanied by any one of the following: ROM, bloody show, cervical dilatation, and/or effacement. It can be either spontaneous or induced and normally comprises three stages—first stage, second stage, and third stage. Since the most common fetal position is left occipitolateral (transverse) position **(Fig. 2.1)**, the mechanism of labor in context to this position comprises the following cardinal movements: engagement, flexion, descent, internal rotation, extension, and external rotation of fetal head. Various stages of labor as described by Friedman (1955) are described in **Table 2.1** and depicted in **Figures 2.2A and B**. Classification of labor depending on the period of gestation has been described in **Table 2.2**.

FIRST STAGE OF LABOR

The first stage of labor begins with the onset of regular uterine contractions and ends with complete dilatation and effacement of cervix. It is divided into two phases.

Latent Phase (Preparatory Phase)

Latent phase begins with the onset of regular contractions, with contractions occurring after every 15–20 minutes, lasting 20–30 seconds. Gradually, the frequency of contractions increases, and they can occur after every 5–7 minutes, lasting for 30–40 seconds. This phase ends when cervix becomes about 3–5 cm dilated. The latent phase lasts for approximately 8–9 hours in the primigravida, and less than 6 hours in multigravida. Prolonged latent phase can be defined as greater than 20 hours in primigravida and greater than 14 hours in the multigravida.

Active Phase

As described by Friedman (1955), active phase begins when the cervix is about 4 cm dilated and ends when it becomes fully dilated. The normal rate of cervical dilatation during this stage is approximately 1–1.5 cm/h. The intensity of contractions increases with the contractions occurring after every 2–3 minutes and lasting for about 40–60 seconds. This stage lasts for an average of 4.6 hours in a primigravida and approximately 2.4 hours in multigravidas.

SECOND STAGE OF LABOR

The second stage of labor begins when the cervical dilatation and effacement are complete and ends with the delivery of

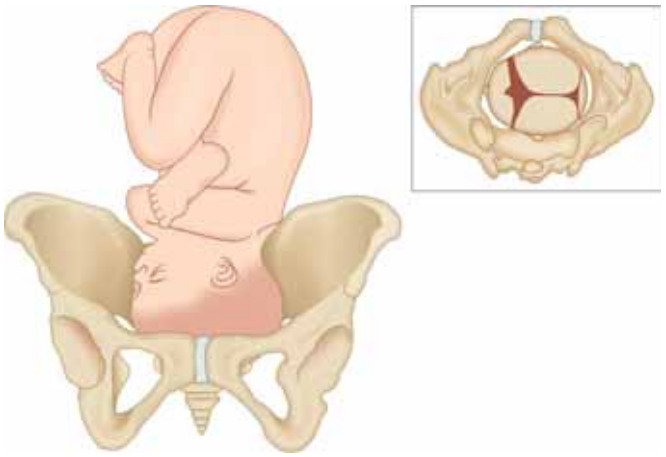


Fig. 2.1: Occipitolateral (transverse) position of the fetal head.

TABLE 2.1: Various stages of labor.

Stages of labor	*Description*	*Characteristics*	*Duration in primigravida*	*Duration in multigravida*
Stage I	Starts from the onset of true labor pains and ends with complete dilatation of cervix	Can be divided into: • *Latent phase:* Slow and gradual cervical effacement and dilatation (up to 3 cm) • *Active phase:* Active cervical dilatation (3–10 cm) and fetal descent. It comprises: – Acceleration phase – Phase of maximum slope – Deceleration phase	8–20 hours 6–12 hours	6–14 hours 3–6 hours
Stage II	Starts from full dilatation of cervix and ends with expulsion of the fetus from birth canal	–	50–180 minutes	30–50 minutes
Stage III	It begins after expulsion of the fetus and is associated with expulsion of placenta and membranes	–	15 minutes	15 minutes
Stage IV	Stage of observation, which lasts for at least 1 to 2 hours after the expulsion of afterbirths	–	60 minutes	60 minutes

the fetus. Its mean duration is 50 minutes for nullipara and 20 minutes for multipara. During this stage, the woman begins to bear down. The abdominal muscles contract, which helps in the descent of fetal head. When the crowing of fetal head has occurred at vulvar opening, birth of the baby is imminent.

The exact mechanism for the initiation of labor is still unclear. However, the most likely mechanisms are as follows:

- *Mechanical factors:* Uterine distention
- *Endocrine factors:* There is increased cortisol secretion by fetal adrenals and increased production of estrogens and prostaglandins (PGE_2) from the placenta. Together, these cause an increased release of oxytocin from the maternal pituitary and increased synthesis of contraction-associated proteins.

HISTORY AND CLINICAL PRESENTATION

If detailed history had not been taken during the time of antenatal checkup, it must be taken now, at the time of admission. The details, which need to be elicited at the time of taking history, are described in Chapter 1.

GENERAL PHYSICAL EXAMINATION

General physical examination involves assessment of the patient's vital signs, similar to that done during the time of antenatal examination (Chapter 1).

SPECIFIC SYSTEMIC EXAMINATION

Findings of specific systemic examination are summarized in **Table 2.3**.

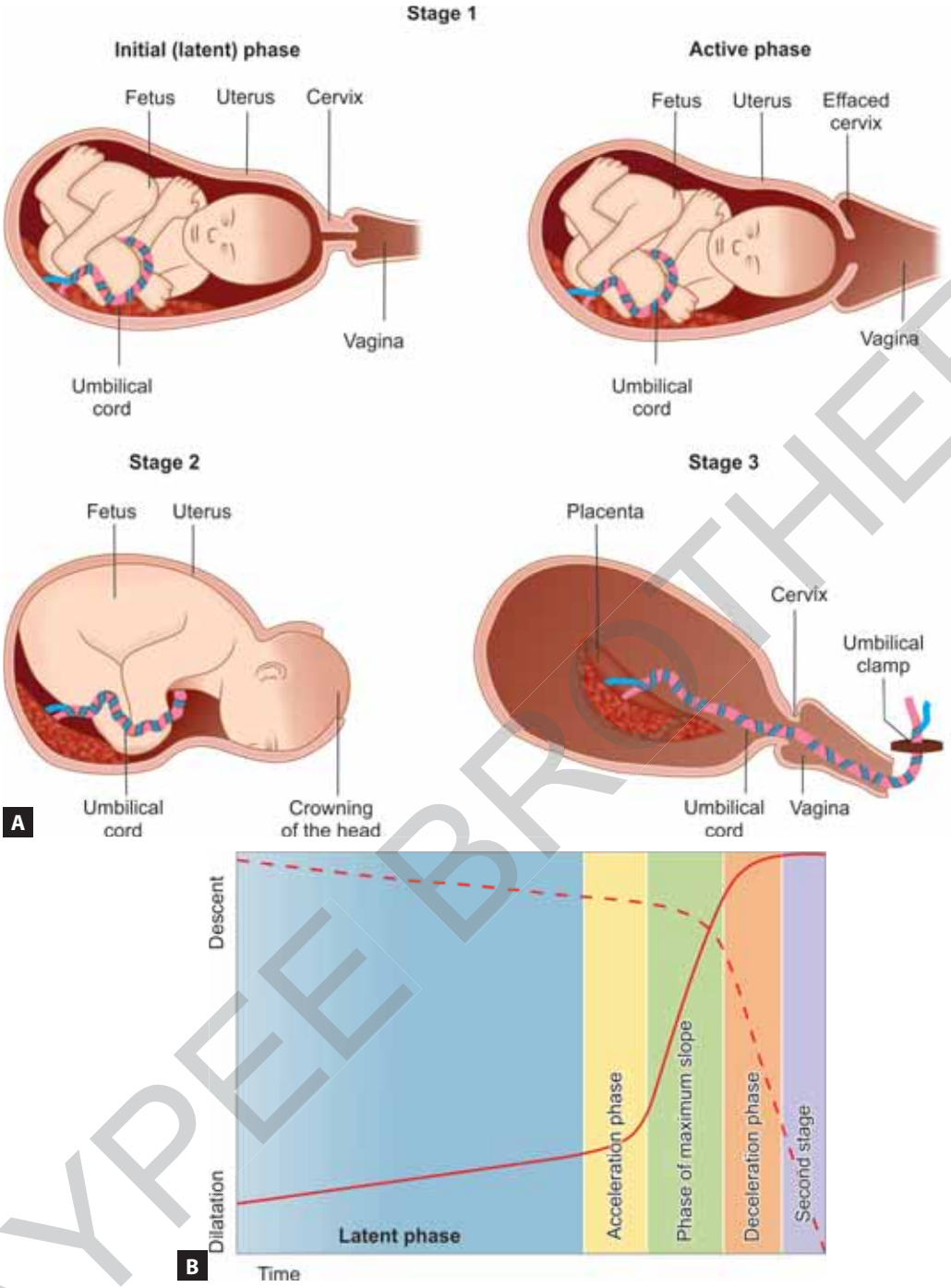
ABDOMINAL EXAMINATION

The abdominal examination forms an important part of every complete physical examination in labor. It must be done at the time of admission and each time before a vaginal examination is performed. The parameters to be assessed at the time of abdominal examination of a patient who is in labor are similar to those observed at the time of antenatal examination and have been described before. Additionally, descent and engagement of the fetal presenting part, assessment of fetal position, and uterine contractions are especially important when the patient is in labor. The amount of descent and engagement of the presenting part is assessed by feeling how many fifths of the head are palpable above the brim of the pelvis.

Various parameters on abdominal examination, such as estimation of fundal height, detection of fetal lie, presentation, position, conducting the four Leopold's maneuvers, and auscultation of fetal heart rate, have been described in details in Chapter 1. Besides this, other parameters, which need to be assessed at the time of abdominal examination during labor, are given in the following text.

Assessment of Fetal Size

While palpating the fetus, the obstetrician must try to assess the size of the fetus itself. A note should be made regarding the expected fetal weight. This should be later compared with the actual weight of the baby at the time of delivery. Regular use of this practice greatly helps in improving the accuracy of fetal weight estimation. The obstetrician should observe if the uterus appears to be full with the fetus or the fetus feels smaller than what is expected for the particular period of gestation. A fetus, which feels smaller than expected, could be indicative of IUGR or oligohydramnios or wrong dates. A fetus, which feels larger than expected, could



Figs. 2.2A and B: (A) Stages of normal labor; (B) Graphical representation of normal labor as depicted by Friedman (1955).

TABLE 2.2: Classification of labor based on the period of gestation.

Classification	*Period of gestation*
Preterm labor	Prior to 37 weeks
Term	37–42 weeks
Post-term	After 42 weeks
Postdated	After 40 weeks

be indicative of fetal macrosomia (particularly in association with gestational diabetes), polyhydramnios, or multifetal gestation. In multifetal gestation, though the uterine size is larger than the period of gestation, the size of individual fetuses per se is small.

If the clinician feels that the size of the head appears to be smaller in relation to the period of gestation, he/she must try to assess the size as well as hardness of the fetal head. The fetal head feels harder as the pregnancy gets closer to term. A relatively small fetal head with a hard feel is suggestive of IUGR rather than prematurity.

Engagement

With the progress of second stage of labor, there is progressive downward movement of the fetal presenting

TABLE 2.3: Findings of specific systemic examination.

Abdominal examination	*Per speculum examination*	*Per vaginal examination*
• Estimation of height of uterine fundus • The fetal lie may be longitudinal, transverse, or oblique • Fetal presentation may be cephalic, podalic (breech), or shoulder • Obstetric grips (Leopold's maneuvers) • Uterine contractions • Estimation of fetal descent • Assessing the engagement of fetal presenting part • Auscultation of fetal heart rate • Assessment of the fetal size • Assessment of the amount of liquor present	Indicators of ruptured membranes are as follows: • Gross vaginal pooling of fluid • Positive results on nitrazine paper test and fern testing of vaginal secretions • Evidence of meconium	• Cervical dilatation • Cervical consistency and effacement • Fetal presentation and position • Assessment of fetal membranes and amount of liquor • Fetal descent (station of fetal head) • Molding of fetal skull • Pelvic assessment

part in relation to the pelvic cavity. Engagement is said to have occurred when the largest diameter of presenting part passes through pelvic inlet. Engagement of the fetal presenting part is of great importance as it helps in ruling out fetopelvic disproportion. It is evident from abdominal and vaginal examinations. Vaginal examination reveals the descent of fetal head in relation to the ischial spines (would be described with the vaginal examination).

Abdominal Assessment of Fetal Descent

The assessment of fetal descent through the abdominal examination is done by using the fifth's formula **(Figs. 2.3A to C)**. In this method, the number of fifths of fetal head above the pelvic brim is estimated. The amount of fetal head that can be palpated per abdominally is estimated in terms of finger breadth, which is assessed by placing the radial margin of the index finger above the symphysis pubis successively. Depending upon the amount of fetal head palpated per abdominally, other fingers of the hand can be placed in succession, until all the five fingers cover the fetal head.

A free-floating head would be completely palpable per abdomen. This head accommodates full width of all the five fingers above the pubic symphysis and can be described as 5/5. A head which is fixing but not yet engaged may be three-fifth palpable per abdominally and is known as 3/5. A recently engaged fetal head may be two-fifth palpable per abdominally and is known as 2/5, while a deeply engaged fetal head may not be palpable at all per abdominally and may be described as 0/5.

Assessment of the Amount of Liquor Present

Under normal circumstances, the amount of liquor decreases as the pregnancy approaches term. The amount of liquor can be clinically assessed by feeling the way that the fetus can be balloted while being palpated. Reduced degree of fetal ballottement at the time of abdominal palpation is indicative of reduced amount of amniotic fluid or oligohydramnios. On the other hand, increased degree of fetal ballottement at the time of abdominal palpation is suggestive of increased amount of amniotic fluid or polyhydramnios. Some of the causes for polyhydramnios and oligohydramnios are enumerated in **Table 2.4**. In both the cases an ultrasound examination needs to be performed by a trained person to exclude multiple gestation, congenital abnormality in the fetus, or IUGR.

Uterine Contractions

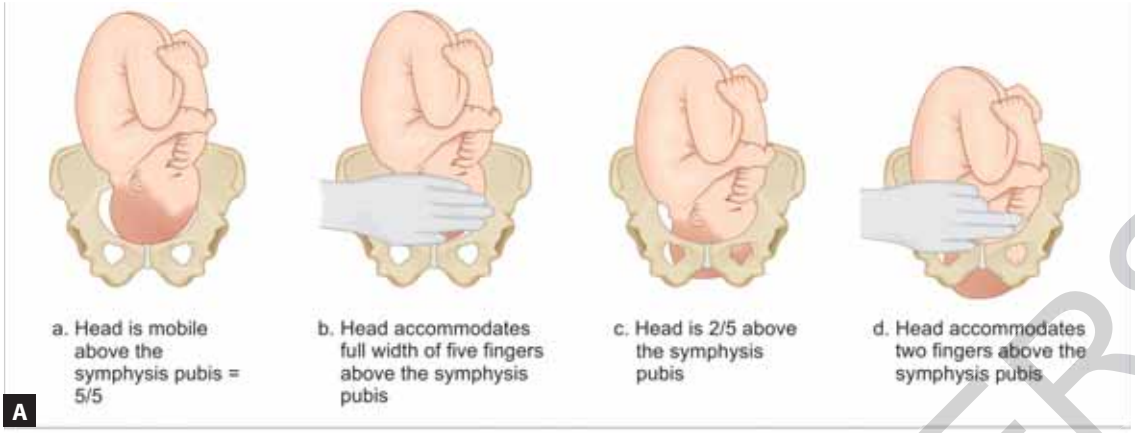
The clinician will get an idea regarding the woman's uterine contractions by typically placing hands on the patient's abdomen and feeling her uterus contract. The parameters to be assessed at the time of abdominal examination include the number of uterine contractions in a 10-minute period, duration of contractions, regularity of contractions, and intensity of contractions. Another important parameter to assess is whether the contractions result in simultaneous dilatation of the cervix. One way to determine the intensity of a contraction is by comparing the firmness of the uterus to areas on the clinician's face. For example, the cheek could be considered as mild, the tip of the nose as moderate and forehead as strong. In the early stages of labor, the frequency of the uterine contractions may be after every 15–20 minutes, lasting for about 20–30 seconds. However, as the labor progresses, the frequency and duration of uterine contractions greatly increase with contractions occurring after every 1–2 minutes and lasting for about 60–120 seconds. Some of the features of uterine contractions, which need to be assessed are given in the following text.

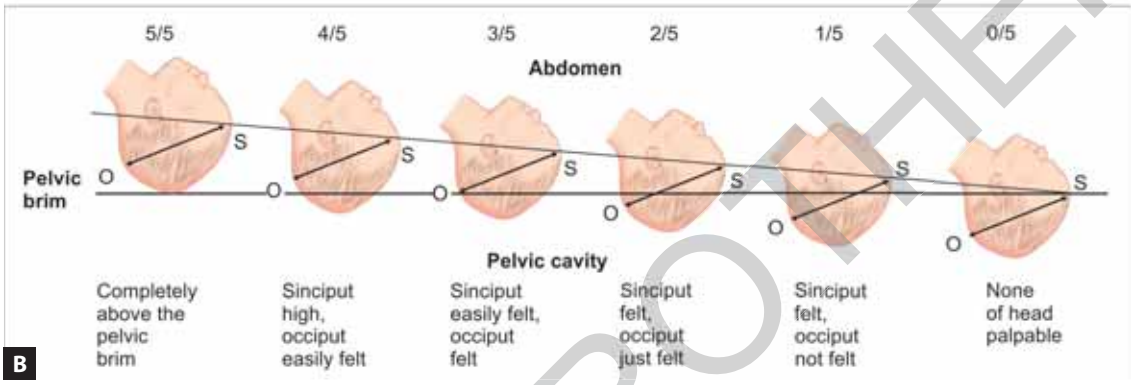
Duration of Uterine Contractions

Placing a hand on the abdomen and feeling when the uterus becomes hard and when it relaxes help in assessing the length of the uterine contractions. Depending upon the time duration for which the contractions last, they can be classified as strong, moderate, and weak contractions. Grading of the duration of uterine contractions is described in **Table 2.5**.

Strength of Contractions

Measuring the degree of hardness, which the uterus undergoes at the time of contraction, helps in assessing the strength of contractions or their intensity. An experienced obstetrician can estimate the intensity of uterine contractions by palpating the uterine fundus during the contractions.





Figs. 2.3A to C: Estimation of the descent of fetal head. (A) Abdominal examination for fetal descent; (B) Stages of fetal descent through the pelvic cavity; (C) Assessment of fetal descent by using the fifth's formula.

TABLE 2.4: Causes for abnormalities in the amount of liquor.

Causes of polyhydramnios	***Causes of oligohydramnios***
• Multiple gestation • Maternal diabetes • Twin-to-twin transfusion syndrome • Fetal parvovirus B19 infection • Rh blood incompatibilities between the mother and the fetus • Fetal congenital abnormalities (e.g., birth defects) involving the gastrointestinal tract and central nervous system (e.g., esophageal atresia, spina bifida, anencephaly, etc.)	• Intrauterine growth retardation • *Placental dysfunction:* Presence of amnion nodosum (squamous metaplasia of amnion) on the placenta • Premature rupture of the membranes • Birth defects, especially those involving the kidneys and urinary tract, e.g., renal agenesis or obstruction of the urinary tract (posterior urethral valves) • Post-term pregnancy (>40 weeks) • Chronic maternal disorders including gestational diabetes mellitus, preeclampsia, chronic hypertension, systemic lupus erythematosus, etc. • Medications including angiotensin-converting enzyme inhibitors (such as captopril), prostaglandin inhibitors (aspirin, etc.)

TABLE 2.5: Grading the duration of contractions.

Duration of contractions	*Grading of contractions*
Contractions lasting less than 20 seconds	Weak contractions
Contractions lasting for 20–40 seconds	Moderate contractions
Contractions lasting more than 40 seconds	Strong contractions

During a mild contraction, the uterine wall can be indented, whereas during a strong contraction, it cannot be indented.

Frequency of Uterine Contractions

Frequency of uterine contractions measures the number of times the uterine contractions occur in a period of 10 minutes.

True/False Labor Pains

Q. Write a short note on false labor pains.

Q. Discuss in brief about the lower uterine segment.

During the first stage of labor, the obstetrician needs to determine whether the woman is having true or false uterine contractions. False labor pains can occur prior to the onset of true labor pains. They occur more frequently in a primigravida where they may occur 1–2 weeks prior to the onset of true labor pains. In multigravida, they may precede the true labor pains by a few days.

The false labor pains are usually dull in nature and are confined to the lower abdominal and groin regions. They have no relation with the uterine contractions and do not cause any effect on cervical dilatation and effacement. This pain is usually relieved by enema and administration of sedatives. False labor pain is related to the formation of lower uterine segment and taking up of cervix, which may cause cervical stretching and irritation of the surrounding ganglia. Difference between true and false labor pain is enumerated in **Table 2.6**.

On the other hand, true labor pains comprise of painful uterine contractions at regular intervals; these contractions tend to increase in intensity and duration with the progression of labor; they are usually experienced at lower back and radiate to abdomen and tend to become more intense with walking, cervical changes, and fetus moving into the lower pelvis. True labor pains are accompanied with the appearance of show (expulsion of cervical mucus plug mixed with blood) and progressive cervical dilatation and effacement. There also may be the formation of bag of membranes. As the lower uterine segment is stretched, membranes get detached from the decidua. With the progressive cervical dilatation, the membranes tend to become unsupported and bulge into the cervical canal. Due to the rise of intra-amniotic pressure at the time of uterine contractions, these membranes tend to become tense and convex, resulting in the formation of bag of membranes. This bulging of membranes usually disappears as the contraction passes off. Formation of bag of membranes is a certain sign of labor.

True uterine contractions usually follow a rhythmic pattern, with periods of contractions followed by periods of relaxation in between, which would allow the woman to rest. During the phase of relaxation, restoration of placental circulation occurs, which is important for the baby's oxygenation. The uterus appears to be hard during the strong uterine contractions and it may be difficult to palpate the fetal parts. Causes for abnormal hardness of the uterus are enumerated in **Box 2.1**. The most common causes for abnormal hardness and tenderness of the uterus include abruptio placenta or a ruptured uterus. Some of the features of uterine contractions, which need to be assessed, are described in the following text.

TABLE 2.6: Differences between true labor and false labor pain.

True labor	*False labor*
• Contractions occur at regular intervals • Interval gradually shortens • Intensity increases • Duration of contraction increases • Progressive cervical dilatation and effacement • Not relieved by sedation	• Occurs at irregular intervals • Remains irregular • Intensity remains same over a period of time • Tends to become shorter in duration over time • No progress in cervical dilatation or effacement • Pain is relieved by sedation

BOX 2.1: Causes for abnormal hardness of the uterus.

Some primigravidas
At the time of strong uterine contractions
Abruptio placenta
Rupture of the uterus

VAGINAL EXAMINATION

Vaginal examination must be performed at the time of admission of the pregnant patient in labor. It is carried out at least once every 4 hours during the first stage of labor or if there is ROM or if any intervention is needed. Preparations for delivery are made as the cervical dilatation and effacement approach completion and/or crowning of the fetal presenting part becomes evident at the vaginal introitus.

Prerequisites for a Vaginal Examination

- The patient must be carefully explained about the examination, prior to performing the examination.
- Adequate permission must be taken from the patient.

- There should be a valid reason for performing the examination.
- A vaginal examination must always be preceded by an abdominal examination.

Indications for a Vaginal Examination in Labor

Indications for performing a vaginal examination during the various periods of pregnancy are enumerated in **Box 2.2**.

BOX 2.2: Indications for vaginal examination in labor.

- Assessment of the ripeness of the cervix prior to induction of labor
- Performance of artificial rupture of the membranes to induce labor
- Detection of cervical effacement and/or dilatation
- Identification of the fetal presenting part
- Performance of pelvic assessment
- To note progress of labor
- Following rupture of membranes to rule out cord prolapse
- Whenever interference is contemplated
- To confirm the second stage of labor

Contraindications for Vaginal Examination in Pregnancy

Antepartum hemorrhage (see Chapter 8) and preterm ROM without contractions are conditions in which the vaginal examination is contraindicated. In these cases a sterile speculum examination can be done to confirm or exclude ROM.

Preparation for Vaginal Examination

- The patient's bladder must be empty.
- The procedure must be carefully explained to the patient.
- The patient must be placed in either the dorsal or lithotomy position. In clinical practice, dorsal position is most commonly used because it is more comfortable and less embarrassing than the lithotomy position. Also the lithotomy position usually requires equipment such as lithotomy poles and stirrup, which is not the case with dorsal position.
- If the membranes have not ruptured or are not going to be ruptured during the examination, an ordinary surgical glove can be used and there is no need to swab the patient with antiseptic solution. However, if the membranes have ruptured or are going to be ruptured during the examination, vaginal examination in labor should be performed as a sterile procedure. Therefore, in these cases a sterile tray which contains sterile swabs, sterile gloves, sterile instruments (preferably Kocher's forceps) for performing ARM, an antiseptic vaginal solution (betadine), or sterile lubricant (Savlon) is required.
- The clinicians before performing the vaginal examination must either scrub or thoroughly wash their hands and wear sterile gloves. The patient's vulva and perineum must be swabbed with Savlon or Betadine solution. This is done by first swabbing the labia majora and groin on both sides and then swabbing the introitus while keeping the labia majora apart with the thumb and forefinger.

  A vaginal examination must be preceded by the inspection of the external and internal genitalia, for signs of sexually transmitted diseases such as presence of single or multiple ulcers, a purulent discharge, or enlarged inguinal lymph nodes. The vulva must also be carefully inspected for any abnormalities, e.g., scars, warts, varicosities, congenital abnormalities, ulcers, or discharge. Vagina and cervix can be inspected by performing a per speculum examination. The vagina must be assessed for the presence or absence of the following features: vaginal discharge, a full loaded rectum, vaginal stricture or septum, or prolapse of the umbilical cord through the vaginal introitus.
- Presence of a wart-like growth or an ulcer on the cervix may be suggestive of cervical carcinoma. The cervical surface can also be assessed while performing a vaginal examination. A bimanual examination helps in assessing the cervical dilatation and effacement, the size of the uterus, and masses in the adnexa (ovaries and fallopian tubes).

  In the first trimester of pregnancy, a bimanual examination helps in assessment of the uterine size in comparison with the period of amenorrhea. After the first trimester, the uterine size is primarily assessed on abdominal examination. Lastly, the fornices are palpated to exclude any masses, the most common of which is an ovarian cyst or tumor.

  Special care must be taken when performing a vaginal examination late in pregnancy, especially in the presence of a high presenting part. The nonengagement of the presenting part could be due to an undiagnosed placenta previa. If this is suspected, the finger must not be inserted into the cervical canal. Instead, the presenting part is gently palpated through all the fornices. If any bogginess is noted between the fingers of the examining hand and the presenting part, the examination must be immediately abandoned and the patient must be referred urgently for an ultrasound examination.

Parameters to be Observed during Vaginal Examination

Q. Discuss in detail changes in the uterine cervix during pregnancy and labor.

The parameters to be observed while performing a vaginal examination are described in **Box 2.3** and include the following:

- Consistency and position of cervix
- Degree of effacement and dilatation of cervix
- To note whether the cervix/vagina is well applied to the presenting part
- Station and position of presenting part

- Whether the membranes are present or absent
- Assessment of pelvis and to rule out cephalopelvic disproportion (CPD)

Cervical Dilatation and Effacement

Cervical dilatation **(Figs. 2.4A to D)** must be assessed in centimeters and is best measured by assessing the degree of separation of the fingers on vaginal examination.

The cervix undergoes progressive shortening or effacement in early labor **(Figs. 2.5A and B)**. The cervical effacement is measured by assessing the length of the endocervical canal.

BOX 2.3: Parameters to be observed while performing a vaginal examination.

- Consistency of cervix
- Cervical dilatation
- Cervical effacement
- Fetal presentation
- Position
- Assessment of fetal membranes
- Assessment of liquor
- Fetal descent (station of fetal head)
- Molding of fetal skull
- Pelvic assessment

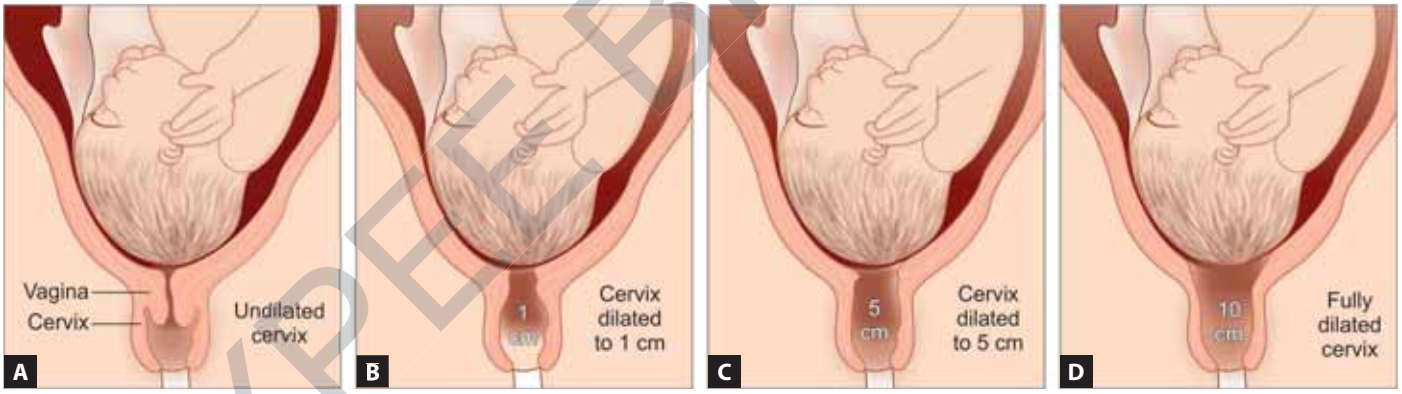
Cervical effacement refers to the distance between the internal os and the external os on digital examination. In an uneffaced cervix, the endocervical canal is approximately 3 cm long. However, when the cervix becomes fully effaced there will be no endocervical canal, only a ring of thin cervix. The cervical effacement is measured as a percentage.

Evaluation of the state of cervix: This is done by calculation of the Bishop's score **(Table 2.7)**. A maximum score of 13 is possible with this scoring system. Labor is most likely to commence spontaneously with a score of 9 or more, whereas lower scores (especially those <5) may require cervical ripening and/or augmentation with oxytocin.

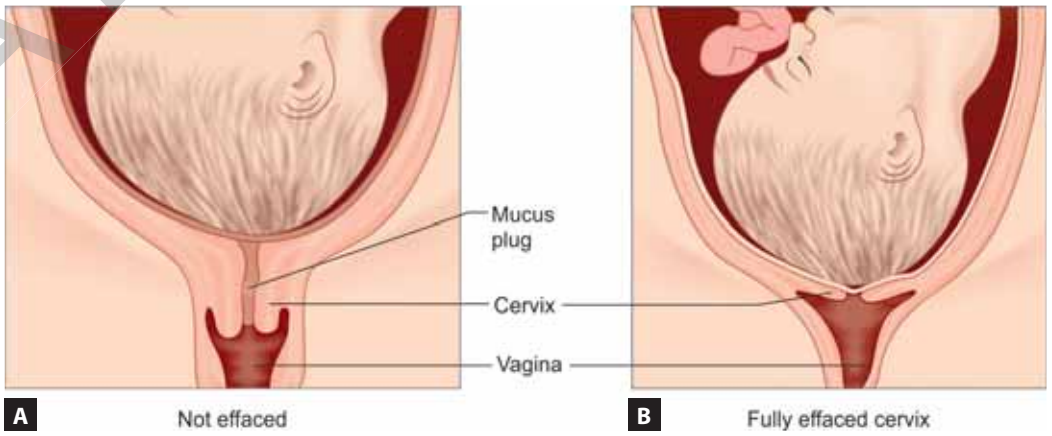
Fetal Presentation

An abdominal examination performed earlier helps in determining the fetal lie and the presenting part. The presenting part of the fetus can be confirmed on vaginal examination. The presenting part could be head, breech, or shoulder. If the head is presenting, the exact fetal presentation, e.g., vertex, brow, or face, needs to be determined.

- *Features of a vertex presentation:* The posterior fontanel is normally felt. It is a small triangular space. In contrast, the anterior fontanel is diamond-shaped. If the head is



Figs. 2.4A to D: Cervical dilatation.



Figs. 2.5A and B: Cervical effacement.

TABLE 2.7: Bishop's score (modified).

Score	Dilation (cm)	Effacement (%)	Station of the presenting part	Cervical consistency	Position of cervix
0	Closed	0–30	–3	Firm	Posterior
1	1–2	40–50	–2	Medium	Mid position
2	3–4	60–70	–1, 0	Soft	Anterior
3	>5	>80	+1, +2	–	–

well flexed, the anterior fontanel will not be felt. If the anterior fontanel can be easily felt, the head is deflexed.

- *Features of a face presentation:* On abdominal examination the presenting part is the head. However, on vaginal examination the following features are observed:
  - Instead of a firm skull, something soft is felt.
  - The gum margins distinguish the mouth from the anus.
  - The cheek bones and the mouth form a triangle.
  - The orbital ridges above the eyes can be felt.
  - The ears may be felt.
- *Features of a brow presentation:* The presenting part is high. The anterior fontanel is felt on one side of the pelvis, the root of the nose on the other side, and the orbital ridges may be felt laterally.
- *Features of a breech presentation:* On abdominal examination the presenting part is the breech (soft and triangular). On vaginal examination, instead of a firm skull, something soft is felt; the anus does not have gum margins; the anus and the ischial tuberosities form a straight line.
- *Features of a shoulder presentation:* On abdominal examination, the lie will be transverse or oblique. Features of a shoulder presentation on vaginal examination will be quite easy if the arm has prolapsed. The shoulder is not always that easy to identify, unless the arm can be felt. The presenting part is usually high. For details related to shoulder presentation, kindly refer to Chapter 4.

Fetal Position

Fetal position refers to relationship of the designated landmark on the fetal presenting part with the left or right side of the maternal pelvis. Fetal position has been described in detail previously in Chapter 1.

Assessment of the Membranes

Drainage of liquor indicates that membranes have ruptured. However, even if the liquor is obviously draining, the obstetrician must always try to feel for the presence of membranes overlying the presenting part. If the presenting part is high, it is usually quite easy to feel intact membranes. However, it may be difficult to feel the membranes, if the presenting part is well applied to the cervix. In this case, one should wait for a contraction when some liquor often comes in front of the presenting part, allowing the membranes to be felt. If the membranes are intact, and the patient is in the active phase of labor, the membranes should be ruptured. However, if the presenting part is high, there is always the danger that the umbilical cord may prolapse, with the ARM. Following precautions should therefore be taken while performing an ARM in a patient with high presenting part:

- Before doing an ARM, the fetal head must be stabilized using the abdominal hand in order to minimize the chances of cord prolapse.
- Fetal heart rate should be heard following the ARM. Decline in fetal heart rate could be indicative of fetal distress resulting from cord prolapse.
- A vaginal examination must be performed following ARM, in order to exclude the possibility of cord presentation.

  Membranes are normally not ruptured in HIV-positive patients unless there is poor progress of labor.

Condition of the liquor when the membranes rupture: An important parameter, which must be assessed at the time of assessing the membranes, is the condition of liquor following ROM. Clear-colored liquor following ROM is indicative of a normal healthy fetus. Greenish colored liquor is suggestive of the presence of meconium. The presence of meconium may change the management of the patient as it indicates the presence of fetal distress. In these cases, it may be required to expedite the delivery.

Determining the Descent and Engagement of the Head

The engagement of the fetal head is assessed on abdominal and not on vaginal examination. However, the vaginal examination does help in assessing the descent of fetal presenting part. The level of the fetal presenting part is usually described in relation to the ischial spines, which is halfway between the pelvic inlet and pelvic outlet. When the lowermost portion of the fetal presenting part is at the level of ischial spines, it is designated as "zero" station. The ACOG has devised a classification system that divides the pelvis above and below the spines into fifths. This division represents the distance in centimeters above and below the ischial spine. Thus, as the presenting fetal part descends from the inlet toward the ischial spine; the designation is –5,

–4, –3, –2, –1, and then 0 station. Below the ischial spines, the fetal head passes through +1, +2, +3, +4, and + 5 stations till delivery **(Fig. 2.6)**. +5 station represents that the fetal head is visible at the introitus. If the leading part of the fetal head is at the zero station or below, the fetal head is said to be engaged. This implies that the biparietal plane of the fetal head has passed through the pelvic inlet. However, in the presence of excessive molding or caput formation, engagement may not have taken place even if the head appears to be at zero station.

Molding

Q. With help of a short essay discuss about molding and its clinical significance.

Molding is the overlapping of the fetal skull bones at the regions of sutures, which may occur during labor due to the head being compressed as it passes through the maternal pelvis. Molding results in the compression of the engaging diameter of the fetal head with the corresponding elongation of the diameter at right angles to it **(Fig. 2.7)**. For example, if the fully flexed fetal head engages in the suboccipitobregmatic diameter, this diameter gets compressed. At the same time, the mentovertical diameter (which is at right angles to the suboccipitobregmatic diameter) gets elongated.

- *Diagnosis of molding:* In a cephalic (head) presentation, molding is diagnosed by feeling the overlapping of the sutures of the skull on vaginal examination and assessing whether or not the overlap can be reduced (corrected) by pressing gently with the examining finger.

  The presence of caput succedaneum (soft-tissue edema of fetal scalp) can also be felt as a soft, boggy swelling, which may make it difficult to identify the presenting part of the fetal head clearly. With severe caput, the sutures may be impossible to feel.
- *Grading the degree of molding **(Fig. 2.8)**:* The occipitoparietal and sagittal sutures are palpated, and the relationship or closeness of the two adjacent bones is assessed. The degree of molding is assessed according to the scale described in **Table 2.8**.

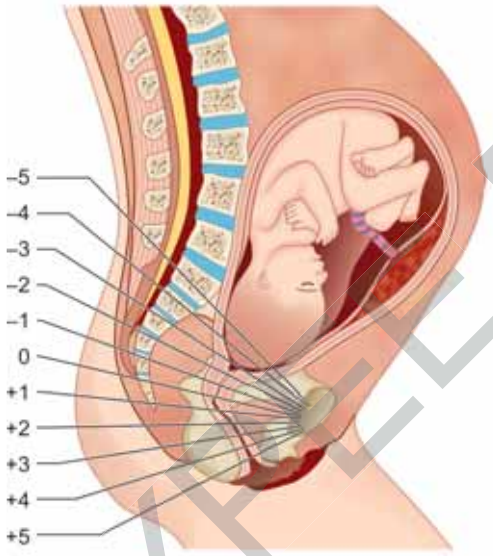


Fig. 2.6: Fetal descent.

PELVIC ASSESSMENT

While assessing the pelvis, it is important to adopt a step-by-step method, i.e., first assessing the size and shape of the pelvic inlet, then the midpelvis, and lastly the pelvic outlet.

Assessment of Pelvic Inlet

For assessment of pelvic inlet, the sacral promontory and the retropubic areas are palpated.

Assessment of Midpelvis

For assessment of the midpelvis, the curve of the sacrum, the sacrospinous ligaments, and the ischial spines are palpated.

Assessment of the Pelvic Outlet

For assessment of the pelvic outlet, the subpubic angle, intertuberous diameter, and mobility of the coccyx are determined.

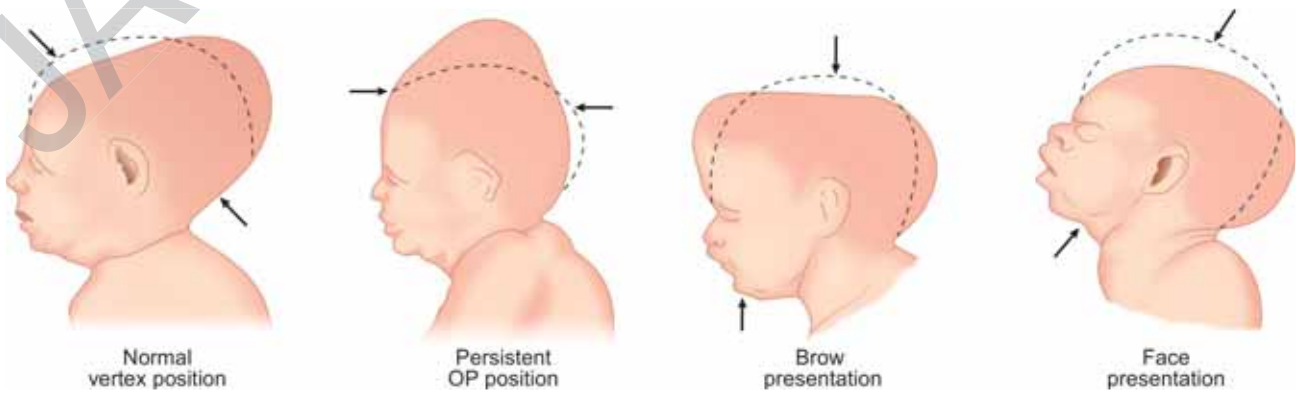


Fig. 2.7: Pattern of molding in different types of cephalic presentations.

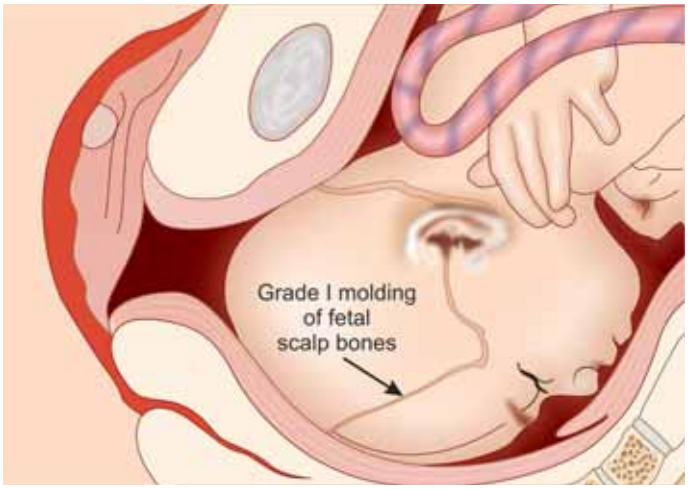
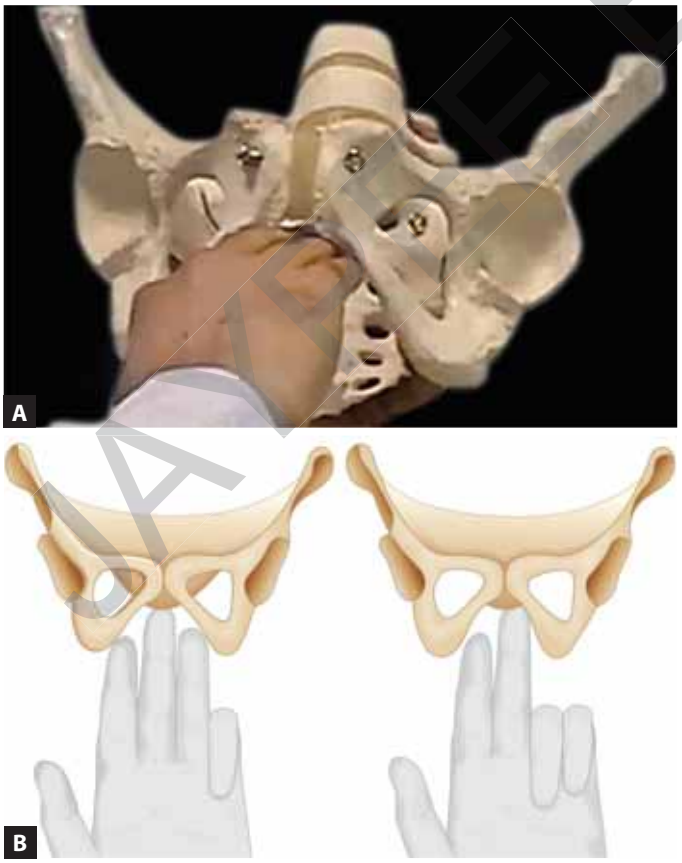


Fig. 2.8: Grade I molding of fetal scalp bones.

TABLE 2.8: Degree of molding of fetal skull.

Degree of molding	*Description*
0 (normal)	Normal separation of the bones with open sutures
1+ (mild molding)	Bones touching each other
2+ (moderate molding)	Bones overlapping, but can be separated with gentle digital pressure
3+ (severe molding)	Bones overlapping, but cannot be separated with gentle digital pressure



Figs. 2.9A and B: Assessment of subpubic angle.

The obstetrician must begin the pelvic assessment by starting with the sacral promontory and then following the curve of the sacrum down the midline. In an adequate pelvis, the promontory cannot be easily palpated, the sacrum is well curved, and the coccyx cannot be felt. In case of an inadequate pelvis, the sacral promontory is easily palpated and prominent, the sacrum is straight, and the coccyx is prominent and/or fixed. After assessing the sacrum, the obstetrician must move his/her fingers lateral to the midsacrum where the sacrospinous ligaments can be felt. If these ligaments are followed laterally, the ischial spines can be palpated. In an adequate pelvis, the sacrospinous ligaments are 3 cm or longer, i.e., at least two of the obstetrician's fingers can be placed over the sacrospinous ligaments. In case of an inadequate pelvis, it may not be possible to place two fingers over the sacrospinous ligaments; the ligaments usually allow less than two fingers. Also, the ischial spines may appear sharp and prominent. Next, the retropubic area is palpated. For this the obstetrician must put two examining fingers with the palm of the hand facing upward, behind the symphysis pubis. The hand is then moved laterally to both sides. In case of an adequate pelvis, the retropubic area is flat. In case of an inadequate pelvis, the retropubic area is angulated. To measure the subpubic angle, the examining fingers are turned so that the palm of the hand faces downward. At the same time, the third finger is also held out at the vaginal introitus, and the angle under the pubis is felt. If three fingers can be placed under the pubis, the subpubic angle is approximately 90°, which can be considered as adequate **(Figs. 2.9A and B)**. If the subpubic angle allows only two fingers, the subpubic angle is about 60°, which is indicative of an inadequate pelvis. Finally, as the obstetrician's hand is withdrawn from the vaginal introitus, the intertuberous diameter is measured with the knuckles of the closed fist of the hand placed between the ischial tuberosities. If the pelvis is adequate, the intertuberous diameter allows four knuckles. In case of an inadequate pelvis, the intertuberous diameter allows less than four knuckles.

MANAGEMENT

Management comprising investigations and definitive obstetric management is discussed next.

INVESTIGATIONS

The investigations which need to be done during the antenatal period have been discussed in Chapter 1. In case these investigations have not been done previously due to some reason or an unbooked patient without the history of previous antenatal visits presents for the first time in labor, these investigations need to be done at the time of admission.

General principles of care to be observed at the time of labor are enlisted in **Box 2.4**.

Rx TREATMENT/OBSTETRIC MANAGEMENT

Q. What should be the next step of management in the case study described in the beginning of the chapter?

The following need to be done in the above-mentioned case study:

- Detailed history must be taken if not had been taken previously in the antenatal period.
- A general physical, vaginal, and abdominal examination must be done. Cervix must be checked for dilatation, effacement, position, and consistency. In this case, the patient was having regular uterine contractions after every 10–15 minutes with each contraction lasting for about a minute. The cervix was dilated by 3–4 cm, was 50–60% effaced, head was at –1 station, and membranes were absent. The baby's head was in occipitoanterior position.
- A management plan for normal vaginal delivery was formulated in this case, following which the patient was admitted to the labor and delivery unit.
- Consent forms must be signed for delivery and potential blood transfusion by the patient and her husband/partner.
- Nonstress test must be performed.
- The patient must be placed on a clear diet and intravenous fluids.
- Intermittent fetal heart monitoring to be done every 30 minutes during the active phase of the first stage, after every contraction during the second stage, and immediately following the spontaneous ROM.
- Patient must be given a choice of whether she wants epidural analgesia or not.

BOX 2.4: General principles of care to be observed at the time of labor.

- Antenatal summary card to be reviewed
- Antenatal visits and investigations to be reviewed
- General physical examination, vital signs, obstetric examination including per speculum examination (especially if leaking is present), and a per vaginal examination needs to be performed

Five important factors are responsible for the normal progress of labor. These include the passage, fetus, relationship between the passage and the fetus, forces of labor, and psychosocial considerations. This can be remembered by the mnemonic called the 5 "Ps" of labor: *P*assageway (maternal pelvis), *P*assenger (fetus), *P*ower (uterine contractions), *P*osition, and *P*sychologic responses.

MATERNAL PELVIS (PASSAGEWAY)

Q. Write a long essay on android pelvis.

Q. Discuss in detail the clinical difference between different types of female pelvis.

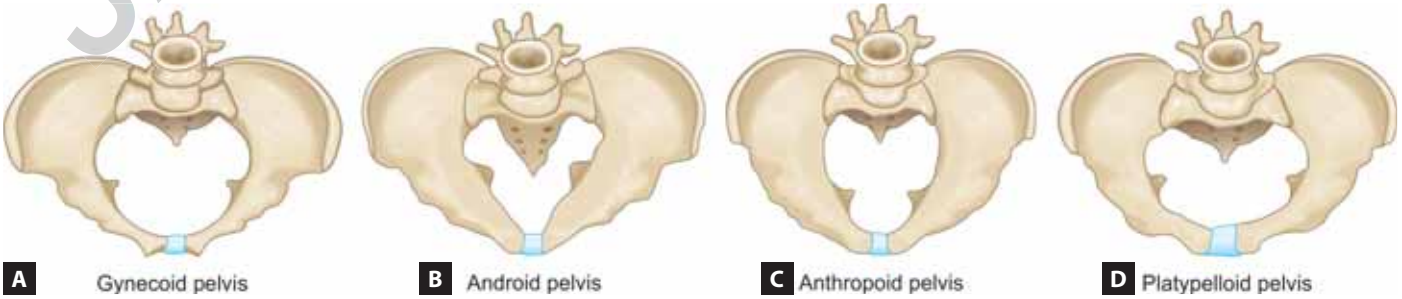
Q. Discuss maternal pelvis in brief.

The birth passage comprises three parts, namely the pelvic inlet, pelvic cavity, and the pelvic outlet. The bony pelvis can be classified into four types: gynecoid, android, anthropoid, and platypelloid **(Figs. 2.10 and Table 2.9)**. Of these, the gynecoid type of pelvis is the most common, with the diameters favorable for vaginal delivery. The anterior view of maternal gynecoid pelvis is shown in **Figure 2.11**. Gynecoid pelvis is an ideal type of pelvis and is characterized by the presence of the following features:

- The pelvic brim is almost round in shape, but slightly oval transversely.
- Ischial spines are not prominent.
- Subpubic arch is rounded and measures at least 90° in size.
- Obturator foramen is triangular in shape.
- Sacrum is wide with average concavity and inclination.
- Sacrosciatic notch is wide.

The pelvic brim **(Fig. 2.12)** divides the pelvis into false pelvis and true pelvis. The boundaries of the pelvic brim or inlet include the following: sacral promontory, sacral alae, sacroiliac joints, iliopectineal lines, iliopectineal eminence, upper border of superior pubic rami, pubic tubercles, pubic crest, and upper borders of pubic symphysis.

- *False pelvis:* False pelvis lies above the pelvic brim and has no obstetrical significance.



Figs. 2.10A to D: Caldwell and Moloy's classification of pelvis.

TABLE 2.9: Various pelvic dimensions in different types of pelvis.

Part of pelvis	*Dimension*	*Gynecoid*	*Anthropoid*	*Android*	*Platypelloid*
Pelvic inlet	Widest diameter of pelvic inlet	12 cm	<12 cm	12 cm	12 cm
	Shape of the pelvic inlet	Oval at the inlet with anterior–posterior diameter being just slightly less than the transverse diameter	Oval, long, and narrow; the anterior–posterior diameter of the inlet exceeds the transverse diameter, giving it an oval shape	Heart-shaped/ triangular with the base toward the sacrum. As a result, posterior segment is short, and anterior segment is narrow	Pelvic brim is flat and transverse kidney-shaped. Transverse diameter is much larger than the anterior–posterior diameter
	Anteroposterior diameter of inlet	11 cm	12 cm	11 cm	10 cm
	Forepelvis	Wide	Divergent	Narrow	Straight
Pelvic midcavity	Sidewalls	Straight	Narrow	Convergent (widest posteriorly)	Wide (diverge downward)
	Sacrosciatic notch	Wide and shallow	Wider and more shallow	Narrow and deep	Slightly narrow and small
	Inclination of sacrum	Sacrum is well-curved, and sacral angle exceeds 90%	Sacrum is long and narrow with usual curve; sacral angle is >90°	Sacrum is inclined forward and straight; sacral angle is <90°	The sacrum is prominent and the sacral promontory tends to encroach upon the area of the hind pelvis; sacral angle is >90°
	Ischial spines	Not prominent	Not prominent	Prominent	Not prominent
Pelvic outlet	Subpubic arch	Wide and curved subpubic arch (subpubic angle is not <85°)	Subpubic arch is long and narrow; subpubic angle may be slightly narrowed	Long and straight subpubic arch, narrow subpubic angle	The subpubic arch is generally wide, and the subpubic angle is in the excess of 90°
	Transverse diameter of the outlet	10 cm	10 cm	<10 cm	10 cm

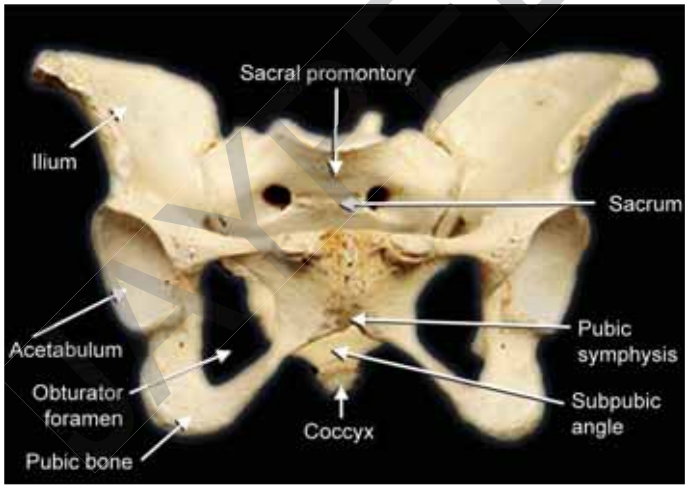


Fig. 2.11: Anterior view of maternal pelvis.

- *True pelvis:* True pelvis lies below the pelvic brim and plays an important role in childbirth and delivery. It forms a bony canal through which the fetus passes at the time of labor. It is formed by the symphysis pubis anteriorly and sacrum and coccyx posteriorly. The true pelvis can be divided into three parts: pelvic inlet, cavity, and outlet.

Pelvic Inlet

Pelvic inlet is round in shape and is narrowest in the anteroposterior dimension and widest in the transverse diameter. The fetal head enters the pelvic inlet with the longest diameter of the fetal head (AP diameter) in the widest part of the pelvic inlet (transverse diameter) **(Figs. 2.13A to C)**.

The plane of the pelvic inlet (also known as superior strait) is not horizontal, but is tilted forward. It makes an angle of 55° with the horizontal. This angle is known as the angle of inclination. Radiographically, this angle can be measured by measuring the angle between the front of the vertebra L5 and plane of inlet and subtracting this from 180°. Increase in the angle of inclination has obstetric significance as this may result in delayed engagement of the fetal head and delay in descent of fetal head. Increase in the angle of inclination also favors occipitoposterior position. On the other hand, the reduction in the angle of inclination may not have any obstetric significance.

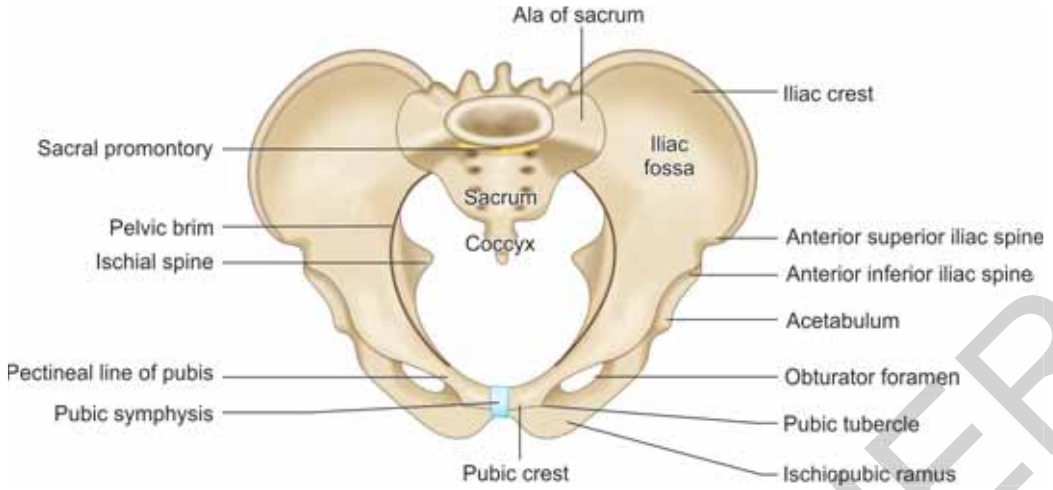
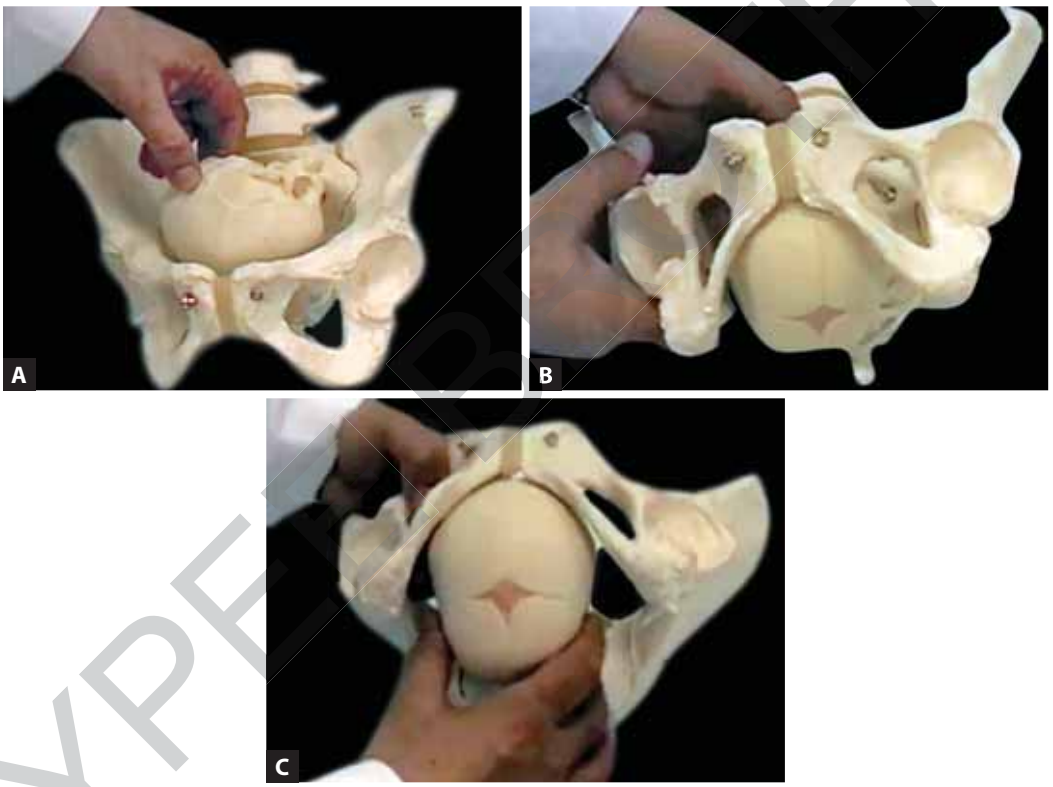


Fig. 2.12: Boundaries of the pelvic brim.



Figs. 2.13A to C: Entry of fetal head into the maternal pelvis. (A) The engaging diameter of fetal head engages in the transverse diameter of the inlet; (B and C) The fetal head undergoes internal rotation by 90° inside the pelvic cavity so that the longest diameter of fetal head engages in AP diameter of the outlet, which is its largest diameter.

The axis of the pelvic inlet is a line drawn perpendicular to the plane of inlet in the midline **(Fig. 2.14)**. It is in downward and backward directions. Upon extension, this line passes through the umbilicus anteriorly and through the coccyx posteriorly. For proper descent and engagement of fetal head, it is important that the uterine axis coincides with the axis of inlet.

Diameters of the Pelvic Inlet AP Diameter

- *AP diameter (true conjugate or anatomical conjugate = 11 cm):* This is measured from the midpoint of sacral promontory to the upper border of pubic symphysis **(Fig. 2.15)**.
- *Obstetric conjugate (10.5 cm):* It is measured from the midpoint of sacral promontory to the most bulging point on the back of symphysis pubic. This is the shortest AP diameter of the pelvic inlet and measures about 10.5 cm.
- *Diagonal conjugate (12.5 cm):* It is measured from the tip of sacral promontory to the lower border of pubic symphysis.

Out of the three AP diameters of pelvic inlet, only diagonal conjugate can be assessed clinically during the late

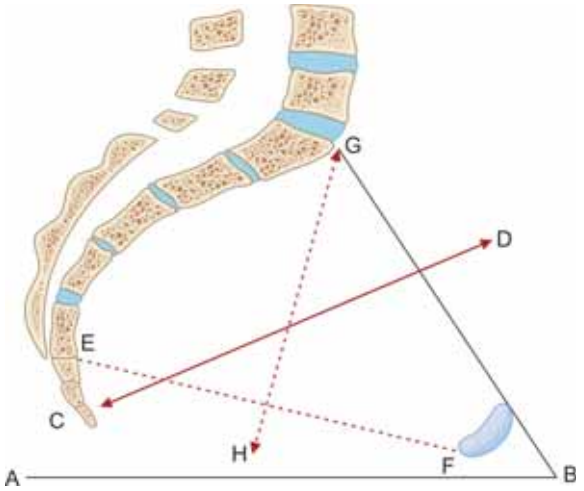


Fig. 2.14: Different planes and axes of the pelvis AB—horizontal line; GB—plane of inlet; FE—plane of obstetric outlet; DC—axis of the inlet; GH—axis of obstetrical outlet.

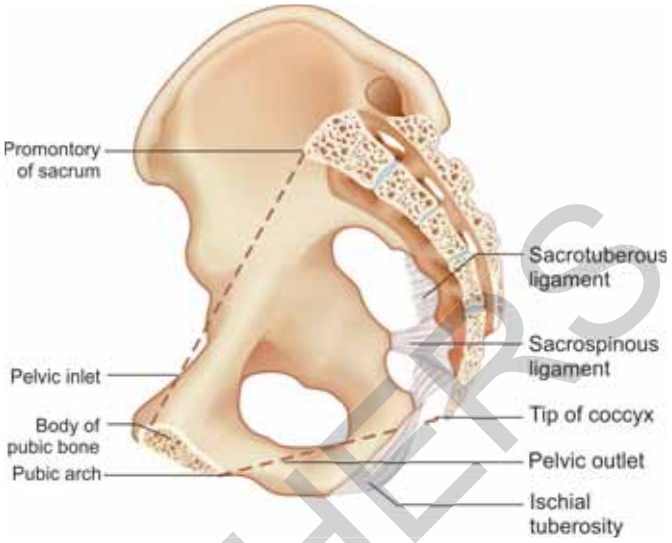
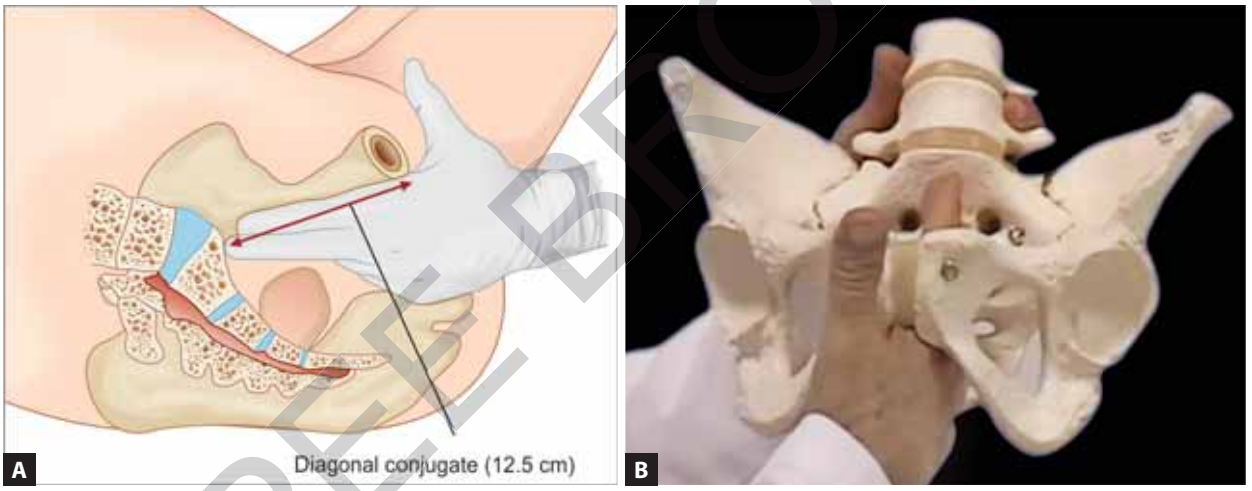


Fig. 2.15: Medial view of maternal pelvis (from left).



Figs. 2.16A and B: Measurement of diagonal conjugate.

pregnancy or at the time of the labor. Obstetric conjugate can be calculated by subtracting 1.5–2 cm from the diagonal conjugate. Also, the true conjugate can be inferred by subtracting 1.2 cm from the diagonal conjugate.

Measurement of the Diagonal Conjugate

After placing the patient in dorsal position and taking all aseptic precautions, two fingers are introduced into vagina. The clinician tries to feel the anterior sacral curvature with these fingers **(Figs. 2.16A and B)**. In normal cases, it will be difficult to feel the sacral promontory. The clinician may be required to depress the elbow and wrist while mobilizing the fingers upward in order to reach the promontory. The point at which the bone recedes from the finger is sacral promontory. A marking is placed over the gloved index finger by the index finger of the other hand. After removing the fingers from the vagina, the distance between the marking and the tip of the middle finger is measured in order to obtain the measurement of diagonal conjugate. In clinical situations, it may not always be feasible to measure the diagonal conjugate. In these cases, if the middle finger fails to reach the sacral promontory or reaches it with difficulty, the diagonal conjugate can be considered as adequate. Under normal circumstances, an adequate pelvis would be able to allow an average-sized fetal head to pass through.

Transverse Diameter of Pelvic Inlet

- *Anatomical transverse diameter (13 cm)*: It is the distance between the farthest two points on the iliopectineal line **(Fig. 2.17)**. It is the largest diameter of the pelvic inlet and

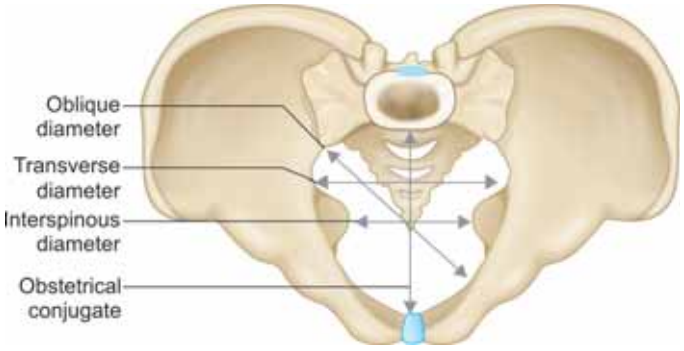


Fig. 2.17: Superior view of pelvic inlet.

lies 4 cm anterior to the promontory and 7 cm behind the symphysis.

- *Obstetric transverse diameter:* This diameter passes through the midpoint of true conjugate and is therefore slightly shorter than the anatomical transverse diameter.

Oblique Diameters of Pelvic Inlet

There are two oblique diameters, right and left (12 cm). The right oblique diameter passes from right sacroiliac joint to the left iliopubic eminence, whereas the left diameter passes from left sacroiliac joint to the right iliopubic eminence.

Pelvic Cavity

The pelvic cavity is bounded above by the pelvic brim and below by the plane of least pelvic dimension, anteriorly by the symphysis pubis and posteriorly by sacrum. The plane of least pelvic dimension extends from the lower border of pubic symphysis to the tip of ischial spines laterally and to the tip of fifth sacral vertebra posteriorly.

Plane of Cavity (Plane of Greatest Pelvic Dimensions)

The plane of cavity passes between the middle of the posterior surface of the symphysis pubis and the junction between second and third sacral vertebrae. Laterally it passes through the center of acetabulum and the upper part of greater sciatic notch. Since this is the roomiest plane of pelvis, it is also known as the plane of greatest pelvic dimensions. This is almost round in shape. Internal rotation of the fetal head occurs when the biparietal diameter of the fetal skull occupies this wide pelvic plane while the occiput is on the pelvic floor, i.e., at the plane of least pelvic dimensions.

Diameters of Pelvic Cavity

- *AP diameter (12 cm):* It measures from the midpoint on the posterior surface of pubis symphysis to the junction of second and third sacral vertebrae.
- *Transverse diameter (12 cm):* It is the distance between two farthest points laterally. Since there are no bony landmarks, the diameter cannot be exactly measured and can be roughly estimated to be about 12 cm.

Pelvic Outlet

- *Anatomical outlet:* It is a lozenge-shaped cavity bounded by anterior border of symphysis pubis, pubic arch, ischial tuberosities, sacrotuberous ligaments, sacrospinous ligaments, and tip of coccyx.
- *Plane of anatomical outlet:* It passes along with the boundaries of the anatomical outlet and consists of two triangular planes with a common base, which is the bituberous diameter.
- *Anterior sagittal plane:* Its apex is at the lower border of the symphysis pubis.
- *Anterior sagittal diameter (6–7 cm):* It extends from the lower border of the pubic symphysis to the center of bituberous diameter.
- *Posterior sagittal plane:* Its apex lies at the tip of the coccyx.
- *Posterior sagittal diameter (7.5–10 cm):* It extends from the tip of the sacrum to the center of bituberous diameter.
- *Obstetric outlet:* It is bounded above by the plane of least pelvic dimensions, below by the anatomical outlet, anteriorly by the lower border of symphysis pubis, posteriorly by the coccyx, and laterally by the ischial spines.

Diameters of Pelvic Outlet

- AP diameters of pelvic outlet include the following:
  - *Anatomical AP diameter (11 cm):* It extends from tip of the coccyx to the lower border of symphysis pubis.
  - *Obstetric AP diameter (13 cm):* It extends from the lower border of symphysis pubis to the tip of coccyx (as it moves backward during the second stage of labor).
- Transverse diameter of the pelvic outlet includes the following:
  - *Bituberous diameter (11 cm):* It extends between the inner aspects of ischial tuberosities. The bituberous diameter is measured with the knuckles of the closed fist of the hand placed between the two ischial tuberosities **(Fig. 2.18)**. If the pelvis is adequate, the intertuberous diameter allows four knuckles.
  - *Bispinous/interspinous diameter (10.5 cm):* It extends between the tips of ischial spines.
  - Measurement of various pelvic diameters is summarized in **Table 2.10**.

Pelvic Axis

- *Anatomical axis:* This is an imaginary line joining the central points of the planes of inlet, cavity, and outlet. This axis is C-shaped with concavity directed forward. It has no obstetric significance.
- *Obstetric axis:* It is an imaginary line, which represents the direction in which the head passes during the labor. It is J-shaped and passes downward and backward along the axis of the inlet till the ischial spines are reached, after

Bedside
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This book would serve as a valuable resource for the postgraduate students and residents, comprising all the common and important case studies in the field of both Obstetrics and Gynecology, which they might encounter during the practical examinations, university examinations and clinical practice. This is a two-part book, the first section of this book is titled *Obstetrics*, while the second section is titled *Gynecology*. In the third edition, several new chapters, updated guidelines, new medicines, treatment regimens and management protocols have been incorporated in various chapters.

The book emphasizes the importance of clinical examination over the use of unnecessary investigations. Long cases that are important from the perspective of postgraduates have been explained in the form of case study. Each case study has been deliberately chosen to simulate the clinical practice scenarios in order to elicit the proper patient approach and clinical judgement. Questions from past 10-year papers have been incorporated in each chapter at topic level for the postgraduate students to prepare and pass university examinations with utmost ease. Numerous detailed yet succinct flowcharts, color images and clinical pictures have been used to demonstrate the case diagnosis and management.

Keeping the focus on traditional case-based approach, the book highlights the need for medical students and professionals to become proficient in the abilities of taking history and performing clinical examinations. Simultaneously, keeping up with modern medical practice, all recent advances in the field of obstetrics and gynecology have been added. In line with this, special focus is given on evidence-based clinical trials which are added at the end of each chapter to keep the postgraduates and practitioners up-to-date with the latest evidence-based medicine in the field. These can be accessed by scanning a QR code given in the book. Each reference is linked to the source article, thereby allowing interested students to access the full article from there in just one click.

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She did her graduation from Maulana Azad Medical College and postgraduation (MD Obstetrics & Gynecology) from New Delhi. She was outstanding in the academics throughout the medical course and subsequently, only followed the upside of growth curve through hard work and determination. Besides being a prolific Author to more than a dozen medical books, she is an Excellent Teacher, Revolutionary Thinker, Exceptional Doctor, and an ardent Promotor of woman's health—*Let's Talk Woman's Health* is her initiative dedicated towards **E**mpowering and **E**nlightening women through **E**ducation, and **E**-consultation. To know more about her, kindly visit *www.drrichasaxena.com*.

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