



Unit 4

Labor and Birth



chapter 13

Labor and Birth Process

Key TERMS

attitude
dilation
doula
duration
effacement
engagement
frequency
intensity
lie
lightening
molding
position
presentation
station

Learning OBJECTIVES

After studying the chapter content, the student should be able to accomplish the following:

1. Outline premonitory signs of labor.
2. Compare and contrast true versus false labor.
3. Discuss the critical factors affecting labor and birth.
4. List the cardinal movements of labor.
5. Identify the maternal and fetal responses to labor and birth.
6. Describe the stages of labor and the critical events occurring during each stage.
7. Recognize the normal physiologic/psychological changes occurring during all four stages of labor.
8. Describe the concept of pain as it relates to the woman in labor.



WOW

Intense physical and emotional support promotes a positive and memorable birthing experience.

The process of labor and birth involves more than the delivery of a newborn. Numerous physiologic and psychological events occur that ultimately result in the birth of a newborn and the creation or expansion of the family.

This chapter describes labor and birth as a process. It addresses the premonitory signs of labor, including true and false labor, critical factors affecting labor and birth, maternal and fetal response to the laboring process, and the four stages of labor. The chapter also identifies specific criteria related to each stage of labor.

Initiation of Labor

Labor is a complex, multifaceted interaction between the mother and fetus. Thus, it is difficult to determine exactly why labor begins and what initiates it. Although several theories have been proposed to explain the onset and maintenance of labor, it is widely believed that labor is influenced by a combination of factors, including uterine stretch, progesterone withdrawal, increased oxytocin sensitivity, and increased release of prostaglandins.

Several theories have been advanced to explain what initiates labor. However, none of these have been proved scientifically. One theory suggests that labor is initiated by a change in the estrogen-to-progesterone ratio. During the last trimester of pregnancy, estrogen levels increase and progesterone levels decrease. This change leads to an increase in the number of myometrium gap junctions. Gap junctions are proteins that connect cell membranes and facilitate coordination of uterine contractions and myometrial stretching (Gilbert & Harmon, 2003).

Prostaglandin levels increase late during pregnancy secondary to elevated estrogen levels. Prostaglandins stimulate smooth muscle contraction of the uterus. An increase in prostaglandins leads to myometrial contractions and to a reduction in cervical resistance. Subsequently, the cervix softens, thins out, and dilates during labor.

Although physiologic evidence for the role of oxytocin in the initiation of labor is inconclusive, the number of oxytocin receptors in the uterus increases at the end of pregnancy. This creates an increased sensitivity to oxytocin. Estrogen, the levels of which are also rising, increases myometrial sensitivity to oxytocin. With the increasing levels of oxytocin in the maternal blood in conjunction with fetal production, initiation of uterine contractions can occur. Oxytocin also aids in stimulating prostaglandin synthesis through receptors in the decidua. Prostaglandins lead to additional contractions, cervical softening, gap junction induction, and myometrial sensitization, thereby leading to a progressive cervical dilation (Blackburn & Loper, 2003).

Premonitory Signs of Labor

Before the onset of labor, a pregnant woman's body undergoes several changes in preparation for the birth of the newborn. The changes that occur often lead to characteristic signs and symptoms that suggest that labor is near. These premonitory signs and symptoms can vary, and not every woman experiences every one of these signs and symptoms.

Cervical Changes

Before labor begins, cervical softening and possible cervical **dilation** with descent of the presenting part into the pelvis occurs. This stage can begin 1 month to 1 hour before actual labor begins.

As the time for labor approaches, the cervix changes from an elongated structure to a shortened, thinned segment. Cervical collagen fibers undergo enzymatic rearrangement into smaller, more flexible fibers that facilitate water absorption, leading to a softer, more stretchable cervix. These changes occur secondary to the effects of prostaglandins and pressure from Braxton Hicks contractions (Burst et al., 2004).

Lightening

Lightening occurs when the fetal presenting part begins to descend into the maternal pelvis. The uterus lowers and moves into a more anterior position. The shape of the abdomen changes as a result of the change in the uterus. With this descent, the woman usually notes that her breathing is much easier. However, she may complain of increased pelvic pressure, cramping, and low back pain. She also may note edema of the lower extremities as a result of the increased stasis of blood pooling, an increase in vaginal discharge, and more frequent urination. In primiparas, lightening can occur 2 weeks or more before labor begins, and among multiparas it may be as late as during labor (Youngkin & Davis, 2004).

Increased Energy Level

Some women report a sudden increase in energy before labor. This is sometimes referred to as *nesting*, because many women will focus this energy toward childbirth preparation by cleaning, cooking, preparing the nursery, and spending extra time with other children in the household. The increased energy level usually occurs 24 to 48 hours before the onset of labor. It is thought to be the result of an increase in epinephrine release caused by a decrease in progesterone (Mattson & Smith, 2004).

Bloody Show

At the onset of labor, the mucous plug that fills the cervical canal during pregnancy is expelled as a result of cervical softening and increased pressure of the presenting part. The exposed cervical capillaries release a small amount of blood that mixes with mucus, resulting in pink-tinged secretions known as *bloody show*.

Braxton Hicks Contractions

Braxton Hicks contractions, which the woman may have been experiencing throughout the pregnancy, may become stronger and increase in **frequency**. These contractions aid in moving the cervix from a posterior position to an anterior position. They also help in ripening and softening the cervix. However, the contractions are irregular and diminish by walking, voiding, eating, increasing fluid intake, or changing position.

Braxton Hicks contractions are typically felt as a tightening or pulling sensation of the top of the uterus. They occur primarily in the abdomen and groin areas and gradually spread downward before relaxing. In contrast, true labor contractions are more commonly felt in the lower back.

Braxton Hicks contractions will usually last about 30 seconds but can persist for as long as 2 minutes. As birth draws near and the uterus becomes more sensitive to oxytocin, the frequency and **intensity** of these contractions increase. However, if the contractions last more than 30 seconds and occur more than four to six times an hour, the woman should contact her healthcare provider so that she can be evaluated for possible preterm labor, especially if she is less than 35 weeks pregnant.

Spontaneous Rupture of Membranes

One in four women will experience spontaneous rupture of the membranes before the onset of labor (Engstrom, 2004). The rupture of membranes can result in either a sudden gush or a steady leakage of amniotic fluid. Although much of the amniotic fluid is lost when the rupture occurs, a continuous supply is produced to ensure protection of the fetus until birth.

After the amniotic sac has ruptured, the barrier to infection is gone and an ascending infection is possible. In addition, there is danger of cord prolapse if **engagement** has not occurred with the sudden release of fluid and pressure with rupture. With these potential complications, women are advised to notify their healthcare provider and go in for an evaluation.

True Versus False Labor

False labor is a condition occurring during the latter weeks of some pregnancies in which irregular uterine contractions are felt, but the cervix is not affected. In contrast, true labor is characterized by contractions occurring at regular intervals that increase in frequency, **duration**, and intensity. True labor contractions bring about progressive cervical dilation and **effacement**. Table 13-1 summarizes the differences between true and false labor. False labor, prodromal labor, and Braxton Hicks contractions are all names for contractions that do not contribute in a measurable way toward the delivery goal.

Many women fear being sent home from the hospital with “false labor.” All women feel anxious when they feel contractions, but should be informed that labor could be a long process, especially if it is their first pregnancy. With

Table 13-1 Differences between True and False Labor

Parameters	True Labor	False Labor
Contraction timing	Regular, becoming closer together, usually 4–6 minutes apart, lasting 30–60 seconds	Irregular, not occurring close together
Contraction strength	Become stronger with time, vaginal pressure is usually felt	Frequently weak, not getting stronger with time or alternating (a strong one followed by weaker ones)
Contraction discomfort	Starts in the back and radiates around toward the front of the abdomen	Usually felt in the front of the abdomen
Position changes	Contractions continue no matter what positional change is made	Contractions may stop or slow down with walking or making a position change
Stay or go?	Staying home until contractions are 5 minutes apart, lasting 45–60 seconds, and strong enough so that a conversation during one is not possible—go to hospital	Drinking fluids and walking to assess if there is any change; if diminish—stay home

Sources: Leonard (2002), Mattson & Smith (2004), Condon (2004); Breslin & Lucas (2003).

first pregnancies, the cervix can take up to 20 hours to dilate completely (Lowdermilk & Perry, 2004).

Factors Affecting the Labor Process

In many references, the critical factors that affect the process of labor and birth are outlined as the five Ps:

1. Passageway (birth canal)
2. Passenger (fetus and placenta)
3. Powers (contractions)
4. Position (maternal)
5. Psychological response

These critical factors are commonly accepted and discussed by health care professionals. However, there may be five additional factors that affect the labor process as well:

1. Philosophy (low tech, high touch)
2. Partners (support caregivers)
3. Patience (natural timing)
4. Patient preparation (childbirth knowledge base)
5. Pain control (comfort measures)

These five additional “Ps” are helpful in planning care for the laboring family. These patient-focused factors are an attempt to foster labor that can be managed through the use of high touch, patience, support, knowledge, and pain management.

Passageway

The birth passageway is the route through which the fetus must travel to be delivered vaginally. The passageway consists of the maternal pelvis and soft tissues. Of the two, however, the maternal bony pelvis is more important because it is relatively unyielding (except for the coccyx).

Typically the pelvis is assessed during the first trimester, often at the first visit to the healthcare provider, to identify any abnormalities or barriers that might hinder a successful vaginal delivery. As the pregnancy progresses, the hormones relaxin and estrogen cause the connective tissues to become more relaxed and elastic, and cause the joints to become more flexible to prepare the mother’s pelvis for birth. Additionally, the soft tissues usually yield to the forces of labor.

Bony Pelvis

The maternal bony pelvis can be divided into the *true* and *false* portions. The false (or greater) pelvis is composed of the upper flared parts of the two iliac bones with their concavities and the wings of the base of the sacrum. The false pelvis is divided from the true pelvis by an imaginary line drawn from the sacral prominence at the back to the superior aspect of the symphysis pubis at the front of the pelvis. This imaginary line is called the *linea terminalis*. The false pelvis lies above this imaginary line; the true pelvis lies below it (Fig. 13-1).

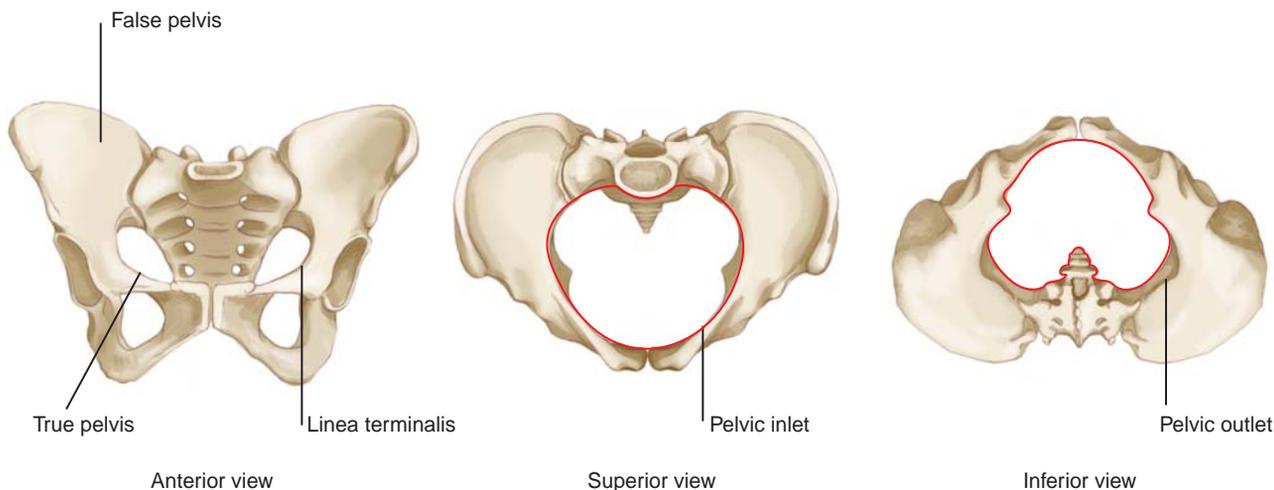
The true pelvis is the bony passageway through which the fetus must travel. It is made up of three planes: the inlet, the mid pelvis (cavity), and the outlet.

Pelvic Inlet

The pelvic inlet allows entrance to the true pelvis. It is bounded by the sacral prominence in the back, the ileum on the sides, and the superior aspect of the symphysis pubis in the front (Pillitteri, 2003). The pelvic inlet is heart shaped and is wider in the transverse aspect (sideways) than it is from front to back.

Mid Pelvis

The mid pelvis (cavity) occupies the space between the inlet and outlet. It is through this snug, curved-shaped space that the fetus must navigate to reach the outside.



● Figure 13-1 The bony pelvis.

As the fetus passes through this small area, its chest is compressed, causing lung fluid and mucus to be expelled. This expulsion removes the space-occupying fluid so that air can enter the lungs with the newborn's first breath.

Pelvic Outlet

The pelvic outlet is bound by the ischial tuberosities, the lower rim of the symphysis pubis, and the tip of the coccyx. In comparison with the pelvic inlet, the outlet is wider from front to back. For the fetus to pass through the pelvis, the outlet must be of adequate size.

To ensure the adequacy of the pelvic outlet for vaginal delivery, the following pelvic measurements are assessed:

- Diagonal conjugate of the inlet (distance between the anterior surface of the sacral prominence and the anterior surface of the inferior margin of the symphysis pubis)
- Transverse or ischial tuberosity diameter of the outlet (distance at the medial and lowermost aspect of the ischial tuberosities, at the level of the anus; a known hand span or clenched-fist measurement is generally used to obtain this measurement)
- True or obstetric conjugate (distance estimated from the measurement of the diagonal conjugate; 1.5 cm is subtracted from the diagonal conjugate measurement. For more information about pelvic measurements, see Chapter 12.)

If the diagonal conjugate measures at least 11.5 cm, and the true or obstetric conjugate measures 10 cm or more (1.5 cm less than the diagonal conjugate, or about 10 cm), then the pelvis is adequate for a vaginal birth of what would be considered a normal-size newborn.

Pelvic Shape

In addition to size, the shape of a woman's pelvis is a determining factor for a vaginal delivery. The pelvis is divided into four main shapes: anthropoid, android, gynecoid, and the platypelloid (refer back to Fig. 12-6).

The anthropoid pelvis is common in men and occurs in 20 to 30% of women (Sloane, 2002). The pelvic inlet is oval and the sacrum is long, producing a deep pelvis. This pelvic shape is usually favorable for a vaginal delivery.

The android pelvis is also common in men and occurs in approximately 20% of women. It has a heart-shaped inlet with narrow side walls. This pelvic type is also called a *funnel pelvis*, and it produces difficulty in vaginal delivery. Descent of the fetal head into the pelvis is slow, and failure of the fetus to rotate is common. Labor prognosis is poor.

The gynecoid pelvis is less common in men and is considered the true female pelvis, although only about half of all women have this type (Sloane, 2002). Vaginal birth is most favorable with this type of pelvis because the inlet is round and the outlet is roomy. This shape offers the optimal diameters in all three planes of the pelvis.

The platypelloid or flat pelvis is the least common type of pelvic structure among men and women, with an

approximate incidence of 5% (Mattson & Smith, 2004). The pelvic cavity is shallow, but widens at the pelvic outlet, making it difficult for the fetus to descend through the mid pelvis. It is not favorable for a vaginal birth unless the fetal head can pass through the inlet. Women with this type of pelvis usually require cesarean delivery.

Many women have a combination of these four basic pelvis types with no two pelvises being exactly the same. An important principle is that most pelvises are not purely defined, but occur in nature as mixed types. Regardless of the shape, the newborn will be born if size and positioning remain compatible. The narrowest part of the fetus attempts to align itself with the narrowest pelvic dimension (e.g., biparietal to interspinous diameters, which means the fetus generally tends to rotate to the most ample portion of the pelvis).

Soft Tissues

The soft tissues of the passageway consist of the cervix, the pelvic floor muscles, and the vagina. The cervix effaces (thins) and dilates (opens) to allow the presenting fetal part to descend into the vagina, similar to pulling a turtle-neck sweater over your head. The pelvic floor muscles help the fetus to rotate anteriorly as it passes through the birth canal. The soft tissues of the vagina expand to accommodate the fetus during birth.

Passenger

The fetus (with placenta) is the passenger. The fetal skull (size and presence of **molding**), fetal **attitude** (degree of body flexion), fetal **lie** (relationship of body parts), fetal **presentation** (first body part), fetal **position** (relationship to maternal pelvis), fetal **station**, and fetal engagement are all important factors that have an effect on the ultimate outcome in the birthing process.

Fetal Skull

The fetal head is the largest and least compressible fetal structure, making it an important factor in relation to labor and birth. Considerable variation in the size and diameter of the fetal skull is often seen. Some diameters shorten whereas others lengthen as the head is molded during the labor and birthing process.

Compared with an adult, the fetal head is large in proportion to the rest of the body, usually about one quarter of the body surface area (Hait, 2002). The bones that make up the face and cranial base are fused and essentially fixed. However, the bones that make up the rest of the cranium (two frontal bones, two parietal bones, and the occipital bone) are not fused; rather, they are soft and pliable with gaps between the plates of bone. These gaps, which are membranous spaces between the cranial bones, are called *sutures*, and the intersections of these sutures are called *fontanelles*. Sutures are important because they allow the cranial bones to overlap in order for the head to adjust

in shape (elongate) when pressure is exerted on it by uterine contractions or the maternal bony pelvis. (These sutures close as the bones grow and the brain reaches its full growth.)

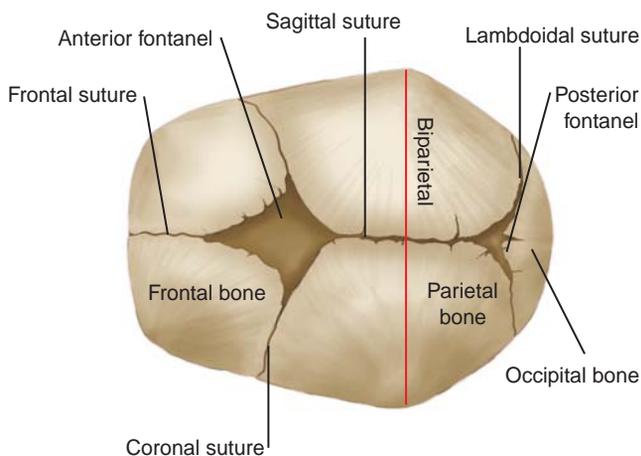
The changed shape of the fetal skull as a result of overlapping of the cranial bones is known as *molding*. This malleability of the fetal skull may decrease fetal skull dimensions by 0.5 to 1 cm (Mattson & Smith, 2004).

Along with molding, fluid can also collect in the scalp (caput succedaneum) or blood can collect beneath the scalp (cephalohematoma), further distorting the shape and appearance of the fetal head. Parents may become concerned about this distortion. However, reassurance that the oblong shape is only temporary is usually all that is needed to reduce their anxiety.

Sutures also play a role in helping to identify the position of the fetal head during a vaginal exam. See Figure 13-2 for a view of a fetal skull.

The *coronal sutures* are located between the frontal and parietal bones, and extend transversely on both sides of the anterior fontanelles. The *frontal suture* is located between the two frontal bones. The *lambdoidal sutures* are located between the occipital bone and the two parietals, extending transversely on either side of the posterior fontanelles. The *sagittal suture* is located between the parietal bones and divides the skull into the right and left halves. During a pelvic examination, palpation of these sutures by the examiner reveals the position of the fetal head and the degree of rotation that has occurred.

The anterior and posterior fontanelles, also useful in helping to identify the position of the fetal head, allow for molding. In addition, the fontanelles are important when evaluating the newborn. The anterior fontanelle is the famous “soft spot” of the newborn’s head. It is diamond shaped and measures about 2 to 3 cm. It remains open for 12 to 18 months after birth to allow for growth of the brain (Ladewig et al., 2006). The posterior fontanelle corresponds to the anterior one but is located at the back of the



● Figure 13-2 Fetal skull.

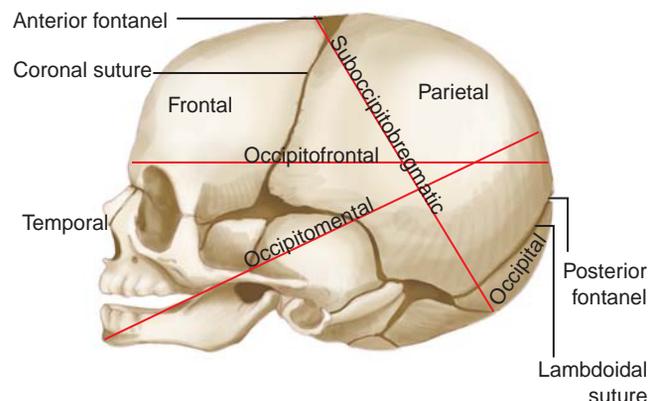
fetal head and is triangular in shape. This one closes within 8 to 12 weeks after birth and measures, on average, 0.5 to 1 cm at its widest diameter (Mattson & Smith, 2004).

The diameter of the fetal skull is an important consideration during the labor and birth process. Fetal skull diameters are measured between the various landmarks of the skull. Diameters include occipitofrontal, occipitomenthal, suboccipitobregmatic, and biparietal (Fig. 13-3). The two most important diameters that can affect the birth process are the suboccipitobregmatic (approximately 9.5 cm at term) and the biparietal (approximately 9.25 cm at term) diameters. The suboccipitobregmatic diameter, measured from the base of the occiput to the center of the anterior fontanelle, identifies the smallest anteroposterior diameter of the fetal skull. The biparietal diameter measures the largest transverse diameter of the fetal skull: the distance between the two parietal bones. In a cephalic (head-first) presentation, which occurs in 95% of all term births, if the fetus presents in a flexed position in which the chin is resting on the chest, the optimal or smallest fetal skull dimensions for a vaginal birth are demonstrated. If the fetal head is not fully flexed at birth, the anteroposterior diameter increases. This increase in dimension might prevent the fetal skull from entering the maternal pelvis.

Fetal Attitude

Fetal attitude is another important consideration related to the passenger. Fetal attitude refers to the posturing (flexion or extension) of the joints and the relationship of fetal parts to one another. The most common fetal attitude when labor begins is with all joints flexed—the fetal back is rounded, the chin is on the chest, the thighs are flexed on the abdomen, and the legs are flexed at the knees (Fig. 13-4). This normal fetal position is most favorable for vaginal birth, presenting the smallest fetal skull diameters to the pelvis.

When the fetus presents to the pelvis with abnormal attitudes (no flexion or extension), the diameter can increase the diameter of the presenting part as it



● Figure 13-3 Fetal skull diameters.



● Figure 13-4 Fetal attitude: Full flexion. Note that the smallest diameter presents to the pelvis.

passes through the pelvis, increasing the difficulty of birth. Extension tends to present larger fetal skull diameters, which may make birth difficult.

Fetal Lie

Fetal lie refers to the relationship of the long axis (spine) of the fetus to the long axis (spine) of the mother. There are two primary lies: longitudinal (which is the most common) and transverse (Fig. 13-5).

A longitudinal lie occurs when the long axis of the fetus is parallel to that of the mother (fetal spine to maternal spine side-by-side). A transverse lie occurs when the long axis of the fetus is perpendicular to the long axis of



A. Longitudinal lie



B. Transverse lie

● Figure 13-5 Fetal lie.
(A) Longitudinal lie.
(B) Transverse lie.

the mother (fetus spine lies across the maternal abdomen and crosses her spine). A fetus in a transverse lie position cannot be delivered vaginally (Wong et al., 2002).

Fetal Presentation

Fetal presentation refers to the body part of the fetus that enters the pelvic inlet first (the “presenting part”). This is the fetal part that lies over the inlet of the pelvis or the cervical os. Knowing which fetal part is coming first with birth is critical for planning and initiating appropriate interventions.

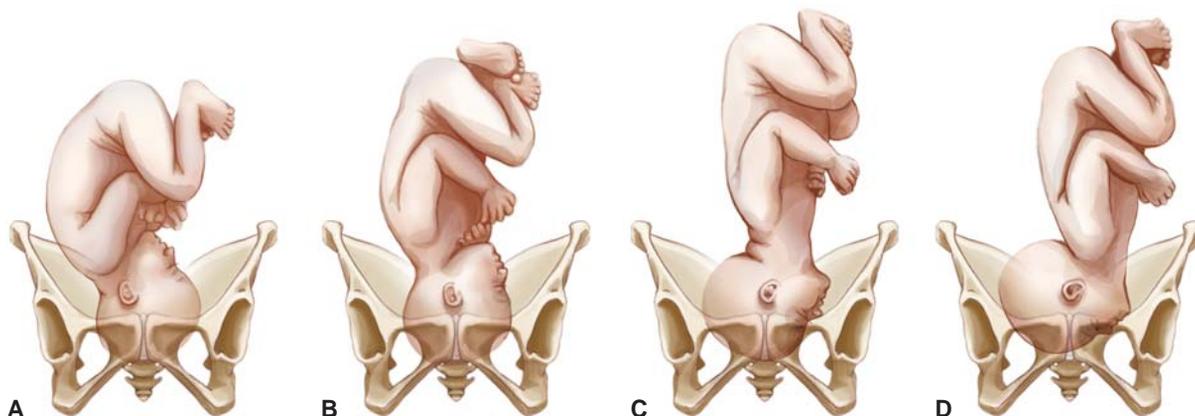
The three main fetal presentations are cephalic (head first), breech (pelvis first), and shoulder (scapula first). The majority of term newborns (95%) enter into this world in a cephalic presentation; breech presentation accounts for 3% of term births, whereas shoulder presentations account for approximately 2% of term births (Mattson & Smith, 2004).

In a *cephalic presentation*, the presenting part is usually the occiput portion of the fetal head. This would be the portion of the head that is covered by wearing a beanie cap (Fig. 13-6). This presentation is also referred to as a *vertex presentation*. Variations in a vertex presentation include the military, brow, and face presentations.

The *breech presentation* occurs when the fetal buttocks or feet enter the maternal pelvis first and the fetal skull enters last. This abnormal presentation poses several challenges at birth. Primarily, the largest part of the fetus (skull) is born last and may become “hung up” in the pelvis. In addition, the umbilical cord can become compressed between the fetal skull and the maternal pelvis after the fetal chest is born because the head is the last to exit. Moreover, unlike the hard fetal skull, the buttocks are soft and are not as effective as a cervical dilator when compared with a cephalic presentation. Also, there is the possibility of trauma to the after-coming head as a result of the lack of opportunity for molding.

The types of breech presentations are determined by the positioning of the fetal legs (Fig. 13-7). In a frank breech (50–70%), the buttocks present first with both legs extended up toward the face, similar to a pike position. In a full or complete breech (5–10%), the fetus sits crossed-legged above the cervix similar to a cannonball position. In a footling or incomplete breech (10–30%), one or both legs are presenting. Breech presentations are associated with prematurity, placenta previa, multiparity, uterine abnormalities (fibroids), and some congenital anomalies such as hydrocephaly (Fischer, 2004).

A shoulder presentation occurs when the fetal shoulders present first, with the head tucked inside. Odds of a shoulder presentation are one in 1,000 (Cunningham et al., 2005). The fetus is in a transverse lie with the shoulder as the presenting part (denominator is scapula). Conditions associated with shoulder presentation including placenta previa, multiple gestation, or fetal anomalies. A cesarean birth is typically necessary (McKinney et al., 2005).



● **Figure 13-6** Fetal presentation: cephalic presentations (A) Vertex. (B) Military. (C) Brow. (D) Face.

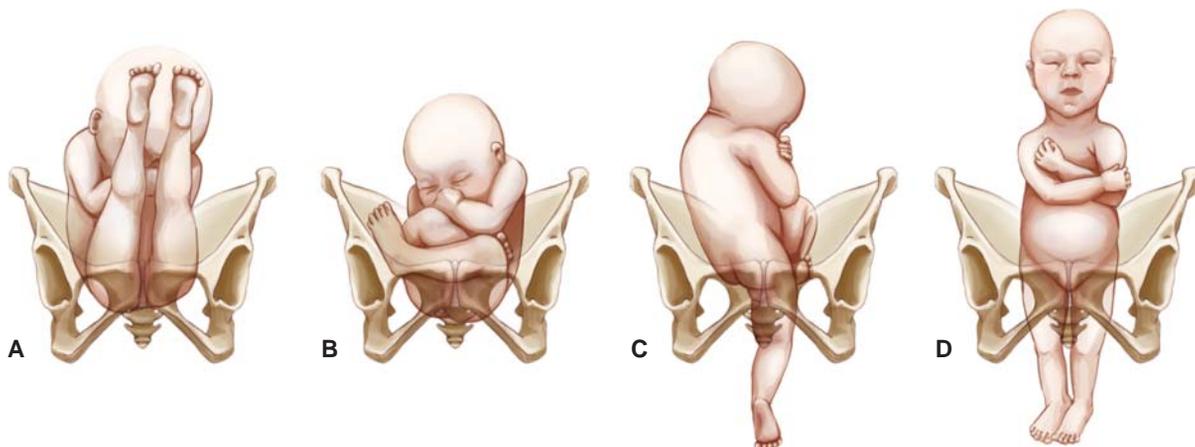
Fetal Position

Fetal position describes the relationship of a given point on the presenting part of the fetus to a designated point of the maternal pelvis (O'Toole, 2003). The landmark fetal presenting parts include the occipital bone (O), which designates a vertex presentation; the chin (mentum [M]), which designates a face presentation; the buttocks (sacrum [S]), which designate a breech presentation; and the scapula (acromion process [A]), which designates a shoulder presentation.

In addition, the maternal pelvis is divided into four quadrants: right anterior, left anterior, right posterior, and left posterior. These quadrants designate whether the presenting part is directed toward the front, back, left, or right of the pelvis. Fetal position is determined first by identifying the presenting part and then the maternal quadrant the presenting part is facing. Position is indicated by a three-letter abbreviation as follows:

- The first letter defines whether the presenting part is tilted toward the left (L) or the right (R) side of the maternal pelvis.
- The second letter represents the particular presenting part of the fetus: O for occiput, S for sacrum (buttocks), M for mentum (chin), A for acromion process, and D for dorsal (refers to the fetal back) when denoting the fetal position in shoulder presentations (Olds et al., 2004).
- The third letter defines the location of the presenting part in relation to the anterior (A) portion of the maternal pelvis or the posterior (P) portion of the maternal pelvis. If the presenting part is directed to the side of the maternal pelvis, the fetal presentation is designated as transverse (T).

For example, if the occiput is facing the left anterior quadrant of the pelvis, then the position is termed left occipitoanterior and is recorded as LOA. LOA is the most common fetal position for birthing today, followed by



● **Figure 13-7** Breech presentations. (A) Frank breech. (B) Complete breech. (C) Single footling breech. (D) Double footling breech.

right occipitoanterior (ROA). See Box 13-1 for a list of the various fetal positions.

Fetal Station

Station refers to the relationship of the presenting part to the level of the maternal pelvic ischial spines. Fetal station is measured in centimeters and is referred to as a minus or plus, depending on its location above or below the ischial spines. Typically, the ischial spines are the most narrow part of the pelvis and are the natural measuring point for the delivery progress.

Zero (0) station is designated when the presenting part is at the level of the maternal ischial spines. When the presenting part is above the ischial spines, the distance is recorded as minus stations. When the presenting part is below the ischial spines, the distance is recorded as plus stations. For instance, if the presenting part is above the ischial spines by 1 cm, it is documented as being a -1 station; if the presenting part is below the ischial spines by 1 cm, it is documented as being a $+1$ station. An easy way to understand this concept is to think in terms of meeting the goal, which is the birth. If the

fetus is descending downward (past the ischial spines) and moving toward meeting the goal of birth, then the station is positive and the centimeter numbers grow bigger from $+1$ to $+5$. If the fetus is not descending past the ischial spines, then the station is negative and the centimeter numbers grow bigger from -1 to -5 . The farther away the presenting part from the outside, the larger the negative number (-5 cm). The closer the presenting part to the outside, the larger the positive number ($+5$ cm). See Figure 13-8 for stations of presenting part.

Fetal Engagement

Along with station, which measures the degree of fetal presenting part descent, engagement occurs also. Engagement is determined by pelvic examination and it signifies the entrance of the largest diameter of the fetal presenting part (usually the fetal head) into the smallest diameter of the maternal pelvis (O'Toole, 2003). The fetus is said to be “engaged” in the pelvis when the presenting part reaches 0 station. Engagement is determined by vaginal examination.

The largest diameter of the fetal head is the biparietal diameter. It extends from one parietal prominence to the other. It is an important factor in the navigation through the maternal pelvis. Engagement typically occurs in primigravidas 2 weeks before term, whereas multiparas may experience engagement several weeks before the onset of labor or not until labor begins. The term *floating* is used when engagement has not occurred, because the presenting part is freely movable above the pelvic inlet.

Cardinal Movements of Labor

The fetus goes through many positional changes as it navigates through the passageway. These positional changes are known as *cardinal movements of labor*. They are deliberate, specific, and very precise movements that allow the smallest diameter of the fetal head to pass through a corresponding diameter of the mother’s pelvic structure. Although cardinal movements are conceptualized

BOX 13-1

SELECTED FETAL POSITIONS

Vertex Presentation (Occiput)

- Left occipitoanterior (LOA)
- Left occipitotransverse (LOT)
- Left occipitoposterior (LOP)
- Right occipitoanterior (ROA)
- Right occipitotransverse (ROT)
- Right occipitoposterior (ROP)

Face Presentation (Mentum)

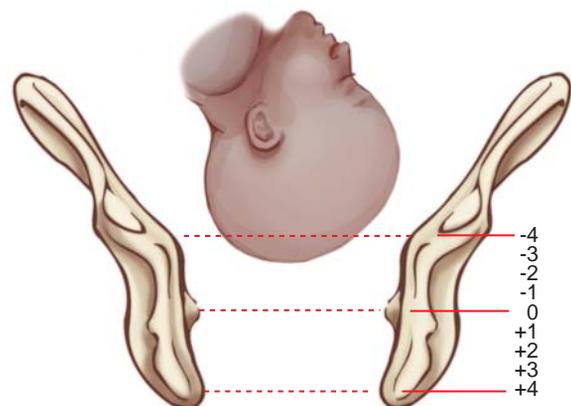
- Left mentoanterior (LMA)
- Left mentotransverse (LMT)
- Left mentoposterior (LMP)
- Right mentoanterior (RMA)
- Right mentotransverse (RMT)
- Right mentoposterior (RMP)

Breech Presentation (Sacrum)

- Complete breech—all-body flexion
- Left sacroanterior (LSA)
- Left sacrotransverse (LST)
- Left sacroposterior (LSP)
- Right sacroanterior (RSA)
- Right sacroposterior (RSP)

Shoulder Presentation (Acromion)

- Left acromion dorsal anterior (LADA)
 - Left acromion dorsal posterior (LADP)
 - Right acromion dorsal anterior (RADDA)
 - Right acromion dorsal posterior (RADDP)
- Olds et al., 2003)



● Figure 13-8 Fetal stations.

as separate and sequential, the movements are typically concurrent (Figs. 13-9 and 13-10).

Engagement

Engagement occurs when the greatest transverse diameter of the head in vertex (biparietal diameter) passes through the pelvic inlet (usually 0 station). The head usually enters the pelvis with the sagittal suture aligned in the transverse diameter.

Descent

Descent is the downward movement of the fetal head until it is within the pelvic inlet. Descent occurs intermittently

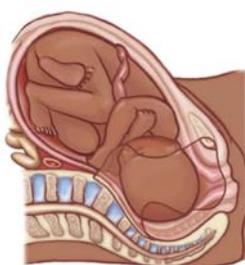
with contractions and is brought about by one or more forces: pressure of the amniotic fluid, direct pressure of the fundus on the fetus' buttocks or head (depending on which part is located in the top of the uterus), contractions of the abdominal muscles (second stage), and extension and straightening of the fetal body. It occurs throughout labor, ending with birth. During this time, the mother experiences discomfort, but she is unable to isolate this particular fetal movement from her overall discomfort.

Flexion

Flexion occurs as the vertex meets resistance from the cervix, walls of the pelvis, or the pelvic floor. As a result,



Engagement, Descent, Flexion



Internal Rotation



External Rotation (restitution)



Extension Beginning (rotation complete)



External Rotation (shoulder rotation)



Extension Complete



Expulsion

● Figure 13-9 Cardinal movements of labor.



● **Figure 13-10** Delivery sequence from crowning through birth of the newborn. (A) Early crowning of the fetal head. Notice the bulging of the perineum. (B) Late crowning. Notice that the fetal head is appearing face down. This is the normal OA position. (C) As the head extends, you can see that the occiput is to the mother's right side—ROA position. (D) The cardinal movement of extension. (E) The shoulders are born. Notice how the head has turned to line up with the shoulders—the cardinal movement of external rotation. (F) The body easily follows the shoulders. (G) The newborn is held for the first time! (© B. Proud.)

the chin is brought into contact with the fetal thorax and the presenting diameter is changed from occipitofrontal to suboccipitobregmatic (9.5 cm), which achieves the smallest fetal skull diameter presenting to the maternal pelvic dimensions.

Internal Rotation

After engagement, as the head descends, the lowermost portion of the head (usually the occiput) meets resistance from one side of the pelvic floor. As a result, the head rotates about 45° anteriorly to the midline under the symphysis. This movement is known as *internal rotation*. Internal rotation brings the anteroposterior diameter of the head in line with the anteroposterior diameter of the pelvic outlet. It aligns the long axis of the fetal head with the long axis of the maternal pelvis. The widest portion of the maternal pelvis is the anteroposterior diameter, and thus the fetus must rotate to accommodate the pelvis.

Extension

With further descent and full flexion of the head, the nucha (the base of the occiput) becomes impinged under the symphysis. Resistance from the pelvic floor causes the fetal head to extend so that it can pass under the pubic arch. Extension occurs after internal rotation is complete. The head emerges through extension under the symphysis pubis along with the shoulders. The bregma, brow, nose, mouth, and chin are born successively.

External Rotation (Restitution)

After the head is born and is free of resistance, it untwists, causing the occiput to move about 45° back to its original left or right position (restitution). The sagittal suture has now resumed its normal right-angle relationship to the transverse (bisacromial) diameter of the shoulders (i.e., the head realigns with the position of the back in the birth canal). External rotation of the fetal head allows the shoulders to rotate internally to fit the maternal pelvis.

Expulsion

Expulsion of the rest of the body occurs more smoothly after the delivery of the head, and the anterior and posterior shoulders (Littleton & Engebretson, 2005).

Powers

The primary stimulus powering labor is uterine contractions. Contractions cause complete dilation and effacement of the cervix during the first stage of labor. The secondary powers in labor involve the use of intraabdominal pressure (voluntary muscle contractions) exerted by the woman as she pushes and bears down during the second stage of labor.

Uterine Contractions

Uterine contractions are involuntary and therefore cannot be controlled by the woman experiencing them, regardless

of whether the contractions are spontaneous or induced. Uterine contractions are rhythmic and intermittent, with a period of relaxation between contractions. This pause allows the woman and the uterine muscles to rest. In addition, this pause restores blood flow to the uterus and placenta, which is temporarily reduced during each uterine contraction.

Uterine contractions are responsible for thinning and dilating the cervix, and they thrust the presenting part toward the lower uterine segment. With each uterine contraction, the upper segment of the uterus becomes shorter and thicker, whereas the lower passive segment and the cervix become longer, thinner, and more distended. The division between the contractile upper portion (fundus) of the uterus and the lower portion is described as the *physiologic retraction ring*. Longitudinal traction on the cervix by the fundus as it contracts and retracts leads to cervical effacement and dilation. Uterine contractions cause the upper uterine segment to shorten, making the cervix paper thin when it becomes fully effaced.

The cervical canal reduces in length from 2 cm to a paper-thin entity and is described in terms of percentages from 0 to 100%. This thinning out process is termed *effacement*. In primigravidas, effacement typically starts before the onset of labor and usually begins before dilation; whereas, in multiparas, neither effacement nor dilation may start until labor ensues. On clinical examination the

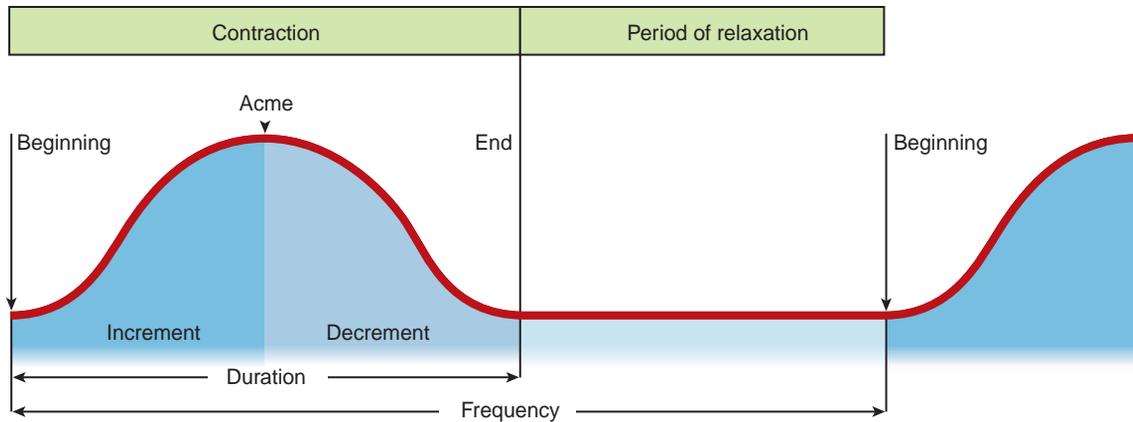
- Cervical canal equal to 2 cm in length would be described as 0% effaced
- Cervical canal equal to 1 cm in length would be described as 50% effaced
- Cervical canal equal 0 cm in length would be described as 100% effaced

The opening or enlargement of the external cervical os is termed *dilation*. Its opening is dependent on the pressure of the presenting part and the contraction and retraction of the uterus. The diameter of the cervical os increases from less than 1 cm to approximately 10 cm to allow for birth. When the cervix is fully dilated, it is no longer palpable on vaginal examination. Descriptions may include the following:

- External cervical os closed: 0 cm dilated
- External cervical os half open: 5 cm dilated
- External cervical os fully open: 10 cm dilated

During early labor, uterine contractions are described as mild, they last about 30 seconds, and they occur about every 5 to 7 minutes. As labor progresses, contractions last longer (60 seconds), occur more frequently (2–3 minutes apart), and are described as being moderate to high in intensity.

Each contraction has three phases: *increment* (buildup of the contraction), *acme* (peak or highest intensity), and *decrement* (descent or relaxation of the uterine muscle fibers; Fig. 13-11).



● Figure 13-11 The three phases of a uterine contraction.

Uterine contractions are monitored and assessed according to three parameters: frequency, duration, and intensity:

1. Frequency refers to how often the contractions occur and is measured from the increment of one contraction to the increment of the next contraction.
2. Duration refers to how long a contraction lasts and is measured from the beginning of the increment to the end of the decrement for the same contraction.
3. Intensity refers to the strength of the contraction determined by manual palpation or measured by an internal intrauterine catheter.

Accurate assessment of contraction intensity can only be measured internally by means of an intrauterine pressure catheter (IUPC), which is positioned in the uterine cavity through the cervix after the membranes have ruptured. The IUPC reports intensity by measuring the pressure of the amniotic fluid inside the uterus in millimeters of mercury (Littleton & Engbretson, 2005).

Intra-Abdominal Pressure

Increased intraabdominal pressure (voluntary muscle contractions) compresses the uterus and adds to the power of the expulsion forces of the uterine contractions (Lowdermilk & Perry, 2004). Coordination of these forces in unison promotes delivery of the fetus, fetal membranes, and placenta from the uterus. Interference with these forces (such as when a woman is highly sedated or extremely anxious) can affect the effectiveness of these powers.

Psychological Response

Childbearing can be one of the most life-altering experiences for a woman. The experience of childbirth goes beyond the physiologic aspects. This experience influences a woman's self-confidence, self-esteem, and her view of life, her relationships, and her children. Her state of mind (psyche) throughout the entire process is critical to evoke

a positive outcome for her and her family. Factors influencing a positive birth experience include

- Clear information on procedures
- Positive support, not being alone
- Sense of mastery, self-confidence
- Trust in staff caring for her
- Positive reaction to the pregnancy
- Personal control over breathing
- Preparation for the childbirth experience

Having a strong sense of self and meaningful support from others can often help women manage labor well. Feelings of safety and security typically promote feelings of control and ability to withstand the challenges of the childbearing experience. Anxiety and fear, however, decrease a woman's ability to cope with the discomfort of labor. Maternal catecholamines are secreted in response to anxiety and fear and can inhibit uterine blood flow and placental perfusion. In contrast, relaxation can augment the natural process of labor (Murray et al., 2006). Preparing mentally for childbirth is important for women to enable them to work with, rather than against, the natural forces of labor.

Position (Maternal)

Maternal positioning during labor historically has been a topic of interest, but has only recently been the subject of well-controlled research that validates that nonmoving, back-lying positions during labor are not healthy (Simkin, 2002). Despite the scientific evidence to the contrary, most women lie flat on their backs. Why is this so? Some of the reasons may include the following:

- Laboring women need to conserve their energy and not tire themselves.
- Nurses cannot keep track of the whereabouts of ambulating women.
- The supine position facilitates vaginal examinations and external belt adjustment.

- A bed is simply where one is usually supposed to be in a hospital setting.
- Blind routine practice is convenient for the delivering health professional.
- Laboring women are “connected to things” that impede movement (Declercq et al., 2002).

Although many labor and birthing facilities claim that all women are allowed to adopt any position of comfort during their laboring experience, the great majority of women spend their time on their backs during labor and birth. If the only furniture provided is a bed, this is what the woman will use. Furnishing rooms with comfortable chairs, bean bags, and other props fosters a woman’s ability to choose a variety of positions and be free to move during labor. Using the research available can bring better outcomes, heightened professionalism, and evidence-based practice to childbearing practices (Livingston & Denny, 2002).

Changing positions and moving around during labor and birth do offer several benefits. Maternal position can influence pelvic size and contours. Changing position and walking affect the pelvic joints, and they facilitate fetal descent and rotation. Squatting enlarges the pelvic outlet by approximately 25%, whereas a kneeling position removes pressure on the maternal vena cava and assists to rotate the fetus in the posterior position (Breslin & Lucas, 2003). The use of any upright or lateral position, compared with supine or lithotomy positions, may

- Reduce the duration of the second stage of labor
- Reduce the number of assisted deliveries (vacuum and forceps)
- Reduce episiotomies and perineal tears
- Contribute to fewer abnormal fetal heart rate patterns
- Increase comfort/reduce requests for pain medication
- Enhance a sense of control reported by mothers
- Alter the shape and size of the pelvis, which assists descent
- Assist gravity to move the fetus downward
- Reduce the length of labor (Gupta & Hofmeyr, 2003)

Philosophy

Birth in the 21st century for many women has become “intervention intensive”—designed to start, continue, and end labor through medical management rather than allowing the normal, natural process of birth to unfold. Not everyone views childbirth the same way. A philosophical continuum exists that extends from viewing labor as a natural process to viewing labor as a disease process. One philosophy assumes that women are capable, reasoning individuals who can actively participate in their birth experience. The other philosophy assumes that women are unable to manage the birth experience adequately, and therefore need constant expert monitoring and management.

Advances in medical care have improved the safety for women with high-risk pregnancies. However, the routine use of IV therapy, electronic fetal monitoring, augmentation, and epidural anesthesia has not necessarily improved birth outcomes for all women (Lothian et al., 2003). Perhaps a middle-of-the-road philosophy for intervening when circumstances dictate, along with weighing the risks and benefits before doing so, may be appropriate.

The current health care system view in the United States appears to be leaning toward the latter philosophy, commonly applying technologic interventions to most mothers who enter the hospital system. During the 1970s, FCMC was developed in response to the consumer reaction to the depersonalization of birth. The hope was to shift the philosophy from “technologization” to personalization to humanize childbirth. The term *family-centered birthing* is more appropriate today to denote the low-tech, high-touch approach requested by many childbearing women. Thus, childbirth is viewed as a natural process.

No matter what the philosophy, it is critical that everyone—from the health care provider to the birthing mother—share the same philosophy toward the birth process.

Partners

Throughout the world, few women are left to labor totally alone or in isolation. Women support other women in childbirth worldwide. Emotional, physical, or spiritual support during labor would appear to be the norm for most cultures (Hodnett et al., 2003). The use of massage, light touch, acupressure, hand-holding, stroking, relaxation, helping women communicate their wishes to caregivers, warm water or lotions, and providing a continuous presence by caring partners can all help bring some degree of comfort to the laboring woman (Hodnett et al., 2003). Although a father’s presence at the birth provides special emotional support to the birthing experience, a partner can be anyone who is present to support the woman throughout the experience.

One important type of support that often may be used is a **doula**. This is a female support person who is an experienced labor companion. The doula provides the woman and her partner with emotional, informational, and physical support throughout the entire labor and birth experience.

The Cochrane Review (2003) of women supporting women reported that the continuous presence of a female trained support person (doula) reduced the incidence of medication for pain relief, use of vacuum or forceps, and cesarean births. Continuous support was also associated with a slight reduction in the length of labor (Hodnett et al., 2003). A similar study in the United States found that nursing care has been shown to decrease the likelihood of negative evaluations of the childbirth experience, feelings of tenseness during labor, and finding labor worse than

expected. Also reported were less perineal trauma, reduced difficulty in mothering, and reduced likelihood of early cessation of breast-feeding (Trainor, 2002).

Women in labor desire support and to be cared for by a caregiver. Caregivers can convey emotional support through their continued presence and words of encouragement. Most women want to be included in the decision-making process during childbirth.

Given the many benefits associated with intrapartum support, laboring women should always have the option to receive partner support, whether from nurses, doulas, significant others, or family. This support partner should provide a continuous presence and hands-on comfort and encouragement.

Patience

The delivery process takes time. If more time were allowed for women to labor naturally without intervention, the cesarean birth rate would most likely be reduced (Larimore & Cline, 2000). The literature suggests that interventional delay can be helpful in affording a woman enough time to progress in labor and reduce the need for surgical intervention (American College of Obstetricians and Gynecologists [ACOG], 2000a). The cesarean birth rate in the United States (26%) is now the highest reported rate since these data first became available from birth certificates in 1989 (Hamilton et al., 2003). Cesarean birth is associated with increased morbidity and mortality for both mother and infant, as well as increased inpatient length of stay and healthcare costs (Rayburn & Zhang, 2002).

It is difficult to predict how a labor will progress and, therefore, equally difficult to determine how long a woman's labor will last before delivery. There is no way to estimate the likely strength and frequency of uterine contractions, the extent to which the cervix will soften and dilate, and how much the fetal head will mold to fit the birth canal. Equally, we cannot know beforehand whether the complex fetal rotation needed for an efficient labor will take place properly. All these factors are unknowns when a woman starts labor. There is a trend in health care, however, to limit the length of labor through medical means such as artificial rupture of membranes and augmentation of labor with oxytocin (Bricker & Luckas, 2003).

As a testament to this, the labor induction rate has increased dramatically in the United States since the 1980s (Rayburn & Zhang, 2002). In fact, since 1989 it has doubled and then increased steadily since that same year (Munson & Sutton, 2005).

Approximately one in five women are induced or have their labors augmented with uterine-stimulating drugs or artificial rupture of membranes to accelerate their progress (Munson & Sutton, 2005). An amniotomy (artificial rupture of the fetal membranes) may be performed to augment or induce labor when the membranes have not ruptured spontaneously. Doing so allows the fetal

head to have more direct contact with the cervix to dilate it. This procedure is performed with the fetal head at -2 station or lower, with the cervix dilated to at least 3 cm. Synthetic oxytocin (Pitocin) is also used to induce or augment labor by stimulating uterine contractions. It is administered piggybacked into the primary IV line with an infusion pump titrated to uterine activity.

There is compelling evidence that elective induction of labor significantly increases the risk of cesarean birth, especially for nulliparous women (Simpson & Atterbury, 2003). The belief is that a large number of cesarean births could be avoided if women were allowed to labor longer and permit time for the natural labor process to complete the job. The longer wait (using the intervention of patience) usually results in less intervention.

The ACOG attributes the dramatic increase in inductions in part to pressure from women, convenience for physicians, and liability concerns. They recommend a "cautious approach" regarding elective induction until clinical trials can validate a more liberal use of labor inductions (ACOG, 2002). There are medical indications for inducing labor, such as spontaneous rupture of membranes and when labor does not start, a pregnancy more than 42 weeks' gestation, maternal hypertension, diabetes or lung disease, and a uterine infection (ACOG, 2000b).

Patient Preparation

Basic prenatal education can help women manage their labor process and feel in control of their birthing experience. The literature indicates that if a woman is prepared before the labor and birth experience, the labor is more likely to remain normal or natural (without the need for medical intervention) (Larimore & Cline, 2000). An increasing body of evidence in the literature also indicates that the well-prepared woman, with good labor support, is less likely to need analgesia or anesthesia and is unlikely to require cesarean birth (Hodnett, 2002).

Prenatal education helps teach women about the child-birth experience and increases a woman's sense of control, who then works as an active participant during the labor experience (Maestas, 2003). The research also suggests that prenatal preparation may affect intrapartum and postpartum psychosocial outcomes. For example, prenatal education covering parenting communication classes had a significant affect on postpartum anxiety and postpartum adjustment (Buckley, 2001).

Having the knowledge to understand labor and birth allows women and couples to express their needs and preferences, enhance their confidence, and improve communication between themselves and the staff.

Pain Control

Labor and birth, although a normal physiologic process, can produce significant pain. Pain during labor is a nearly

universal experience for childbearing women. Controlling the pain of labor without harm to the fetus or labor process is the major focus of pain management during the childbearing experience.

Pain is a subjective experience involving a complex interaction of physiologic, spiritual, psychosocial, cultural, and environmental influences (Leeman et al., 2003a). Cultural values and learned behaviors influence perception and response to pain, as do anxiety and fear, both of which tend to heighten the sense of pain (Poole & White, 2003). The challenge for care providers is to find the right combination of pain management methods to keep the pain manageable while minimizing the negative affect on the fetus, the normal physiology of labor, maternal–infant bonding, breast-feeding, and a woman’s perception of the labor itself (Primeau et al., 2003).

Physiologic Responses to Labor

Labor is the physiologic process by which the uterus expels the fetus and placenta from the body. During pregnancy, progesterone secreted from the placenta suppresses the spontaneous contractions of a typical uterus, keeping the fetus within the uterus. In addition, the cervix remains firm and noncompliant. At term, however, changes occur in the cervix that make it softer, and uterine contractions that become more frequent and regular, signaling the onset of labor.

The labor process comprises a series of rhythmic, involuntary, usually quite uncomfortable uterine muscle contractions that bring about a shortening that causes effacement and dilation of the cervix, and a bursting of the fetal membranes. Then, accompanied by both reflex and voluntary contractions of the abdominal muscles (pushing), the uterine contractions result in the birth of the baby (Sloane, 2002). During the laboring process, the mother and fetus make several physiologic adaptations.

Maternal Responses

As the woman experiences and progresses through childbirth, numerous physiologic responses occur that assist her to adapt to the laboring process. The labor process stresses several of the woman’s body systems and they react through numerous compensatory mechanisms. Maternal physiologic responses include

- Increased heart rate by 10 to 18 bpm (Chin, 2001)
- Increased cardiac output by 10 to 15% during the first stage of labor and increased by 30 to 50% during the second stage of labor (Blackburn & Loper, 2003)
- Increased blood pressure by 10 to 30 mm Hg during uterine contractions in all labor stages
- Increase in white blood cell count to 25,000 to 30,000 cells/mm³ perhaps as a result of tissue trauma
- Increased respiratory rate along with greater oxygen consumption related to the increase in metabolism

- Decreased gastric motility and food absorption, which may increase the risk of nausea and vomiting during the transition stage of labor
- Decreased gastric emptying and gastric pH, which increases the risk of vomiting with aspiration
- Slight elevation in temperature possibly as a result of an increase in muscle activity
- Muscular aches/cramps as a result of a stressed musculoskeletal system involved in the labor process
- Increased BMR and decreased blood glucose levels because of the stress of labor (Pagana & Pagana, 2002)

A woman’s ability to adapt to the stress of labor is influenced by her psychologic state. Many factors affect her coping ability. Some influencing factors may include her previous birth experiences and their outcomes, current pregnancy experience (planned versus unplanned, discomforts experienced, age, high-risk status of pregnancy), cultural considerations (values and beliefs about health status), involvement of support system (presence and support of a valued partner during labor), childbirth preparation (attended childbirth classes and has practiced paced breathing techniques), her expectations of this birthing experience, anxiety level, fear of labor experience, loss of control, and fatigue and weariness (Turley, 2004).

Fetal Responses

Although the focus during labor may be on assessing the mother’s adaptations, several physiologic adaptations occur in the fetus as well. The fetus is experiencing labor along with the mother. If the fetus is healthy, the stress of labor usually has no adverse effects. The nurse needs to be alert to any abnormalities in the fetus’ adaptation to labor. Fetal responses to labor include

- Periodic fetal heart rate accelerations and slight decelerations related to fetal movement, fundal pressure, and uterine contractions
- Decrease in circulation and perfusion to the fetus secondary to uterine contractions (A healthy fetus is able to compensate for this drop.)
- Increase in arterial carbon dioxide pressure (PCO₂)
- Decrease in fetal breathing movements throughout labor
- Decrease in fetal oxygen pressure with a decrease in the partial pressure of oxygen (PO₂) (Lowdermilk & Perry, 2004)

All the respiratory changes help prepare the fetus for extrauterine respiration immediately after birth.

Stages of Labor

Labor is typically divided into four stages that are unequal in length. The four stages of labor are the dilation stage, the expulsive stage, the placental stage, and the restorative stage.

The first stage is the longest of all the stages and it begins with the first true contraction and ends with full dilation (opening) of the cervix. Because this stage lasts so long, it is divided into three distinct phases of the first stage of labor: latent phase, active phase, and the transitional phase. Each phase corresponds to the progressive dilation of the cervix.

Stage two of labor, or the expulsive stage, begins when the cervix is completely dilated and ends with the birth of the newborn. The expulsive stage can last from minutes to hours until the birth takes place.

The third stage, or placental stage, starts after the newborn is born and ends with the separation and delivery of the placenta. Continued uterine contractions cause the placenta to be expelled within 5 to 30 minutes typically.

The fourth stage, or restorative stage, lasts from 1 to 4 hours after birth. This period is when the mother's body begins to stabilize after the hard work of labor and the loss of the products of conception. The fourth stage is often not recognized as a true stage of labor, but it is a critical period for maternal physiologic transition as well as new family attachment (Condon, 2004). Box 13-2 summarizes the major events of each stage.

First Stage

During the first stage of labor, the fundamental change underlying the process is progressive dilation of the cervix. Cervical dilation is gauged subjectively by vaginal examination and is expressed in centimeters. The first stage ends when the cervix is dilated to 10 cm in diameter and is large enough to permit the passage of a fetal head of average size. The fetal membranes, or bag of waters, usually rupture during the first stage, but they may have burst earlier or may even remain intact until birth. For the woman having her first birth, the average duration of the first stage of labor is about 12 hours. However, this time can vary widely. For the multiparous woman, the duration of the first stage is usually about half the time of that for a nullipara.

During the first stage of labor, women usually perceive the visceral pain of diffuse abdominal cramping and uterine contractions. Pain during the first stage of labor is primarily a result of the dilation of the cervix and lower uterine segment, and the distention, stretching, and tearing of these structures during contractions. The first stage is divided into three phases: latent phase, active phase, and transition phase.

Latent Phase

The latent phase gives rise to the familiar signs and symptoms of labor. This phase begins with the start of regular contractions and ends when rapid cervical dilation begins. Cervical effacement occurs during this phase and the cervix dilates from 0 to 3 cm.

Contractions usually occur every 5 to 10 minutes, last 30 to 45 seconds, and are described as mild by palpation.

BOX 13-2

STAGES AND PHASES OF LABOR

- First stage of labor goes from 0 to 10 cm dilation; consists of three phases
 - Latent phase lasts from 0 to 3 cm dilation; mild contractions
 - Cervical dilation 0 to 3 cm
 - Cervical effacement from 0 to 40%
 - Nullipara lasting up to 9 hours; multipara lasting up to 5 to 6 hours
 - Contraction frequency every 5 to 10 minutes
 - Contraction duration 30 to 45 seconds
 - Contraction intensity mild to palpation
 - Active phase lasts from 4 to 7 cm dilation; moderate contractions
 - Cervical dilation between 4 to 7 cm
 - Cervical effacement between 40 to 80%
 - Nullipara lasting up to 6 hours; multipara lasting up to 4 hours
 - Contraction frequency every 2 to 5 minutes
 - Contraction duration 45 to 60 seconds
 - Contraction intensity moderate to palpation
 - Transition phase is from 8 to 10 cm dilation; strong contractions
 - Cervical dilation from 8 to 10 cm
 - Cervical effacement from 80 to 100%
 - Nullipara lasting up to 1 hour; multipara lasting up to 30 minutes
 - Contraction frequency every 1 to 2 minutes
 - Contraction duration 60 to 90 seconds
 - Contraction intensity hard by palpation
- Second stage is from complete dilation (10 cm) to birth of newborn; lasts up to 1 hour
 - Pelvic phase: period of fetal descent
 - Perineal phase: period of active pushing
 - Nullipara lasts up to 1 hour; multipara lasts up to 30 minutes
 - Contraction frequency every 2 to 3 minutes or less
 - Contraction duration 60 to 90 seconds
 - Contraction intensity strong by palpation
 - Strong urge to push during the later perineal phase
- Third stage (or placental stage) is separation and delivery of placenta
 - Placental separation: detaching from uterine wall
 - Placental expulsion: coming outside the vaginal opening
- Fourth stage is 1 to 4 hours after birth; time of maternal physiologic adjustment

Effacement of the cervix is from 0 to 40%. Most women are very talkative during this period, perceiving their contractions similar to menstrual cramps. Women may remain at home during this phase, contacting their health care professional about their onset of labor.

For the nulliparous woman, the latent phase typically lasts about 9 hours, whereas in the multiparous woman,

it lasts approximately 6 hours (Littleton & Engebretson, 2005). During this phase, women are apprehensive but excited about the start of their labor after their long gestational period.

Active Phase

Cervical dilation begins to occur more rapidly during the active phase. The cervix usually dilates from 3 to 7 cm with 40% to 80% effacement taking place. This phase can last for as long as 6 hours in for the nulliparous woman and 4.5 hours for the multiparous woman (Smith, 2004). The fetus descends farther in the pelvis. Contractions become more frequent (every 2–5 minutes) and increase in duration (45–60 seconds). The woman's discomfort intensifies (moderate to strong by palpation). She becomes more intense and inwardly focused, absorbed in the serious work of her labor. She limits interactions with those in the room. If she and her partner have attended childbirth education classes, she will begin to use the relaxation and paced breathing techniques learned to cope with the contractions. The suggested dilation rate for the nulliparous woman is 1.2 cm/hour; for the multiparous woman, 1.5 cm/hour (Cunningham et al., 2005).

Transition Phase

The transition phase is the last phase of the first stage of labor. During this phase, dilation slows, progressing from 8 to 10 cm, with effacement from 80% to 100%. The transition phase is the most difficult and, fortunately, the shortest phase for the woman, lasting approximately 1 hour in the first birth and perhaps 15 to 30 minutes in successive births (Sloane, 2002). During transition, the contractions are stronger (hard by palpation), more painful, more frequent (every 1–2 minutes), and last longer (60–90 seconds). The average rate of fetal descent is 1 cm/hour in nulliparous women and 2 cm/hour in multiparous women. Pressure on the rectum is great, and there is a strong desire to contract the abdominal muscles and push.

Other maternal features that are manifested during this transitional phase include nausea and vomiting, trembling extremities, backache, increased apprehension and irritability, restless movement, increased bloody show from the vagina, inability to relax, diaphoresis, feelings of loss of control, and being overwhelmed (with the woman often stating, “I can’t take it any more”). This phase should not last longer than 3 hours for nulliparas and 1 hour for multiparas (Cunningham et al., 2005).

Second Stage

The second stage of labor begins with complete cervical dilation (10 cm) and effacement, and ends with the birth of the newborn. Although the previous stage of labor primarily involved the thinning and opening of the cervix, this stage involves moving the fetus through the birth canal and out of the body. The cardinal movements of

labor occur during the early phase of passive descent in the second stage of labor.

Contractions occur every 2 to 3 minutes, last 60 to 90 seconds, and are described as strong by palpation. The average length of the second stage of labor in a nullipara is approximately 1 hour and less than half that time for the multipara woman. During this expulsive stage, the mother usually feels more in control and less irritable and agitated. She is focused on the work of pushing. Traditionally, women have been taught to hold their breath to the count of 10, inhale again, push again, and repeat the process several times during a contraction. This sustained, strenuous style of pushing has been shown to lead to hemodynamic changes in the mother and interfere with oxygen exchange between the mother and the fetus. In addition, it is associated with pelvic floor damage: the longer the push, the more damage to the pelvic floor (Chalk, 2004). The newest protocol from the Association of Women's Health and Newborn Nursing (AWHONN) recommends an open-glottis method in which air is released during pushing to prevent the build up of intrathoracic pressure. Doing so also supports mother's involuntary bearing-down efforts (Smith, 2004).

During the second stage of labor, pushing can either follow the mother's spontaneous urge or be directed by the caregiver. Much debate still exists between spontaneous and directed pushing during the second stage of labor. Although directed pushing is common practice in hospitals, there is evidence to suggest that directed pushing be avoided. Research seems to support spontaneous pushing—when the woman is allowed to follow her own instincts (Chalk, 2004).

The second stage of labor has two phases related to the existence and quality of the maternal urge to push and to obstetric conditions related to fetal descent. The early phase of the second stage is called the *pelvic phase*, because it is during this phase that the fetal head is negotiating the pelvis, rotating and advancing in descent. The later phase is called the *perineal phase*, because at this point the fetal head is lower in the pelvis and is distending the perineum. The occurrence of a strong urge to push characterizes the later phase of the second stage and has also been called *the phase of active pushing* (Roberts, 2003).

The later perineal phase occurs when there is a tremendous urge to push by the mother as the fetal head is lowered and is distending the perineum. The perineum bulges and there is an increase in bloody show. The fetal head becomes apparent at the vaginal opening, but disappears between contractions. When the top of the head no longer regresses between contractions, it is said to have *crowned*. The fetus rotates as it maneuvers out. The second stage commonly lasts up to 3 hours in a first labor and up to an hour in subsequent ones.

During the second stage of labor, the woman experiences a sharper, more continuous somatic pain in the perineum. Pressure or nerve entrapment caused by the fetus'

head can cause back or leg pain at this time (Leeman et al., 2003a).

Third Stage

The third stage of labor begins with the birth of the newborn and ends with the separation and delivery of the placenta. It consists of two phases: placental separation and placental expulsion.

Placental Separation

After the infant is born, the uterus continues to contract strongly and can now retract, decreasing markedly in size. These contractions cause the placenta to pull away from the uterine wall. The following signs of separation indicate that the placenta is ready to deliver:

- The uterus rises upward
- The umbilical cord lengthens
- A sudden trickle of blood is released from the vaginal opening
- The uterus changes its shape to globular

Spontaneous delivery of the placenta occurs in one of two ways: the fetal side (shiny gray side) presenting first (called *Schultz's mechanism* or more commonly called *shiny Schultz's*) or the maternal side (red raw side) of the placenta presenting first (termed *Duncan's mechanism* or *dirty Duncan*).

Placental Expulsion

After separation of the placenta from the uterine wall, continued uterine contractions cause the placenta to be expelled within 5 to 30 minutes unless there is gentle external traction to assist. After the placenta is expelled, the uterus is massaged briefly by the attending physician or midwife until it is firm in order to constrict uterine blood vessels and minimize the possibility of hemorrhage. Normal blood volume blood loss is approximately 500 mL per vaginal birth and 1000 mL per cesarean birth (Poole & White, 2003).

If the placenta does not spontaneously deliver, the healthcare professional assists with its removal by manual extraction. On expulsion, the placenta is inspected for its intactness by the healthcare professional and the nurse to make sure all sections are present. If any piece is left still attached to the uterine wall, it places the woman at risk for a postpartum hemorrhage, because it becomes a space-occupying object that interferes with the ability of the uterus to contract fully and effectively.

Fourth Stage

The fourth stage begins with completion of the delivery of the placenta and membranes, and ends with the initial physiologic adjustment and stabilization of the mother (1–4 hours after birth). This stage initiates the postpartum period. The mother usually feels a sense of peace

and excitement, is wide awake, and is very talkative initially. The attachment process begins with her inspecting her newborn and desiring to cuddle and breast-feed him or her. The mother's fundus should be firm and well contracted. Typically it is located at the midline between the umbilicus and the symphysis, but then slowly rises to the level of the umbilicus during the first hour after birth (Smith, 2004). If the uterus becomes boggy, it is then massaged to keep it firm. The lochia (vaginal discharge) is red in color, mixed with small clots and of moderate flow. If the woman has experienced an episiotomy during the second stage of labor, it should be intact, with the edges approximated, clean, and no redness or edema present.

The focus of this stage is to monitor the mother closely to prevent hemorrhage, bladder distention, and venous thrombosis. Usually the mother is thirsty and hungry during this time, and may request food and drink. Her bladder is hypotonic and thus the mother has limited sensation to acknowledge a full bladder or to void. The vital signs, amount and consistency of the vaginal discharge (lochia), and palpation of the uterine fundus are usually monitored every 15 minutes for a minimum of an hour. The woman will be experiencing cramp-like discomfort during this time secondary to the uterine contraction status.

KEY CONCEPTS

- Labor is a complex, multifaceted interaction between the mother and fetus. Thus, it is difficult to determine exactly why labor begins and what initiates it.
- Before the onset of labor, a pregnant woman's body undergoes several changes in preparation for the birth of the newborn, often leading to characteristic signs and symptoms that suggest that labor is near. These changes include cervical changes, lightening, increased energy level, bloody show, Braxton Hicks contractions, and spontaneous rupture of membranes.
- False labor is a condition seen during the latter weeks of some pregnancies in which irregular uterine contractions are felt, but the cervix is not affected.
- The critical factors in labor and birth are designated as the 10 Ps: passageway (birth canal), passenger (fetus and placenta), powers (contractions), psychological response, maternal position, philosophy (low tech, high touch), partners (support caregivers), patience (natural timing), patient preparation (childbirth knowledge base), and pain control (comfort measures).
- The size and shape of a woman's pelvis are determining factors for a vaginal delivery. The female pelvis is divided into four main groups: anthropoid, android, gynecoid, and the platypelloid.
- The labor process is comprised of a series of rhythmic, involuntary, usually quite uncomfortable uterine muscle contractions that bring about a shortening

(effacement) and opening (dilation) of the cervix, and a bursting of the fetal membranes. Important parameters of uterine contractions are frequency, duration, and intensity.

- The diameters of the fetal skull vary considerably, with some diameters shortening and others lengthening as the head is molded during the labor and birth process.
- Pain during labor is a nearly universal experience for childbearing women. Having a strong sense of self and meaningful support from others can often help women manage labor well and reduce their sensation of pain.
- Preparing mentally for childbirth is important for women to enable them to work with the natural forces of labor and not against them.
- As the woman experiences and progresses through childbirth, numerous physiologic responses occur that assist her adaptation to the laboring process.
- Labor is typically divided into four stages that are unequal in length.
- During the first stage, the fundamental change underlying the process is progressive dilation of the cervix. It is further divided into three phases: latent phase, active phase, and transition.
- The second stage of labor is from complete cervical dilation (10 cm) and effacement through the birth of the infant.
- The third stage is that of separation and delivery of the placenta. It consists of two phases: placental separation and placental expulsion.
- The fourth stage begins after the delivery of the placenta and membranes, and ends with the initial physiologic adjustment and stabilization of the mother (1–4 hours).

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Web Resources

- Academy of Breast-feeding Medicine, www.bfmed.org
- Academy for Guided Imagery, Inc., www.interactiveimagery.com/
- American College of Obstetricians and Gynecologists, www.acog.org
- American Public Health Association, www.apha.org
- Association of Labor Assistants and Childbirth Educators, www.alace.org
- Association of Women's Health, Obstetric and Neonatal Nurses (AWHONN), www.awhonn.org
- Birthworks, www.birthworks.org
- BMJ publication: *Evidence-Based Nursing*, www.evidencebasednursing.com
- Childbirth Organization, www.childbirth.org
- Diversity Rx, www.diversityrx.org
- Doulas of North America (DONA), www.dona.org
- HypnoBirthing Institute, www.hypnobirthing.com
- International Childbirth Education Association, www.icea.org
- Lamaze International, www.lamaze-childbirth.com
- National Association of Childbearing Centers (NACC), www.birthcenters.org

Chapter WORKSHEET

● MULTIPLE CHOICE QUESTIONS

1. When determining the frequency of contractions, the nurse would measure which of the following?
 - a. Start of one contraction to the start of the next contraction
 - b. Beginning of one contraction to the end of the same contraction
 - c. Peak of one contraction to the peak of the next contraction
 - d. End of one contraction to the beginning of the next contraction
2. Which fetal lie is most conducive for a spontaneous vaginal birth?
 - a. Transverse
 - b. Longitudinal
 - c. Perpendicular
 - d. Oblique
3. Which of the following observations would suggest that placental separation is occurring?
 - a. Uterus stops contracting altogether
 - b. Umbilical cord pulsations stop
 - c. Uterine shape changes from discord to globular
 - d. Maternal blood pressure drops
4. While preparing to assist with an amniotomy, the nurse understands that this procedure will
 - a. Stimulate contractions
 - b. Reduce the risk of infection
 - c. Increase fetal heart accelerations
 - d. Decrease painful contractions
5. The shortest but most intense phase of labor is the
 - a. Latent phase
 - b. Active phase
 - c. Transition phase
 - d. Placental expulsion phase

● CRITICAL THINKING EXERCISES

1. Cindy, a 20-year old primipara, calls the birthing center where you work as a nurse and reports she thinks she is in labor because she feels labor pains. Her due date is this week. The midwives have been giving her prenatal care throughout this pregnancy.
 - a. What additional information do you need to respond appropriately?
 - b. What suggestions/recommendations would you make to her?
 - c. What instructions need to be given to guide her decision making?
2. Based on Cindy, the young woman described in the previous scenario, consider the following:
 - a. What other premonitory signs of labor might the nurse ask about?
 - b. What manifestations would be found if Cindy is experiencing true labor?
3. You are assigned to lead a community education class for women in their third trimester of pregnancy to prepare them for their upcoming birth. Prepare an outline of topics that should be addressed.

● STUDY ACTIVITIES

1. During clinical post conference, share with the other nursing students how the critical forces of labor influenced the length of labor and the birthing process for a laboring woman assigned to you.
2. The cardinal movements of labor include which of the following? Select all that apply.
 - a. Extension and rotation
 - b. Descent and engagement
 - c. Presentation and position
 - d. Attitude and lie
 - e. Flexion and expulsion
3. Interview a woman on the mother–baby unit who has given birth within the last few hours. Ask her to describe her experience and examine psychological factors that may have influenced her laboring process.
4. On the following illustration, identify the parameters of uterine contractions by marking an “X” where the nurse would measure the duration of the contraction.

