UNIT

5

Birth

20 Processes and Stages of Labor and Birth

Source: OJO Images/Getty/SuperStock.

Just as a woman's heart knows how and when to pump, her lungs to inhale, and her hand to pull back from fire, so she knows when and how to give birth.

—Virginia

LEARNING OUTCOMES

1. Compare methods of childbirth preparation.
2. Examine the five critical factors that affect the labor process.
3. Describe the physiology of labor.
4. Discuss premonitory signs of labor.
5. Differentiate between false and true labor.
6. Describe the characteristics of the four stages of labor and their accompanying phases.
7. Describe the physiologic and psychosocial changes that are indicative of the maternal progress during each of the stages of labor.
8. Summarize maternal systemic responses to labor.
9. Describe fetal adaptations to labor.

KEY TERMS

Bloody show, *456*
Cardinal movements, *459*
Cervical dilatation, *455*
Crowning, *458*
Duration, *453*
Effacement, *455*
Engagement, *450*
Fetal attitude, *447*
Fetal lie, *448*
Fetal position, *450*
Fetal presentation, *448*
Fontanelle, *447*
Frequency, *453*
Intensity, *453*
Lightening, *456*
Malpresentations, *448*
Molding, *447*
Presenting part, *448*
Rupture of membranes (ROM), *456*
Spontaneous rupture of membranes (SROM), *456*
Station, *450*
Sutures, *447*

In the final weeks of pregnancy, both mother and baby begin to prepare for birth. The fetus develops and grows in readiness for life outside the womb. The expectant woman undergoes various physiologic and psychosocial changes that gradually prepare her for childbirth and for the role of mother. The onset of labor begins a remarkable change in the relationship between the woman and her baby. During labor, particularly at the end, a woman instinctively knows she is engaging in one of the most important tasks she will ever do. A precious life is about to emerge. In those hours and moments, the birth process may seem to carry all the power in the universe. The mother-to-be and her partner may be stretched beyond all of their normal limits of concentration, purpose, endurance, and pain. The dynamic nature of this experience is what makes the birth of a baby both a physiologic and a psychosocial transition into parenthood.

METHODS OF CHILDBIRTH PREPARATION

Various types of childbirth preparation are taught in North America. Childbirth preparation classes are usually taught by certified childbirth educators. Vital to each method is the educational component, which helps alleviate fear. The classes vary in coverage of subjects related to the maternity cycle, but all teach relaxation and coping techniques, as well as what to expect during labor and birth. Most classes also feature exercises to relax and condition muscles and breathing exercises for use in labor. The greatest differences among the methods lie in the theories of why they work and in the specific comfort techniques and breathing patterns they teach.

Childbirth preparation offers several advantages. It helps a pregnant woman and her support person understand the choices in the birth setting, promotes awareness of available options, and provides tools for them to use during labor and birth. Another advantage is the satisfaction of the parents, for whom childbirth becomes a shared and profound emotional experience. In addition, each method has been shown to shorten labor. All nurses should know how these techniques differ, so that they can support each birth experience effectively. A Cochrane Review recently found that women who receive continuous support during labor require less analgesia, have fewer cesarean and instrument births, and experience a shorter period of labor (Hodnett, Gates, Hofmeyr, et al., 2011). This provides additional evidenced-based practice guidance regarding the need to provide ongoing support of the woman's partner during the labor and birth process.

Programs for Preparation

Some antepartum classes, specifically oriented to preparation for labor and birth, have a name associated with a theory of pain reduction in childbirth. The most common methods are described in *Key Points: Selected Childbirth Preparation Methods.*

KEY POINTS

Selected Childbirth Preparation Methods

- **Lamaze** (psychoprophylactic): Dissociative relaxation, controlled muscle relaxation, and specified breathing patterns are used to promote birth as a normal process.
- **Kitzinger** (sensory-memory): Women use chest breathing, abdominal breathing, and their sensory memory to help work through the birthing process.
- **Bradley** (partner-coached childbirth): Consists of a 12-week session in which the woman works on controlled breathing and deep abdominopelvic breathing with a focus on achieving natural childbirth.
- **HypnoBirthing:** Breathing and relaxation techniques help prepare the body to work in neuromuscular harmony to make the birth process easier, safer, and more comfortable.

SAFETY ALERT!

Explain to women who are using Internet childbirth education resources that some sites may not use health professionals or experts in the childbirth field and may be written by individuals who lack formal education and training. Advise women to look for resources that are supported by licensed professionals or well-known, credible organizations.

One of the most important components of childbirth education is instilling confidence in a woman's ability to give birth (Hodnett et al., 2011). Many childbirth education specialists and educators embrace contemporary models that focus on the interconnectedness of the body and spirit. After that connection is established and understood by pregnant women, coping strategies, stress reduction, and relaxation techniques can be taught.

Another prominent organization that provides educational resources and certification for educators is the International Childbirth Education Association (ICEA). This organization does not advocate a particular method of childbirth preparation but rather promotes a philosophy of "freedom of choice based on knowledge of alternatives" (ICEA, 2012). Many expectant parents find this approach consistent with their own desires to experience birth as informed healthcare consumers. ICEA educators often teach a combination of techniques designed to meet individual needs.

Body-Conditioning Exercises

Some body-conditioning exercises, such as the pelvic tilt, pelvic rock, and Kegel exercises, are taught in childbirth preparation classes. Other exercises strengthen the abdominal muscles for the expulsive phase of labor. (See Chapter 14 ∞ for a description of some recommended exercises.) Exercises aimed at adducting the legs into an extended *McRoberts position*, which is performed by flexing the mother's thighs toward her shoulders while she is lying on her back, help enable the woman to stretch her hamstring muscles, a task usually required during the second stage of labor (O'Leary, 2009). Many childbirth methods utilize body conditioning as a portion of their education program. With the encouragement of daily exercise in pregnancy, women can incorporate exercises into their daily programs that will help build endurance and strength for the labor and birth process.

Relaxation Exercises

Relaxation during labor allows the woman to conserve energy and the uterine muscles to work more efficiently. Most childbirth education methods use a form of relaxation exercise as part of their philosophical basis. Without practice, it is difficult to relax the whole body in the midst of intense uterine contractions. Progressive relaxation exercises such as those taught to induce sleep can be helpful during labor.

The *touch relaxation technique* is often used as a pain relief measure in which the partner's touch enhances the woman's ability to relax or release tense muscles. During labor, the partner's touch can include light touching, stroking, or massaging as a nonverbal cue to relax. The method often combines patterned abdominal breathing with focused touch relaxation. The laboring woman learns to release tension in the specific areas or in a generalized manner when her partner touches her. The partner observes and becomes attuned to the woman's tense, tightened muscles or verbal cues that indicate discomfort.

Table 20–1 provides information on the technique of the touch relaxation method.

TABLE 20–1 Touch Relaxation Technique

- The partner initially touches the woman's brow.
- The woman is encouraged to begin abdominal breathing, in which she breathes in through her nose, allowing her abdomen to rise as much as possible. The woman then breathes out through her mouth while simultaneously allowing her abdomen to fall. The partner reminds her to focus on muscle relaxation as the breath is released and to attempt to completely relax her body as she exhales.
- The partner continues gently touching the woman's brow while providing encouragement, telling her "You are doing fine, you are releasing the tension in your forehead." After five or more breaths, the partner touches the woman's shoulders and the pattern described above is repeated.
- The partner then systematically focuses on the arms, chest, abdomen, thighs, and calves. The last instruction is for the woman to breathe in deeply and relax her entire body. The partner is advised to encourage this complete relaxation strategy at the end of each contraction to allow the woman to rest and reserve her energy between labor contractions.
- The couple should be encouraged to practice this technique prior to labor. Some couples may verbalize understanding of the technique, but actual practice should be encouraged prior to labor. This enables the woman to identify specific touch techniques that she personally finds helpful.
- Couples should be encouraged to practice the technique simulating a true labor pattern to become accustomed to the frequency needed to maintain the actual length of time and duration that will occur when the woman is in true labor. Women who regularly practice with their partners often become cued by touch alone and can begin the relaxation technique as soon as the partner touches her brow. Couples often individualize the technique to their own comfort levels and should be encouraged to make modifications that feel natural to them.

Source: Data from Perez, P. & Hutchins, C. (2014). *The nurturing touch at birth: A labor support handbook* (3rd ed.). Johson, VT: Cutting Edge Press; Simpkin, P. & Ancheta, R. (2011). *The labor progress handbook* (3rd ed.). New York, NY: Wiley-Blackwell.

TABLE 20–2 Visualization, Imagery, and Meditation

Visualization and Imagery	During pregnancy, visualization and imagery are used to induce a state of relaxation. The woman is advised to focus on a calming and relaxing image. Some women may envision a special peaceful place, while others may envision holding their baby or another pleasant event. Images can be suggested by the partner or practitioner or may be chosen by the woman herself. The partner or practitioner describes a tranquil image, such as a sparkling brook with sunshine peeking through the trees and birds singing gently in the background. During labor, this technique assists the woman with muscle relaxation and provides a positive distraction from uterine contractions, which helps conserve energy and fight fatigue.
Meditation	Meditation is a practice in which the woman remains upright in an alert position and focuses on stilling or emptying her mind. The woman focuses and repeats a particular word or sound, called a *mantra*, while attempting to reach a state of dissociation. In this state, she is detached from interacting with the environment and becomes an observer of her surroundings rather than an active participant. Mindfulness is a type of meditation that focuses on the present moment. The participant is aware of her environment and observes her thoughts and feelings without judgment. In mindfulness, the woman is encouraged to embrace the labor experience.

An additional exercise is *disassociation relaxation*. The woman is taught to become familiar with the sensation of contracting and relaxing the voluntary muscle groups throughout her body. She then learns to contract a specific muscle group and relax the rest of her body. The exercise conditions the woman to relax uninvolved muscles while the uterus contracts, creating an active relaxation pattern.

Other strategies to induce relaxation include visualization, imagery, and meditation. See Table 20–2.

Breathing Techniques

Breathing techniques are a key element of most childbirth preparation programs. The Bradley method encourages abdominopelvic breathing, whereas the Kitzinger method utilizes chest breathing in collaboration with abdominal relaxation. Hypnobirthing utilizes deep slow breathing as a center component of its philosophy. Breathing exercises help keep the mother and her unborn baby adequately oxygenated and help the mother relax and focus her attention appropriately. Breathing techniques are best taught during the final trimester of pregnancy. The nurse then supports the mother's use of breathing techniques during labor. Breathing techniques during labor are described in more detail in Chapter 22 ∞.

PREPARATION FOR CHILDBIRTH THAT SUPPORTS INDIVIDUALITY

Childbirth educators stress the value of individuality when providing information to expectant parents. The goal is to encourage women to incorporate their own natural responses into coping with the pain of labor and birth. Self-care activities that may be used include vocalization or "sounding" to relieve tension in pregnancy and labor, massage (light touch) to facilitate relaxation, use of warm water for showers or bathing during labor, visualization (imagery), relaxing music, subdued lighting, and the use of a birthing ball (Figure 20–1 ●).

Additional ways in which the nurse can help the couple during labor and birth include the following:

- Identify the methods of childbirth preparation commonly used in your area and learn the basics of their approaches to relaxation and breathing; practice these methods so that you can support a laboring couple more effectively.
- Encourage expectant mothers and couples to make the birth a personal experience.

Figure 20–1 ● A birthing ball is just one of many options that a family may choose to promote maternal comfort during labor.

- Suggest the couple bring items from home that help create a more personal birthing space, such as warm socks, extra pillows or a favorite blanket, bath powder, lotion, or meaningful photos.
- Encourage the couple to listen to soothing music or watch favorite DVDs to increase personalization of the childbearing experience.

CRITICAL FACTORS IN LABOR

Five factors are important in the process of labor and birth: (1) the birth passageway (birth canal), (2) the passenger (fetus), (3) the physiologic forces of labor, (4) the position of the mother, and (5) the woman's psychosocial considerations (Table 20–3). The progress of labor is critically dependent on the complementary relationship of these five factors. Abnormalities that affect any component of these critical

TABLE 20–3 Critical Factors in Labor

1. Birth passage
   - Size of the maternal pelvis (diameters of the pelvic inlet, midpelvis, and outlet)
   - Type of maternal pelvis (gynecoid, android, anthropoid, platypelloid, or a combination)
   - Ability of the cervix to dilate and efface and ability of the vaginal canal and the external opening of the vagina (the introitus) to distend
2. Fetus
   - Fetal head (size and presence of molding)
   - Fetal attitude (flexion or extension of the fetal body and extremities)
   - Fetal lie
   - Fetal presentation (the body part of the fetus entering the pelvis in a single or multiple pregnancy)
3. The relationship between the passage and the fetus
   - Engagement of the fetal presenting part
   - Station (location of fetal presenting part in the maternal pelvis)
   - Fetal position (relationship of the presenting part to one of the four quadrants of the maternal pelvis)
4. Physiologic forces of labor
   - Frequency, duration, and intensity of uterine contractions as the fetus moves through the passage
   - Effectiveness of the maternal pushing effort
5. Psychosocial considerations
   - Mental and physical preparation for childbirth
   - Sociocultural values and beliefs
   - Previous childbirth experience
   - Support from significant others
   - Emotional status

forces can alter the outcome of labor and jeopardize both the expectant woman and her baby. Complications during labor and birth are discussed in Chapter 25 ∞.

Birth Passageway

The true pelvis and soft tissues of the cervix, vagina, and the pelvic floor form the birth passageway. The true pelvis is the critical factor of the passageway because the fetus must progress through this bony canal during the vaginal birth process. The true pelvis is divided into three sections: the inlet, the pelvic cavity (midpelvis), and the outlet. The four classic types of pelvises are *gynecoid, android, anthropoid,* and *platypelloid* (see Figure 9–13 ∞ on page 158). Implications of each type for childbirth are described in Table 20–4. The ability of the cervix to dilate and efface and the ability of the vaginal canal and the external opening of the vagina (the introitus) to distend are additional factors of the birth passageway. See Chapter 9 ∞ for a discussion of each part of the pelvis and Chapter 12 ∞ for techniques to assess the size and shape of the pelvis.

TABLE 20–4 Implications of Pelvic Type for Labor and Birth

Pelvic Type	Pertinent Characteristics	Implications for Birth
Gynecoid	Inlet rounded with all inlet diameters adequate	Favorable for vaginal birth
	Midpelvis diameters adequate with parallel side walls	
	Outlet adequate	
Android	Inlet heart-shaped with short posterior sagittal diameter	Not favorable for vaginal birth
	Midpelvis diameters reduced	Descent into pelvis is slow
	Outlet capacity reduced	Fetal head enters pelvis in transverse or posterior position with arrest of labor frequent
Anthropoid	Inlet oval in shape, with long anteroposterior diameter	Favorable for vaginal birth
	Midpelvis diameters adequate	
	Outlet adequate	
Platypelloid	Inlet oval in shape, with long transverse diameters	Not favorable for vaginal birth
	Midpelvis diameters reduced	Fetal head engages in transverse position
	Outlet capacity inadequate	Difficult descent through midpelvis
		Frequent delay of progress at outlet of pelvis

Note: Description of pelvic shape is exaggerated for easier comprehension.

Birth Passenger (Fetus)

Several aspects of the fetus's body and the way the fetus moves through the mother's birth canal are considered critical factors of the passenger that affect the outcome of labor. These interacting factors are the fetal head, fetal attitude, fetal lie, fetal presentation, and fetal position. The placenta must also pass through the birth canal but rarely impedes the labor process, except in cases of placenta previa (see Chapter 24 ∞ for placental complications).

FETAL HEAD

The fetal head is composed of bony parts, which can either hinder childbirth or make it easier. Once the head (the least compressible and largest part of the fetus) has been born, the birth of the rest of the body is rarely delayed.

The fetal skull has three major parts: the face, the base of the skull (cranium), and the vault of the cranium (roof). The bones of the face and cranial base are well fused and essentially fixed. The base of the cranium is composed of the two temporal bones, each with a sphenoid bone and an ethmoid bone. The bones composing the vault are the two frontal bones, the two parietal bones, and the occipital bone (Figure 20–2 ●). These bones are not fused, allowing this portion of the head to adjust as it passes through the narrow portions of the maternal pelvis. The cranial bones overlap under pressure of the powers of labor and the demands of the unyielding pelvis. This overlapping is called **molding**.

The **sutures** of the fetal skull are membranous joints that unite the cranial bones. Sutures allow for molding of the fetal head and help the clinician identify the position of the fetal head during vaginal examination. The important sutures of the cranial vault are as follows (see Figure 20–1).

- ***Frontal suture.*** Located between the two frontal bones; becomes the anterior continuation of the sagittal suture
- ***Sagittal suture.*** Located between the parietal bones; divides the skull into left and right halves; runs anteroposteriorly, connecting the two fontanelles

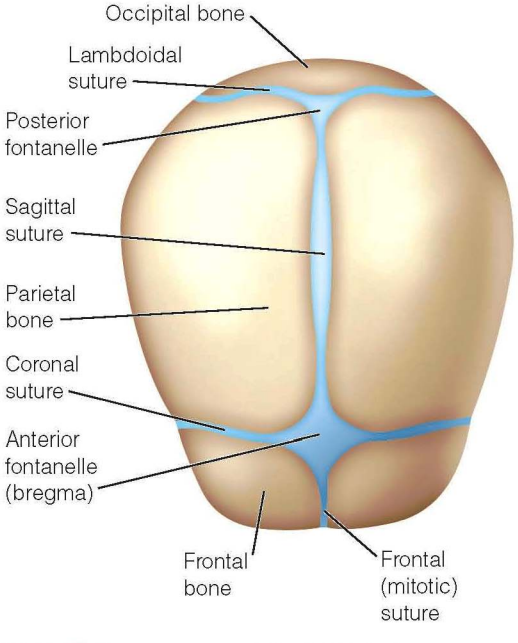


Figure 20–2 ● Superior view of the fetal skull.

- ***Coronal sutures.*** Located between the frontal and parietal bones; extend transversely left and right from the anterior fontanelle (bregma)
- ***Lambdoidal suture.*** Located between the two parietal bones and the occipital bone; extends transversely left and right from the posterior fontanelle

The intersection of several cranial sutures forms an irregular space that is enclosed by a membrane and called a **fontanelle**. The anterior and posterior fontanelles are clinically useful in identifying the position of the fetal head in the pelvis and in assessing the status of the newborn after birth. The greater, or anterior, fontanelle (bregma) is diamond shaped, measures 2 to 3 cm, and is situated at the junction of the sagittal, coronal, and frontal sutures. It permits growth of the brain by remaining unossified for as long as 18 months. The lesser, or posterior, fontanelle is shaped like a small triangle, measures about 1 to 2 cm, and is situated at the intersection of the sagittal and lambdoidal sutures. It closes within 8 to 12 weeks after birth.

Following are several other important landmarks of the fetal skull (Figure 20–3 ●):

- ***Mentum.*** The fetal chin
- ***Sinciput.*** The anterior area known as the brow
- ***Vertex.*** The area between the anterior and posterior fontanelles
- ***Occiput.*** The area of the fetal skull occupied by the occipital bone, beneath the posterior fontanelle

The diameters of the fetal skull vary considerably within normal limits. Some diameters shorten and others lengthen as the head is molded during labor. Fetal head diameters are measured between the various landmarks on the skull (Figure 20–4A ●). For example, the suboccipitobregmatic diameter is the distance from the undersurface of the occiput to the center of the bregma (anterior fontanelle). The biparietal diameter is the largest part of the fetal head (Figure 20–4B ●).

FETAL ATTITUDE

Fetal attitude refers to the relation of the fetal body parts to one another and describes the posture the fetus assumes as it conforms to the shape of the uterine cavity. The normal attitude of the fetus is termed *general flexion,* where the head is flexed so that the chin is on

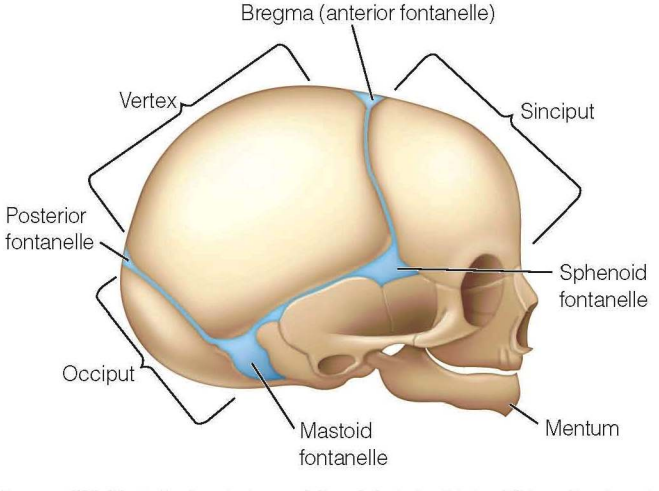


Figure 20–3 ● Lateral view of the fetal skull identifying the landmarks that have significance during birth.

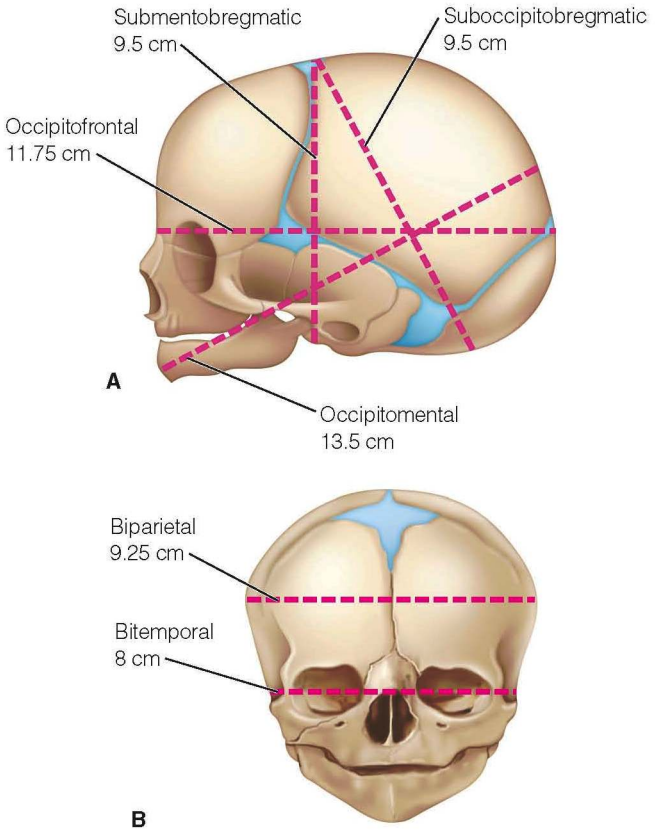


Figure 20–4 ● **A.** Anteroposterior diameters of the fetal skull. When the vertex of the fetus presents and the fetal head is flexed with the chin on the chest, the smallest anteroposterior diameter (suboccipitobregmatic) enters the birth canal. **B.** Transverse diameters of the fetal skull.

the chest with the arms crossed over the chest, and the legs flexed at the knees with the thighs on the abdomen (Figure 20–5A●).

Changes in fetal attitude, particularly in the position of the head, cause the fetus to present larger diameters of the fetal head to the maternal pelvis. These deviations from a normal fetal attitude often contribute to a longer, more difficult labor (Figure 20–5B●).

Figure 20–5 ● Fetal attitude. The attitude (or relationship of body parts) of this fetus is normal. The head is flexed forward with the chin almost resting on the chest. The arms and legs are flexed.

FETAL LIE

Fetal lie refers to the relationship of the long, or cephalocaudal, axis (spinal column) of the fetus to the long, or cephalocaudal, axis of the mother. The fetus may assume either a longitudinal (vertical) or a transverse (horizontal) lie. A *longitudinal lie* occurs when the cephalocaudal axis of the fetus is parallel to the woman's spine. A *transverse lie* occurs when the cephalocaudal axis of the fetal spine is at a right angle to the woman's spine (see Figure 25–11∞ on page 609). A transverse lie is associated with a shoulder presentation and can lead to complications in the later stages of labor. This is discussed in detail in Chapter 25 ∞. Table 20–5 identifies the characteristics associated with a longitudinal versus a transverse fetal lie.

FETAL PRESENTATION

Fetal presentation is determined by fetal lie and refers to the body part of the fetus that enters the maternal pelvis first and leads through the birth canal during labor. The **presenting part**, or the portion of the fetus that is felt through the cervix on vaginal examination, determines the presentation. Fetal presentation may be cephalic (head first), breech (buttocks or feet first), or shoulder.

The most common presentation is cephalic. When this presentation occurs, labor and birth are more likely to proceed normally. Breech and shoulder presentations are associated with difficulties during labor and do not proceed as normal; therefore, they are called **malpresentations**. (See Chapter 25 ∞ for discussion of malpresentations.)

CEPHALIC PRESENTATION The fetal head presents to the birth passage in approximately 97% of term births. The cephalic presentation can be further classified into vertex, sinciput, brow, or face presentation according to the degree of flexion or extension of the fetal head (attitude).

VERTEX PRESENTATION

- When the presenting part is the occiput, the presentation is noted as vertex.
- Vertex is the most common type of presentation.
- The fetal head is completely flexed onto the chest.
- The smallest diameter of the fetal head (suboccipitobregmatic) presents to the maternal pelvis (Figure 20–6A●).

SINCIPUT PRESENTATION

- The fetal head is partially flexed.
- The occipitofrontal diameter presents to the maternal pelvis (Figure 20–6B●).
- The top of the head is the presenting part.

BROW PRESENTATION

- The fetal head is partially extended.
- The occipitomental diameter, the largest anteroposterior diameter, is presented to the maternal pelvis (Figure 20–6C●).

FACE PRESENTATION

- The fetal head is hyperextended (complete extension).
- The submentobregmatic diameter presents to the maternal pelvis (Figure 20–6D●).

BREECH PRESENTATION A breech presentation indicates that the presenting part is the lower extremities or buttocks. Breech

TABLE 20–5 Characteristics Associated with Longitudinal Versus Transverse Fetal Lie

Fetal Lie	Attitude	Presenting Part	Landmark
LONGITUDINAL LIE (99.5%)			
Cephalic presentation (96% to 97%)	Flexion of fetal head onto chest	Vertex (posterior part—occiput)	Occiput (O)
	Military (no flexion, no extension)	Vertex (median part)	Occiput (O)
	Partial extension	Brow	Forehead (frontum) (Fr)
	Complete extension of the head	Face	Chin (mentum) (M)
Breech presentation (Approximately 3%)			
Complete breech	Flexed hips and knees	Buttocks	Sacrum (S)
Frank breech	Flexed hips, extended knees with legs against abdomen and chest	Buttocks	Sacrum (S)
Footling breech: single, double	Extended hips and at least one knee extended with foot in cervical canal	Feet (one or two)	Sacrum (S)
Kneeling breech: single, double	Extended hips, flexed knees	Knees	Sacrum (S)
TRANSVERSE OR OBLIQUE LIE (APPROXIMATELY 0.5%)			
Shoulder presentation	Variable	Shoulder, arm	Scapula (Sc or A)

presentations occur in approximately 3% of all term births (Gabbe, Niebyl, Galan, et al, 2012). These presentations are classified according to the attitude of the fetus's hips and knees. In all variations of the breech presentation (complete, frank, or footling breech), the sacrum (the bone on the buttocks that is felt when palpating) is the landmark.

COMPLETE BREECH

- The fetal knees and hips are both flexed, the thighs are on the abdomen, and the calves are on the posterior aspect of the thighs.
- The buttocks and feet of the fetus present to the maternal pelvis.

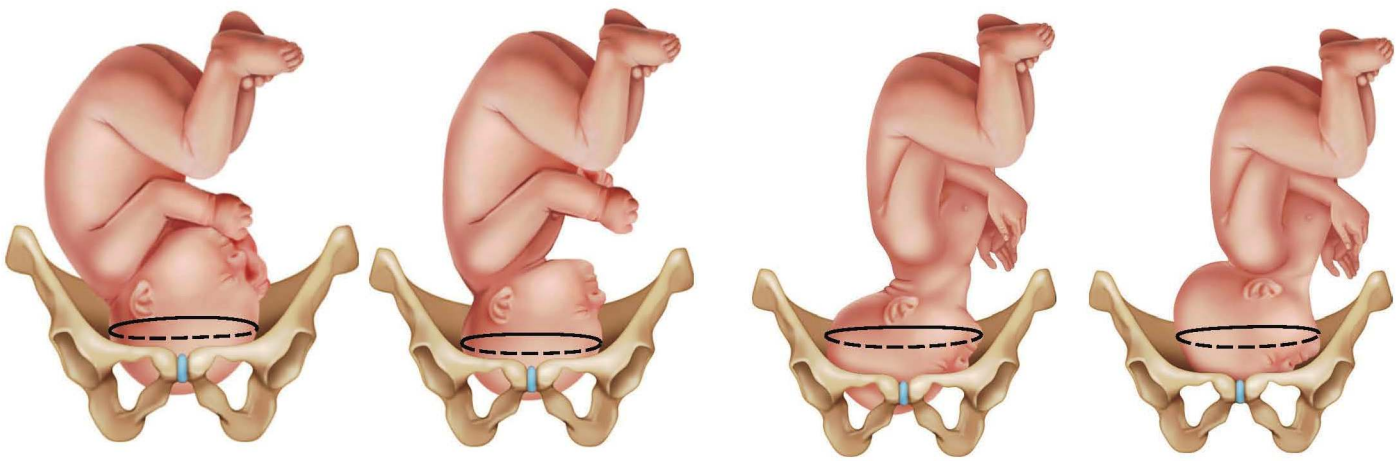
FRANK BREECH

- The fetal hips are flexed, and the knees are extended.
- The buttocks of the fetus present to the maternal pelvis.

FOOTLING BREECH

- The fetal hips and legs are extended.
- The feet of the fetus present to the maternal pelvis.
- In a single footling one foot presents; in a double footling both feet present.

SHOULDER PRESENTATION When the fetal shoulder is the presenting part, the fetus is in a transverse lie and the acromion



A Suboccipitobregmatic diameter **B** Occipitofrontal diameter **C** Occipitomental diameter **D** Submentobregmatic diameter

Figure 20–6 • Cephalic presentation. **A.** Vertex presentation. Complete flexion of the head allows the suboccipitobregmatic diameter to present to the pelvis. **B.** Sinciput (median vertex) presentation (also called *military presentation*) with no flexion or extension. The occipitofrontal diameter presents to the pelvis. **C.** Brow presentation. The fetal head is in partial (halfway) extension. The occipitomental diameter, which is the largest diameter of the fetal head, presents to the pelvis. **D.** Face presentation. The fetal head is in complete extension, and the submentobregmatic diameter presents to the pelvis.

process of the scapula is the landmark. This type of presentation occurs less than 1% of the time (Gabbe et al., 2012).

Relationship of Maternal Pelvis and Presenting Part

The third critical factor, in addition to the birth passage and fetus, is the relationship between these two factors. When assessing the relationship of the maternal pelvis and the presenting part of the fetal body, the nurse considers engagement, station, and fetal position.

ENGAGEMENT

Engagement of the presenting part occurs when the largest diameter of the presenting part reaches or passes through the pelvic inlet (Figure 20–7A ●). When the fetal head is flexed, the biparietal diameter is the largest dimension of the fetal skull to pass through the pelvic inlet in a cephalic presentation. The intertrochanteric diameter (transverse diameter between the right and left trochanter) is the largest to pass through the inlet in a breech presentation.

Engagement can be determined by vaginal examination. In primigravidas, engagement usually occurs 2 weeks before term. Multiparas, however, may experience engagement several weeks before the onset of labor or during the process of labor.

The presenting part is said to be *floating* (or *ballottable*) when it is freely movable above the inlet (see Figure 20–7B ●). When the presenting part begins to descend into the inlet, before engagement has truly occurred, it is said to be dipping into the pelvis (see Figure 20–7C ●).

STATION

Station refers to the relationship of the presenting part to an imaginary line drawn between the ischial spines of the maternal pelvis. In a normal pelvis, the ischial spines mark the narrowest diameter through which the fetus must pass. These spines are not sharp protrusions but rather blunted prominences at the midpelvis. The ischial spines as a landmark have been designated as zero station (Figure 20–8 ●). If the presenting part is higher than the ischial spines, a negative number is assigned, noting centimeters above zero station. Station −5 is at the inlet, and station +4 is at the outlet. If the presenting part can be seen at the woman's perineum, birth will occur momentarily. During labor the presenting part should move progressively from the negative stations to the midpelvis at zero station and into the positive stations. Failure of the presenting part to descend in the presence of strong contractions may be due to disproportion between the maternal pelvis and fetal presenting part.

FETAL POSITION

Fetal position refers to the relationship of the landmark on the presenting fetal part to the anterior, posterior, or sides (right or left) of the maternal pelvis. The landmark on the fetal presenting part is related

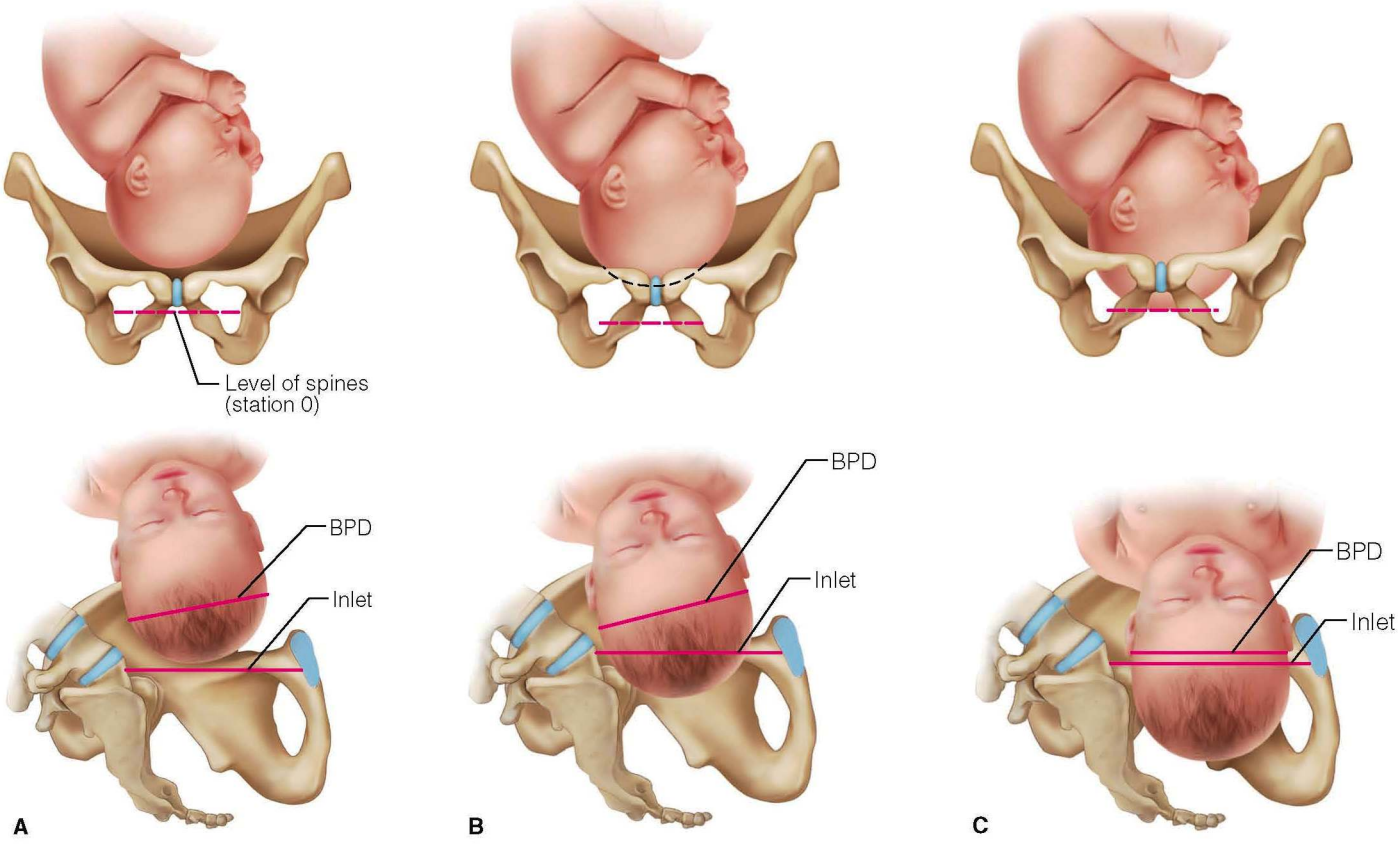


Figure 20–7 ● Process of engagement in cephalic presentation. **A.** Engaged. The biparietal diameter (BPD) of the fetal head is in the inlet of the pelvis. In most instances, the presenting part (occiput) will be at the level of the ischial spines (0 station). **B.** Floating. The fetal head is directed down toward the pelvis but can still easily move away from the inlet. **C.** Dipping. The fetal head dips into the inlet but can be moved away by exerting pressure on the fetus.

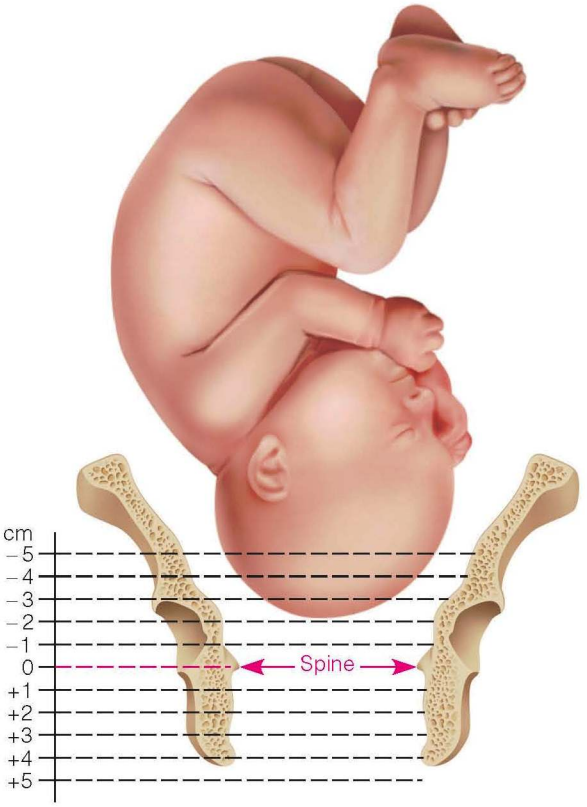


Figure 20–8 ● Measuring the station of the fetal head while it is descending. In this view the station is –2.

to four imaginary quadrants of the maternal pelvis: left anterior, right anterior, left posterior, and right posterior. These quadrants designate where the presenting part is directed. If the landmark is directed toward the center of the side of the pelvis, fetal position is designated as transverse, rather than anterior or posterior.

The landmark chosen for vertex presentations is the occiput, and the landmark for face presentations is the mentum. In breech presentations the sacrum is the designated landmark, and the acromion process on the scapula is the landmark in shoulder presentations.

In summary, three notations are used to describe the fetal position:

1. ***Right (R)*** or ***left (L)*** side of the maternal pelvis
2. The landmark of the fetal presenting part: ***occiput (O)***, ***mentum (M)***, ***sacrum (S)***, or ***acromion (scapula [Sc]) process (A)***
3. ***Anterior (A)***, ***posterior (P)***, or ***transverse (T)***, depending on whether the landmark is in the front, back, or side of the pelvis

The abbreviations of these notations help the healthcare team communicate the fetal position. Thus, when the fetal occiput is directed toward the back and to the left of the passage, the abbreviation used is LOP (left-occiput-posterior). The following is a list of positions for various fetal presentations, some of which are illustrated in Figure 20–9●.

POSITIONS IN VERTEX PRESENTATION

ROA: Right-occiput-anterior
ROT: Right-occiput-transverse
ROP: Right-occiput-posterior
LOA: Left-occiput-anterior
LOT: Left-occiput-transverse
LOP: Left-occiput-posterior

POSITIONS IN FACE PRESENTATION

RMA: Right-mentum-anterior
RMT: Right-mentum-transverse
RMP :Right-mentum-posterior
LMA: Left-mentum-anterior
LMT: Left-mentum-transverse
LMP: Left-mentum-posterior

POSITIONS IN BREECH PRESENTATION

RSA: Right-sacrum-anterior
RST: Right-sacrum-transverse
RSP: Right-sacrum-posterior
LSA: Left-sacrum-anterior
LST: Left-sacrum-transverse
LSP: Left-sacrum-posterior

The term *dorsal (D)* is added when denoting the fetal position in a shoulder presentation; it refers to the fetal back. Thus the abbreviation RADA indicates that the acromion process of the scapula is directed toward the woman's right, and the fetus's back is anterior.

POSITIONS IN SHOULDER PRESENTATION

RADA: Right-acromion-dorsal-anterior
RADP: Right-acromion-dorsal-posterior
LADA: Left-acromion-dorsal-anterior
LADP: Left-acromion-dorsal-posterior

The fetal position influences labor and birth. For example, the fetal head presents a larger diameter in a posterior position than in an anterior position. A posterior position increases the pressure on the maternal sacral nerves, causing the laboring woman to experience backache and pelvic pressure. As a result, the woman may bear down or feel the urge to push earlier than needed. In addition, the second stage of labor may be prolonged when the fetal head remains in a posterior position.

The most common fetal position is occiput anterior. When this position occurs, the labor and birth are more likely to proceed normally. Positions other than occiput anterior are more frequently associated with problems during labor; therefore, they are called *malpositions*. (See Chapter 25 ∞ for discussion of malpositions and their management.)

Assessment techniques to determine fetal position include inspection and palpation of the maternal abdomen and vaginal examination. (See Chapter 21 ∞ for further discussion of assessment of fetal position.)

Physiologic Forces of Labor

Primary and secondary forces work together to deliver the fetus, the fetal membranes, and the placenta from the uterus into the external environment. The *primary force* is uterine muscular contractions, which cause the changes of the first stage of labor—complete effacement and dilatation of the cervix. The *secondary force* is the use of abdominal muscles to push during the second stage of labor. The pushing adds to the primary power after full dilatation.

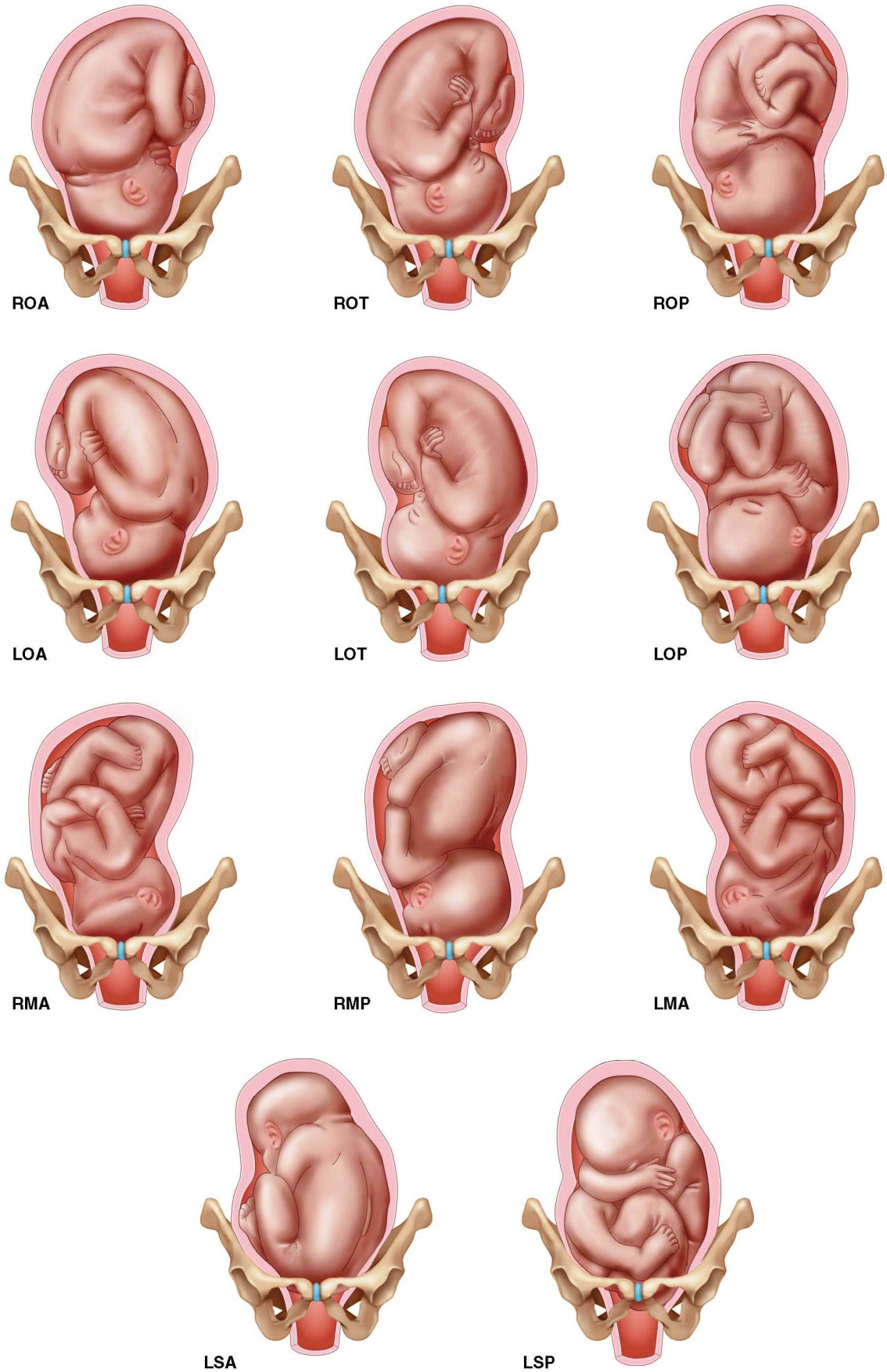


Figure 20–9 ● Categories of presentation.

CONTRACTIONS

Uterine contractions are rhythmic tightenings and shortenings of the uterine muscles during labor. Each contraction has three phases:

1. *Increment:* the "building up" of the contraction (the longest phase)
2. *Acme:* the peak of the contraction
3. *Decrement:* the "letting up" of the contraction

Between contractions is a period of relaxation. This period of relaxation allows uterine muscles to rest and provides respite for the laboring woman. It also restores uteroplacental circulation, which is important to fetal oxygenation and adequate circulation in the uterine blood vessels.

When describing uterine contractions during labor, caregivers use the terms *frequency, duration,* and *intensity.*

Frequency refers to the time between the beginning of one contraction and the beginning of the next contraction. The **duration** of each contraction is measured from the beginning of the contraction to the completion of the contraction (Figure 20–10 ●). In beginning labor, the duration is 30 to 40 seconds. As labor continues, duration increases to 30 to 90 seconds (Anderson & Stone, 2013).

Intensity refers to the strength of the uterine contraction during acme. In most instances the intensity is estimated by palpating the contraction, but it may be measured directly with an intrauterine catheter attached to an electronic fetal monitor. Intensity of uterine contractions cannot be accurately measured by external monitoring with an electronic fetal monitor, because several variables affect the external monitor, including maternal weight, specifically the amount of adipose tissue, and positioning of the monitor on the maternal abdomen. When estimating intensity by palpation, the nurse determines whether it is mild, moderate, or strong by judging the amount of indentability of the uterine wall during the acme of a contraction. If the uterine wall can be indented easily, the contraction is considered mild. Strong intensity exists when the uterine wall cannot be indented. Moderate intensity falls between these two ranges. When intensity is measured with an intrauterine catheter, the normal resting tonus (between contractions) is about 10 to 12 mmHg of pressure. During acme the intensity ranges from 25 to 40 mmHg in early labor, 50 to 70 mmHg in active labor, 80 to 100 mmHg during transition, and greater than 100 mmHg while the woman is pushing in the second stage (Gabbe et al., 2012). (See Chapter 21 ∞ for further discussion of assessment techniques.)

At the beginning of labor the contractions are usually mild, of short duration, and relatively infrequent. As labor progresses, duration and intensity increase, and the frequency is every 2 to 3 minutes. Because the contractions are involuntary, the laboring woman cannot control their duration, frequency, or intensity.

BEARING DOWN

After the cervix is completely dilated, the maternal abdominal musculature contracts as the woman pushes. This pushing is called *bearing down.* The pushing aids in the expulsion of the fetus and the placenta. If the cervix is not completely dilated, bearing down can cause cervical edema (which retards dilatation), possible tearing and bruising of the cervix, and maternal exhaustion. The combined involuntary pressure of the uterine contractions and the voluntary muscle contractions of the abdomen force the fetus toward the outlet so birth can occur.

PSYCHOSOCIAL CONSIDERATIONS

Thus far, the discussion has focused on physical influences on labor outcomes. But the final critical factor is the parents' psychosocial readiness, including their fears, anxieties, birth fantasies, and level of social support. Similar psychosocial factors affect both parents. Both are making a transition into a new role, and both have expectations of themselves and their partner during the labor and birth experience. Although many prospective parents attend childbirth preparation classes, they still tend to be concerned about what labor will be like. Concerns include whether they will each be able to perform the way they expect, whether the discomfort and pain will be more than the mother expects or is able to cope with, whether the father or partner can provide helpful support, and whether they can maintain a sense of control and be advocates for themselves. In addition, both partners face an irrevocable event—the birth of a new family member—and, consequently, disruption of lifestyle, relationships, and self-image.

Many women have preconceived ideas about what birth should be like and some fear "losing control" of their body functions, emotions, or ability to handle the pain associated with labor. Women whose birth experiences do not meet their preconceived ideas may feel loss and disappointment. They may also feel that they have failed to live up to the expectations of friends, family, and peers.

Various factors influence a woman's reaction to labor and contribute to a positive birth experience (Table 20–6). Her accomplishment of the tasks of pregnancy, usual coping mechanisms in response to stressful life events, previous experiences, support system, preparation for childbirth, and cultural influences are all significant factors (Weisman et al., 2010).

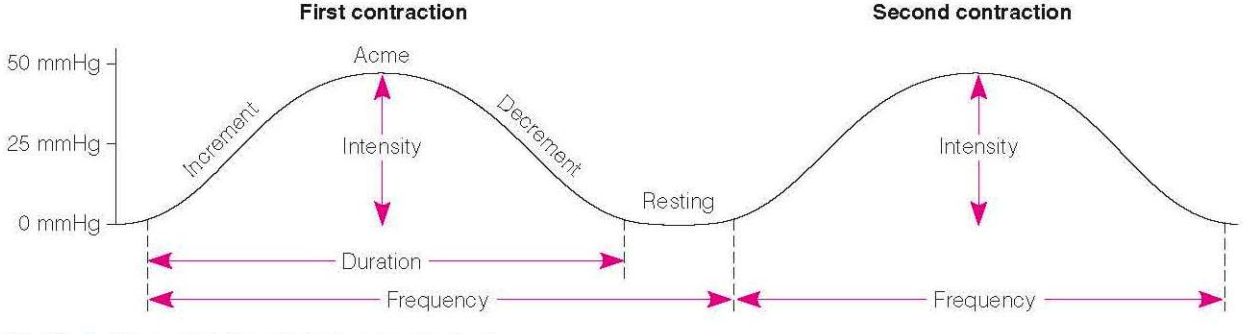


Figure 20–10 ● Characteristics of uterine contractions.

TABLE 20–6 Factors Associated with a Positive Birth Experience

- Motivation for the pregnancy
- Attendance at childbirth education classes
- A sense of competence or mastery
- Self-confidence and self-esteem
- Positive relationship with partner
- Maintaining control during labor
- Support from partner or other person during labor
- Not being left alone in labor
- Trust in the medical/nursing staff
- Having personal control of breathing patterns, comfort measures
- Choosing a physician/certified nurse-midwife who has a similar philosophy of care
- Receiving clear information regarding procedures

Many women have dreams about their birthing experience, their infant, and their early parenting experiences. Dreaming and fantasizing about the unborn baby are a developmental process of pregnancy. The nurse can encourage the woman to share her dreams and fantasies and use them as a tool to examine the woman's expectations, fears, and coping mechanisms. This can assist the woman in forming a maternal role and facilitate bonding with her fetus.

When a woman is facing labor, especially for the first time, she may worry about her ability to withstand the pain of contractions. Some women may place great emphasis on withstanding the pain of childbirth stoically—without medication, crying, moaning, or making other sounds. The nurse's role is to help childbearing families explore options and identify interventions to help each woman cope with the discomfort of labor in a way that is acceptable to her.

The laboring woman's support system may also influence the course of labor and birth. Although some women may prefer not to have a support person or family member with them, for many women the presence of her partner and other significant persons (especially the nurse) tends to have a positive effect. A labor partner's presence at the bedside provides a means to enhance communication and to demonstrate feelings of love. Communication needs may include talking and the use of affectionate and understanding words from the partner. Showing love may take the form of holding hands, hugging, or touching.

How the woman views the birth experience in hindsight may have implications for mothering behaviors. A significant relationship exists between the birth experience and mothering behaviors (Weisman et al., 2010). It appears that any activities by the expectant woman or by healthcare providers that enhance the birth experience will be beneficial to the mother-baby connection. The father's experience of childbirth and his opportunities for bonding may have important implications for fathering as well.

PHYSIOLOGY OF LABOR

In addition to considering the five critical factors affecting the progress of labor and birth, it is essential to explore the physiology of the normal labor experience.

Possible Causes of Labor Onset

Labor usually begins between the 38th and the 42nd week of gestation, when the fetus is mature and ready for birth. Despite medical advances, there is still no full understanding of the biochemical substances and interactions that stimulate labor and birth. Some important aspects have been identified. For example, estrogen is known to stimulate uterine muscle contractions to permit softening, stretching, and eventual thinning of the cervix. Collagen fibers in the cervix are broken down by the action of enzymes such as collagenase and elastase. As the collagen fibers change, their ability to bind is decreased because of increasing amounts of hyaluronic acid (which loosely binds collagen fibrils) and decreasing amounts of dermatan sulfate (which tightly binds collagen fibrils). There is also an increase in the water content of the cervix. All these changes result in a weakening and softening of the cervix, which facilitates cervical stretching and effacement.

Hypotheses have also been formed about the roles of progesterone withdrawal, of prostaglandin, and of corticotropin-releasing hormone.

PROGESTERONE WITHDRAWAL HYPOTHESIS

Progesterone produced by the placenta relaxes uterine smooth muscle by interfering with conduction of impulses from one cell to the next. For this reason, the uterus is usually without coordinated contractions during pregnancy. Biochemical changes toward the end of gestation result in decreased availability of progesterone to myometrial cells. The decrease in availability may be associated with a yet-unknown antiprogestin that inhibits the relaxant effect on the uterus but allows other progesterone actions such as lactogenesis (Blackburn, 2013).

PROSTAGLANDIN HYPOTHESIS

Although the exact relationship between prostaglandin and the onset of labor is not yet established, the effect is clinically demonstrated by the successful induction of labor after vaginal application of prostaglandin E. In addition, preterm labor may be stopped by using an inhibitor of prostaglandin synthesis such as indomethacin (Blackburn, 2013).

The amnion and decidua are the focus of research on the source of prostaglandins. Once prostaglandin is produced, stimuli for its synthesis may include rising levels of estrogen, decreased availability of progesterone, increased levels of oxytocin or response to oxytocin, platelet-activating factor, and endothelin-1(Blackburn, 2013).

CORTICOTROPIN-RELEASING HORMONE HYPOTHESIS

Corticotropin-releasing hormone (CRH) is also a focus for researchers. Its possible role in onset of labor is suggested by the fact that CRH concentration increases throughout pregnancy, with a sharp increase at term. Also, CRH may play a role in increased risk for preterm birth, and CRH levels are elevated in multiple gestations. Finally, CRH is known to stimulate the synthesis of prostaglandin F and prostaglandin E by amnion cells (Blackburn, 2013).

Myometrial Activity

In true labor the uterus divides into two portions. This division is known as the *physiologic retraction ring.* The upper portion, which is the contractile segment, becomes progressively thicker as labor advances. The lower portion, which includes the lower uterine segment and cervix, is passive. As labor continues, the lower uterine segment expands and thins out.

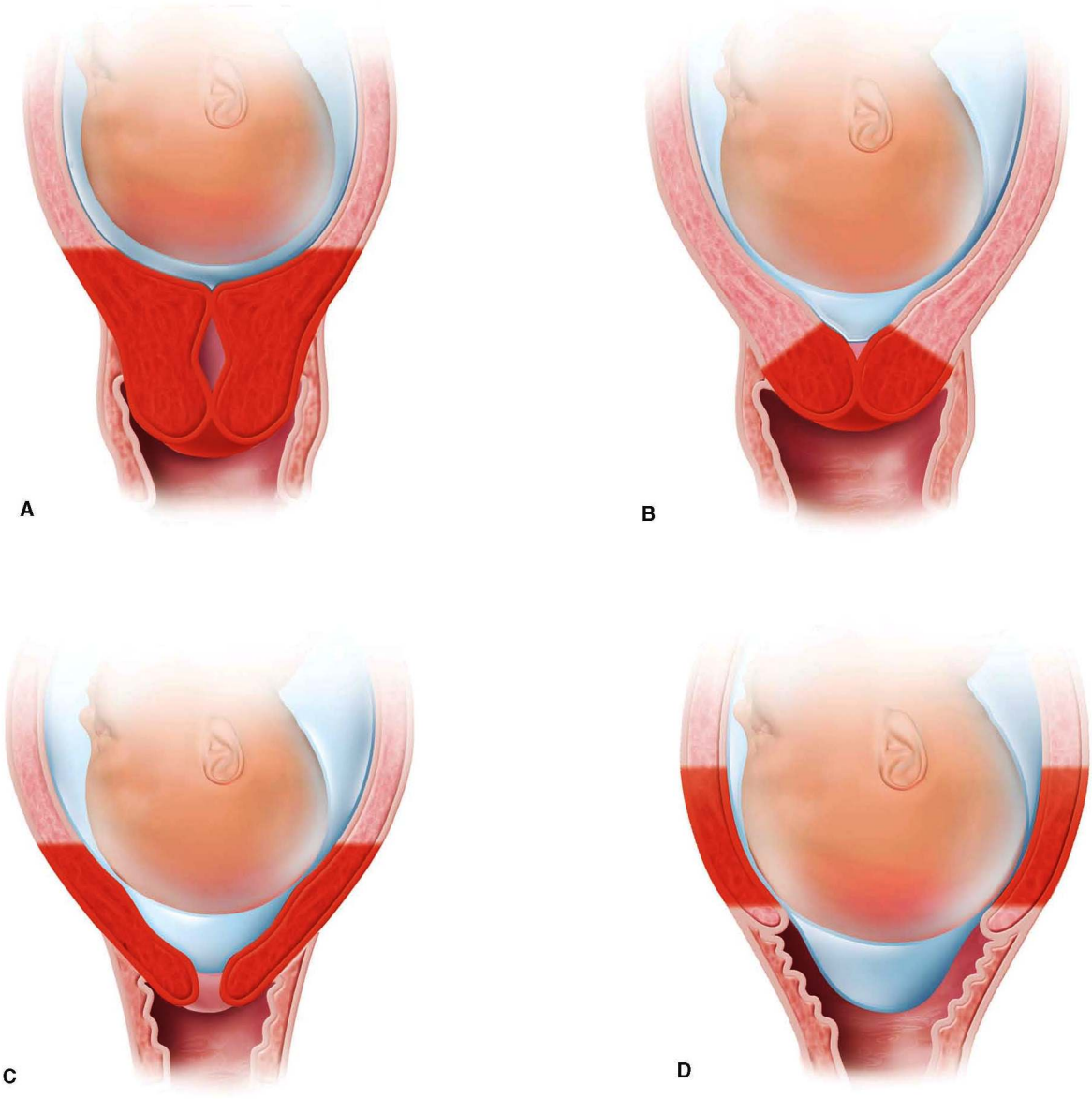


Figure 20–11 ● Effacement of the cervix in the primigravida. **A.** At the beginning of labor, there is no cervical effacement or dilatation. The fetal head is cushioned by amniotic fluid. **B.** Beginning cervical effacement. As the cervix begins to efface, more amniotic fluid collects below the fetal head. **C.** Cervix is about one half (50%) effaced and slightly dilated. The increasing amount of amniotic fluid below the fetal head exerts hydrostatic pressure on the cervix. **D.** Complete effacement and dilatation.

With each contraction, the muscles of the upper uterine segment shorten and exert a longitudinal traction on the cervix, causing effacement. **Effacement** is the taking up (or drawing up) of the internal os and the cervical canal into the uterine side walls. The cervix changes progressively from a long, thick structure to a structure that is tissue-paper thin (Figure 20–11 ●). In primigravidas effacement usually precedes dilatation. The uterine muscle remains shorter and thicker and does not return to its original length. This phenomenon is known as *brachystasis*. The space in the uterine cavity decreases as a result of brachystasis, and this places downward pressure on the fetus (Cunningham et al., 2012).

The uterus elongates with each contraction, decreasing the horizontal diameter. This elongation causes a straightening of the fetal body, pressing the part of the fetus in the upper portion of the uterus against the fundus and thrusting the presenting part down toward the lower uterine segment and the cervix. The pressure exerted by the fetus is called *fetal axis pressure*. As the uterus elongates, the longitudinal muscle fibers are pulled upward over the presenting part. This action and the hydrostatic pressure of the fetal membranes cause **cervical dilatation**. The cervical os and cervical canal widen from less than 1 cm to approximately 10 cm, allowing birth of the fetus. When the cervix is completely dilated and retracted up into the lower uterine segment, it can no longer be palpated.

The round ligament pulls the fundus forward, aligning the fetus with the bony pelvis. This facilitates engagement of the presenting part. Pressure exerted on the cervix by the presenting part aids in both effacement and cervical dilatation (Gabbe et al., 2012).

Musculature Changes in the Pelvic Floor

The levator ani muscle and fascia of the pelvic floor draw the rectum and vagina upward and forward with each contraction, along the curve of the pelvic floor. As the fetal head descends to the pelvic floor, the pressure of the presenting part causes the perineal structure, which was once 5 cm in thickness, to change to a structure less than 1 cm thick. A normal physiologic anesthesia is produced as a result of the decreased blood supply to the area. The anus everts, exposing the interior rectal wall as the fetal head descends forward (Cunningham et al., 2012).

Premonitory Signs of Labor

Most primigravidas and many multiparas experience one or more of the following signs and symptoms of impending labor.

LIGHTENING

Lightening describes the effects that occur when the fetus begins to settle into the pelvic inlet (engagement). With fetal descent, the uterus moves downward, and the fundus no longer presses on the diaphragm, which eases breathing.

However, with increased downward pressure of the presenting part, the woman may notice the following (Cunningham et al., 2012):

- Leg cramps or pains due to pressure on the nerves that course through the obturator foramen in the pelvis
- Increased pelvic pressure
- Increased venous stasis, leading to edema in the lower extremities
- Increased urinary frequency
- Increased vaginal secretions resulting from congestion of the vaginal mucous membranes

BRAXTON HICKS CONTRACTIONS

Before the onset of labor, *Braxton Hicks contractions*—the irregular, intermittent contractions that have been occurring throughout the pregnancy—may become uncomfortable. The pain seems to be in the abdomen and groin but may feel like the "drawing" sensations experienced by some women with dysmenorrhea. When these contractions are strong enough for the woman to believe she is in labor, she is said to be in false labor.

CERVICAL CHANGES

Considerable change occurs in the cervix during the prenatal and intrapartum period. At the beginning of pregnancy the cervix is rigid and firm, and it must soften so that it can stretch and dilate to allow fetal passage. This softening of the cervix, called *ripening*, is under the influence of hormonal factors discussed shortly.

BLOODY SHOW

During pregnancy, cervical secretions accumulate in the cervical canal to form a barrier called a *mucous plug*. With softening and effacement of the cervix, the mucous plug is often expelled, resulting in a small amount of blood loss from the exposed cervical capillaries. The resulting pink-tinged secretions are called **bloody show**.

Bloody show is considered a sign of impending labor, usually within 24 to 48 hours. Vaginal examination that includes manipulation of the cervix may also result in a blood-tinged discharge, which is sometimes confused with bloody show. However, this discharge is typically brownish in color and is not accompanied by the mucous plug.

RUPTURE OF MEMBRANES

In approximately 12% of women, the amniotic membranes rupture before the onset of labor. This is called **rupture of membranes (ROM)**. After membranes rupture, 80% of women will experience spontaneous labor within 24 hours. If membranes rupture and labor does not begin spontaneously within 12 to 24 hours, labor may be induced to avoid infection (once the membranes have ruptured there is an open pathway into the uterine cavity). An induction of labor is done only if the pregnancy is near term.

At the beginning of labor, the amniotic membranes bulge through the cervix in the shape of a cone. When the membranes rupture, the amniotic fluid may be expelled in large amounts. **Spontaneous rupture of membranes (SROM)** generally occurs at the height of an intense contraction with a gush of the fluid out of the vagina. If engagement has not occurred, the danger exists that the umbilical cord may be expelled with the fluid (prolapsed cord). In addition, because of these potential problems, the woman is advised to notify her certified nurse-midwife (CNM) or physician and proceed to the hospital or birthing center. In some instances the fluid is expelled in small amounts and may be confused with episodes of urinary incontinence associated with urinary urgency, coughing, or sneezing. The discharge should be checked to ascertain its source and to determine further action. (See Chapter 21 ∞ for assessment techniques.) In some instances, the membranes are ruptured by the physician/CNM, using an instrument called an amniohook. This procedure is called *amniotomy* or *artificial rupture of membranes (AROM)* and is discussed in Chapter 26 ∞.

Spontaneous rupture of membranes and leakage of amniotic fluid before the onset of labor at any gestational age is known as *premature rupture of membranes (PROM)*. When the membranes rupture and leakage of amniotic fluid from the vagina occurs before 37 weeks of gestation, the term *preterm premature rupture of membranes (PPROM)* is used. PPROM occurs in up to 25% of all cases of preterm labors, complicates more than 3% of pregnancies each year, and is associated with more than one third of preterm births (Posner, Dy, Black, et al., 2012). Infection often precedes PPROM. When PPROM is suspected, strict sterile technique should be used in any vaginal examination. (For a complete discussion of PROM and PPROM, see Chapter 24 ∞.)

SUDDEN BURST OF ENERGY

Some women report a sudden burst of energy approximately 24 to 48 hours before labor. The cause of the energy spurt is unknown. In prenatal teaching the nurse should warn prospective mothers not to overexert themselves and to eat small, nutritious meals during this energy burst so that they will not be excessively tired or weak when labor begins.

OTHER SIGNS

Other premonitory signs include the following:

- Weight loss of 2.2 to 6.6 kg (1 to 3 lb) resulting from fluid loss and electrolyte shifts produced by changes in estrogen and progesterone levels
- Increased backache and sacroiliac pressure from the influence of relaxin hormone on the pelvic joints
- Diarrhea, indigestion, or nausea and vomiting just before the onset of labor (the causes of these signs are unknown)

KEY POINTS

Comparison of True Labor and False Labor

True Labor	False Labor
Contractions are at regular intervals.	Contractions are irregular.
Intervals between contractions gradually shorten.	Usually no change.
Contractions increase in duration and intensity.	Usually no change.
Discomfort begins in back and radiates around to abdomen.	Discomfort is usually in abdomen.
Intensity usually increases with walking.	Walking has no effect on or lessens contractions.
Cervical dilatation and effacement are progressive.	No change.
Contractions do not decrease with rest or warm tub bath.	Rest and warm tub baths lessen contractions.

Differences Between True Labor and False Labor

The contractions of true labor produce progressive dilatation and effacement of the cervix. They occur regularly and increase in frequency, duration, and intensity. The discomfort of true labor contractions usually starts in the back and radiates around to the abdomen. The pain is not relieved by ambulation (in fact, walking may intensify the pain) or by resting.

The contractions of false labor do not produce progressive cervical effacement and dilatation. Classically, they are irregular and do not increase in frequency, duration, and intensity. The contractions may be perceived as a hardening or "balling up" without discomfort, or discomfort may occur mainly in the lower abdomen and groin. The discomfort may be relieved by ambulation, changes of position, resting, or a hot bath or shower (Cunningham et al., 2012). See *Key Points: Comparison of True Labor and False Labor*.

NURSE'S RESPONSE TO FALSE LABOR

During the third trimester, the woman will find it helpful to learn the characteristics of true labor contractions as well as the premonitory signs of ensuing labor. The nurse informs the woman that false labor is common and many times cannot be distinguished from true labor except by vaginal examination. The woman must feel free to come in for accurate assessment of labor and should be counseled not to feel foolish if the labor is false.

In addition, false labor can last for several hours and can be exhausting. The nurse can suggest interventions to decrease the anxiety and physical discomforts associated with false labor such as walking, changing position, or a warm tub bath.

STAGES OF LABOR AND BIRTH

To assist caregivers, common terms have been developed as benchmarks to subdivide the process of labor into *stages* and *phases* of labor. It is important to note, however, that these represent theoretic separations in the process. A laboring woman will not usually experience distinct differences from one to the other. The first stage begins with the beginning of true labor and ends when the cervix is completely dilated at 10 cm. The second stage begins with complete dilatation and ends with the birth of the infant. The third stage begins with the birth of the infant and ends with the expulsion of the placenta.

Some clinicians identify a fourth stage of labor. During this stage, which lasts 1 to 4 hours after expulsion of the placenta, the uterus effectively contracts to control bleeding at the placental site (Cunningham et al., 2012). Nursing care of the laboring woman is discussed in Chapter 22 ∞.

The following discussion characterizes the four stages and their accompanying phases.

First Stage

The first stage of labor is divided into the latent or early, active, and transition phases (Table 20–7). Each phase of labor is characterized by physical and psychologic changes.

LATENT OR EARLY PHASE

The latent or early phase begins with the onset of regular contractions. As the cervix begins to dilate it also effaces, although little or no fetal descent is evident. For a woman in her first labor (nullipara), the latent or early phase averages 8.6 hours but should not exceed 20 hours. This early phase in multiparas averages 5.3 hours but should not exceed 14 hours (Cunningham et al., 2012).

TABLE 20–7 Characteristics of Labor

	First Stage			Second Stage
	Latent (Early) Phase	Active Phase	Transition Phase	
Nullipara	8.6 hr	4.6 hr	3.6 hr	Up to 3 hr
Multipara	5.3 hr	2.4 hr	Variable	0–30 min
Cervical dilatation	0–3 cm	4–7 cm	8–10 cm	
Contractions				
Frequency	Every 3–30 min	Every 2–5 min	Every 1 1/2–2 min	Every 1 1/2–2 min
Duration	20–40 sec	40–60 sec	60–90 sec	60–90 sec
Intensity	Begin as mild and progress to moderate; 25–40 mmHg by intrauterine pressure catheter (IUPC)	Begin as moderate and progress to strong, 50–70 mmHg by IUPC	Strong by palpation; 70–100 mmHg by IUPC	Strong by palpation; 70–90 mmHg by IUPC

Uterine contractions become established during the latent phase and increase in frequency, duration, and intensity. They may start as mild contractions lasting 20 to 40 seconds with a frequency of 3 to 30 minutes. They average 25 to 50 mmHg by intrauterine pressure catheter (IUPC) at acme (Cunningham et al., 2012).

In the early or latent phase of the first stage of labor, contractions are usually mild. The woman feels able to cope with the discomfort. She may be relieved that labor has finally started. Although she may be anxious, she is able to recognize and express those feelings of anxiety. The woman is often talkative and smiling and is eager to talk about herself and answer questions. Excitement is high, and her partner or other support person is often as elated as she is.

ACTIVE PHASE

When the woman enters the early *active phase,* her anxiety tends to increase as she senses the intensification of contractions and pain. She begins to fear a loss of control and may use a variety of coping mechanisms. Some women exhibit a decreased ability to cope and a sense of helplessness. Women who have support persons and family available may experience greater satisfaction and less anxiety than those without support. During this phase the cervix dilates from about 4 to 7 cm. Fetal descent is progressive. The cervical dilatation should be at least 1.2 cm per hour in nulliparas and 1.5 cm per hour in multiparas (Cunningham et al., 2012).

TRANSITION PHASE

The transition phase is the last part of the first stage. When the woman enters the transition phase, she may demonstrate significant anxiety. She becomes acutely aware of the increasing force and intensity of the contractions. She may become restless, frequently changing position. By the time the woman enters the transition phase, she is often inner directed and tired. She may fear being left alone at the same time that the support person may be feeling the need for a break. The nurse should reassure the woman that she will not be left alone. It is crucial that the nurse be available as a relief support at this time and keep the woman informed about where her labor support people are, if they leave the room.

Cervical dilatation slows as it progresses from 8 to 10 cm and the rate of fetal descent increases. The average rate of descent is at least 1 cm per hour in nulliparas and 2 cm per hour in multiparas. The transition phase should not be longer than 3 hours for nulliparas and 1 hour for multiparas (Cunningham et al., 2012). The total duration of the first stage may be increased by approximately 1 hour if epidural anesthesia is used.

During the active and transition phases, contractions become more frequent, are longer in duration, and increase in intensity. At the beginning of the active phase, the contractions have a frequency of 2 to 5 minutes, a duration of 40 to 60 seconds, and are strong in intensity. During transition, contractions have a frequency of 1 1/2 to 2 minutes, a duration of 60 to 90 seconds, and are strong in intensity (Cunningham et al., 2012).

As dilatation approaches 10 cm, there may be increased rectal pressure and an uncontrollable urge to bear down, an increase in bloody show, and rupture of membranes (ROM) (if this has not already occurred). The woman may also fear that she will be "torn open" or "split apart" by the force of the contractions. The woman may experience a sensation of pressure so great with the peak of a contraction that it seems to her that her abdomen will burst open. The woman should be informed that this is a normal sensation and reassured that such bursting will not happen.

During transition the woman will most likely withdraw into herself. Increasingly she may doubt her ability to cope with labor. The woman may become apprehensive and irritable. Although she may be terrified of being left alone, she may not want anyone to talk to her or touch her. However, with the next contraction she may ask for verbal and physical support. She may need help regaining focus. Other characteristics that may accompany this phase include the following:

- Hyperventilation, as the woman increases her breathing rate
- Restlessness
- Difficulty understanding directions
- A sense of bewilderment and anger at the contractions
- Generalized discomfort, including low back pain, shaking, and cramping in the legs
- Increased sensitivity to touch
- Increased need for partner's and/or nurse's presence or support
- Increased apprehension and irritability
- Statements that she "can't take it anymore"
- Requests for medication
- Hiccupping, belching, nausea, or vomiting
- Beads of perspiration on the upper lip
- Increasing rectal pressure
- Curling of her toes
- Loss of control
- Crying or yelling

The woman in this phase is anxious to "get it over with." She may be amnesic and sleep between her now-frequent contractions. Her support persons may start to feel helpless and may turn to the nurse for increased participation as their efforts to alleviate her discomfort seem less effective.

Second Stage

The second stage of labor begins when the cervix is completely dilated (10 cm) and ends with birth of the infant. The second stage is typically completed within 2 hours after the cervix becomes fully dilated for primigravidas (multiparas average 15 minutes). The use of epidural anesthesia may extend the duration of the second stage an additional hour. Contractions continue with a frequency of 1 1/2 to 2 minutes, a duration of 60 to 90 seconds, and strong intensity. Descent of the fetal presenting part continues until it reaches the perineal floor.

As the fetal head descends, the woman has the urge to push because of pressure of the fetal head on the sacral and obturator nerves. As she pushes, intra-abdominal pressure is exerted from contraction of the maternal abdominal muscles. As the fetal head continues its descent, the perineum begins to bulge, flatten, and move anteriorly. The amount of bloody show may increase. The labia begin to part with each contraction. Between contractions, the fetal head appears to recede. With succeeding contractions and maternal pushing effort, the fetal head descends farther. **Crowning** occurs when the fetal head is encircled by the external opening of the vagina (introitus) and means birth is imminent. Some women feel acute, increasingly severe pain and a burning sensation as the perineum distends. The woman may continue to fear that she will tear apart. The nurse needs to instruct the woman to "push through the pain and burning."

Usually, a childbirth-prepared woman feels relieved that the acute pain she felt during the transition phase is over. She also may be relieved that the birth is near and she can now push. Some women feel a sense of control now that they can be actively involved. Others, particularly those without childbirth preparation, may become frightened. They tend to fight each contraction and any attempt of others to persuade them to push with contractions. The woman may feel she has lost control and become embarrassed and apologetic, or she may demonstrate extreme irritability toward the staff or her supporters in an attempt to regain control over external forces against which she feels helpless. Such behavior may be frightening and disconcerting to her support persons. The nurse needs to provide reassurance to the support person(s) that this is a common reaction.

SPONTANEOUS BIRTH (VERTEX PRESENTATION)

As the head distends the vulva with each contraction, the perineum becomes extremely thin, and the anus stretches and protrudes. As extension occurs under the symphysis pubis, the head is born. When the anterior shoulder meets the underside of the symphysis pubis, a gentle push by the mother aids in birth of the shoulders. The body then follows (Figure 20–12●).

POSITIONAL CHANGES OF THE FETUS

For the fetus to pass through the birth canal, the fetal head and body must adjust to the maternal pelvis by certain positional changes. These changes, called **cardinal movements** or *mechanisms of labor*, are described in the order in which they occur (Figure 20–13●).

DESCENT Descent is thought to occur because of four forces: (1) pressure of the amniotic fluid, (2) direct pressure of the fundus of the uterus on the breech of the fetus, (3) contraction of the abdominal muscles, and (4) extension and straightening of the fetal body. The head enters the inlet in the occiput transverse or oblique position because the pelvic inlet is widest from side to side. The sagittal suture is an equal distance from the maternal symphysis pubis and sacral promontory.

FLEXION Flexion occurs as the fetal head descends and meets resistance from the soft tissues of the pelvis, the musculature of the pelvic floor, and the cervix. As a result of the resistance, the fetal chin flexes downward onto the chest.

INTERNAL ROTATION The fetal head must rotate to fit the diameter of the pelvic cavity, which is widest in the anteroposterior diameter. As the occiput of the fetal head meets resistance from the levator ani muscles and their fascia, the occiput rotates from left to right, and the sagittal suture aligns in the anteroposterior pelvic diameter.

EXTENSION The resistance of the pelvic floor and the mechanical movement of the vulva opening anteriorly and forward assist with extension of the fetal head as it passes under the symphysis pubis. With this positional change the occiput, then brow and face, emerge from the vagina.

RESTITUTION The shoulders of the infant enter the pelvis obliquely and remain oblique when the head rotates to the anteroposterior diameter through internal rotation. Because of this rotation the neck becomes twisted. Once the head emerges and is free of pelvic resistance the neck untwists, turning the head to one side (restitution), and aligns with the position of the back in the birth canal.

EXTERNAL ROTATION As the shoulders rotate to the anteroposterior position in the pelvis, the head is turned farther to one side (external rotation).

EXPULSION After the external rotation and through expulsive efforts of the laboring woman, the anterior shoulder meets the undersurface of the symphysis pubis and slips under it. As lateral flexion of the shoulder and head occurs, the anterior shoulder is born before the posterior shoulder. The body follows quickly.

Third Stage

The third stage of labor is defined as the period of time from the birth of the infant until the completed delivery of the placenta.

PLACENTAL SEPARATION

After the infant is born, the uterus contracts firmly, diminishing its capacity and the surface area of placental attachment. The placenta begins to separate because of this decrease in surface area. This separation is accompanied by bleeding, leading to the formation of a hematoma between the placental tissue and the remaining decidua. This hematoma accelerates the separation process. The membranes are the last to separate. They are peeled off the uterine wall as the placenta descends into the vagina.

Signs of placental separation usually appear around 5 minutes after birth of the infant, but can take up to 30 minutes to manifest. These signs are (1) a globular-shaped uterus, (2) a rise of the fundus in the abdomen, (3) a sudden gush or trickle of blood, and (4) further protrusion of the umbilical cord out of the vagina.

PLACENTAL DELIVERY

When the signs of placental separation appear, the woman may bear down to aid in placental expulsion. If this fails and the physician/CNM has ascertained that the fundus is firm, gentle traction may be applied to the cord while pressure is exerted on the fundus. The weight of the placenta as it is guided into the placental pan (a basin that holds the placenta once it is expelled) aids in the removal of the membranes from the uterine wall. A placenta is considered to be *retained* if more than 30 minutes have elapsed from completion of the second stage of labor.

If the placenta separates from the inside to the outer margins, it is expelled with the fetal (shiny) side presenting (Figure 20–14A●). This is known as the *Schultze mechanism* of placental delivery or, more commonly, *shiny Schultze*. If the placenta separates from the outer margins inward, it will roll up and present sideways with the maternal surface delivering first. This is known as the *Duncan mechanism* of placental delivery and is commonly called *dirty Duncan* because the placental surface is rough (Figure 20–14B●). Also see Figures 10–11 and 10–12 ∞ on page 179.

Nursing and medical interventions during the third stage of labor are discussed in Chapter 22 ∞.

Fourth Stage

The fourth stage of labor is the time from 1 to 4 hours after birth in which physiologic readjustment of the mother's body begins.

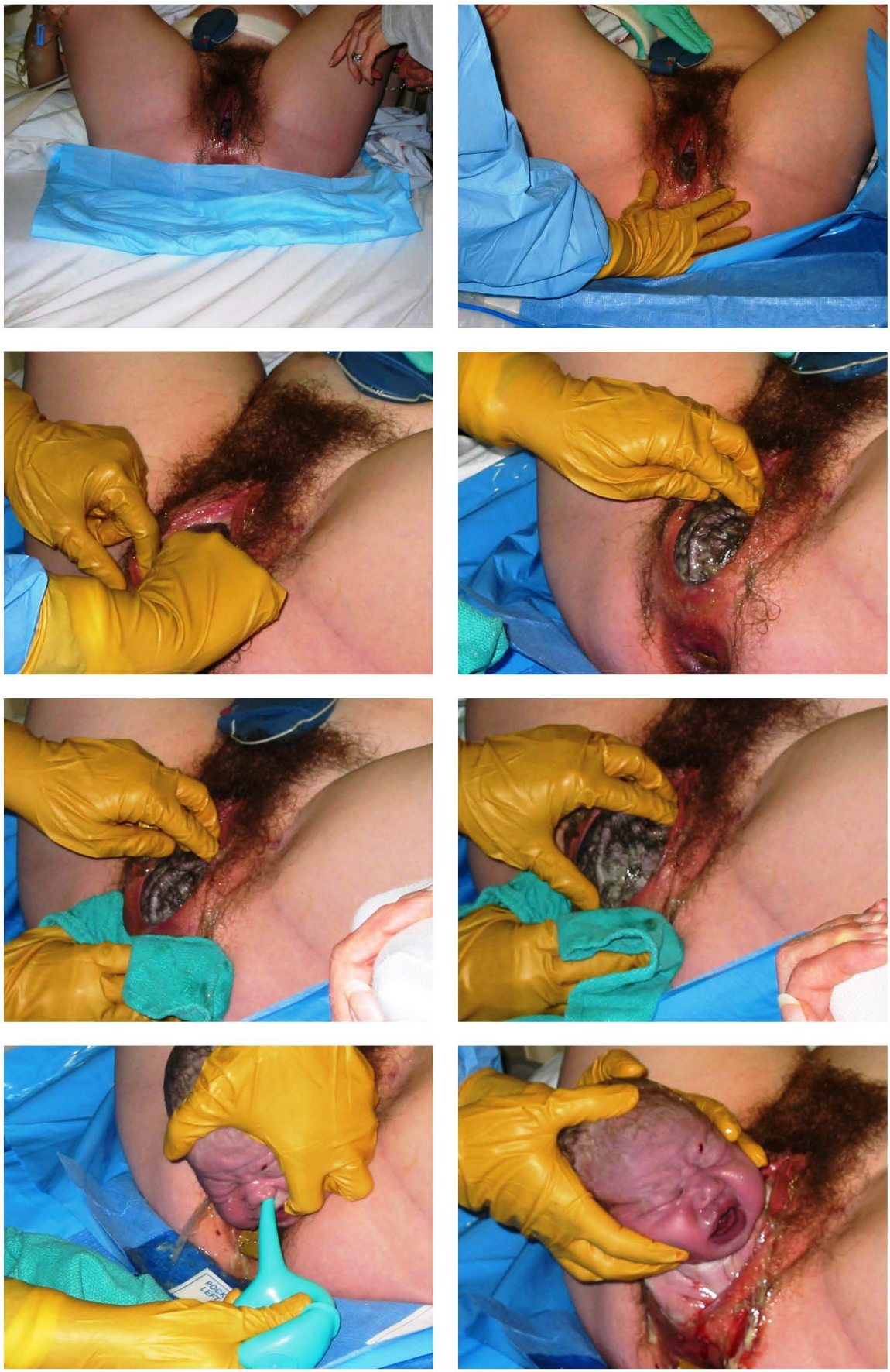


Figure 20–12 ● The birth sequence.

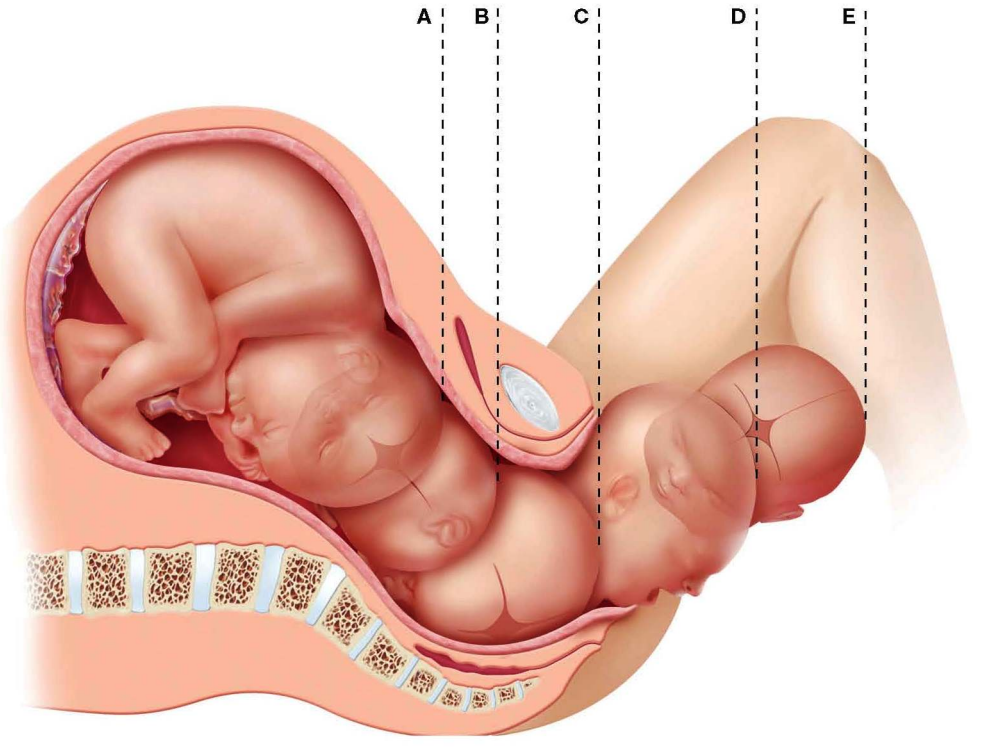


Figure 20–13 ● Cardinal movements (mechanisms of labor). **A.** and **B.** Descent. **C.** Internal rotation. **D.** Extension. **E.** External rotation.

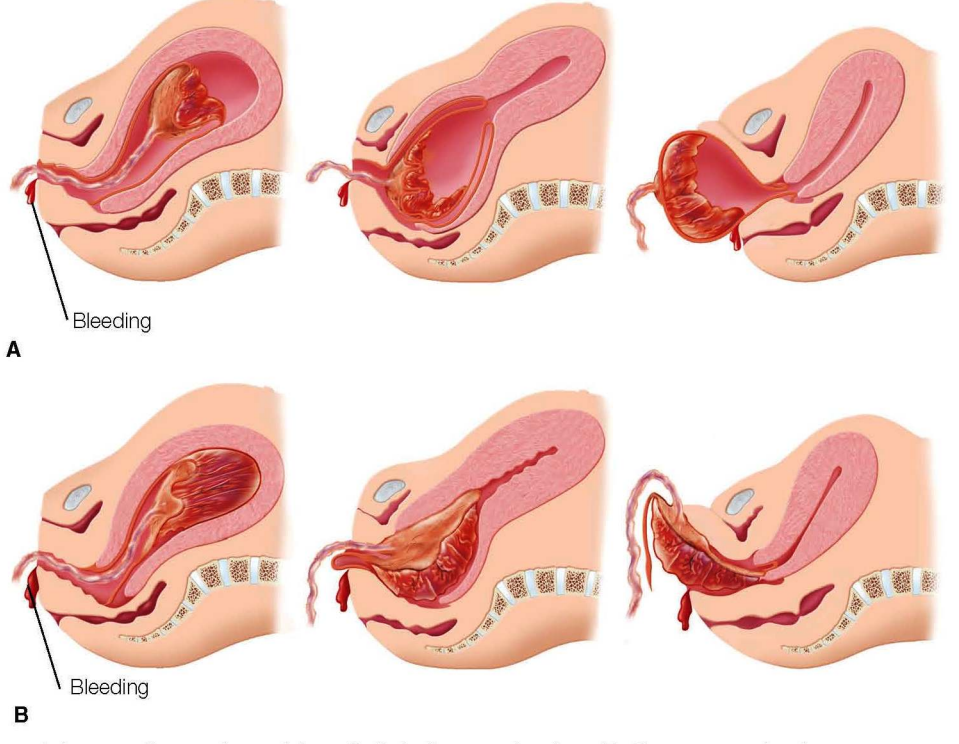


Figure 20–14 ● Placental separation and expulsion. **A.** Schultze mechanism. **B.** Duncan mechanism.

With the birth, hemodynamic changes occur. Blood loss at birth ranges from 250 to 500 mL. With this blood loss and the easing of pressure exerted by the pregnant uterus on the surrounding vessels, blood is redistributed into venous beds. This results in a moderate drop in both systolic and diastolic blood pressure, increased pulse pressure, and moderate tachycardia (Cunningham et al., 2012).

The uterus remains contracted and is in the midline of the abdomen. The fundus is usually midway between the symphysis pubis and umbilicus. Its contracted state constricts the vessels at the site of

placental implantation. Immediately after birth of the placenta, the cervix is widely spread and thick.

Nausea and vomiting experienced during transition usually cease. The woman may be thirsty and hungry. She may experience a shaking chill, which is thought to be associated with the ending of the physical exertion of labor. The bladder is often hypotonic due to trauma during the second stage and/or the administration of anesthetics that may decrease sensations. Hypotonic bladder leads to urinary retention. Nursing care during this stage is discussed in Chapter 22 ∞.

> "I have had the privilege of practicing nursing in the birthing area for many years. In my head I know all the factors that must work together to bring this new life into the world. But it is in my heart and in working with and watching the laboring woman (and her partner if she has one) that I truly believe each labor and birth is a miracle. I, along with these parents, get to participate in a moment of time that will never occur again for any of us. I will never tire of this and will never get enough."

MATERNAL SYSTEMIC RESPONSE TO LABOR

The labor process affects nearly every major body system. Each system adapts to these changes through various compensation mechanisms.

Cardiovascular System

The woman's cardiovascular system is stressed both by the uterine contractions and by the pain, anxiety, and apprehension the woman experiences. In pregnancy, the resting pulse rate increases by 10 to 18 beats per minute (Gabbe et al., 2012). During labor there is a significant increase in cardiac output. Each strong contraction greatly decreases or completely stops the blood flow in the branches of the uterine artery that supply the intervillous space (in the placenta). This leads to a redistribution of about 300 to 500 mL of blood into the peripheral circulation and an increase in peripheral resistance, resulting in increased systolic and diastolic blood pressure, an increasing pulse rate and an increase of about 30% in cardiac output (Cunningham et al., 2012; Posner et al., 2012).

Maternal position also affects cardiac output, blood pressure, and pulse. When the laboring woman turns to a side-lying position, cardiac output increases by about 22%, the pulse rate decreases by about 6 beats per minute, and stroke volume increases by 27%. When the woman is supine, cardiac output increases 25%, stroke volume increases 33%, pulse pressure increases more than 26%, blood pressure rises significantly, and transient tachycardia occurs (Posner et al., 2012).

There is an additional effect on hemodynamics during the bearing-down efforts in the second stage. When the laboring woman holds her breath and pushes against a closed glottis (Valsalva maneuver), intrathoracic pressure rises. As intrathoracic pressure increases, the venous return is interrupted, increasing venous pressure. In addition the blood in the lungs is forced into the left atrium, which leads to a transient increase in cardiac output, blood pressure, and pulse pressure, and causes bradycardia. As venous return to the lungs continues to be diminished while the breath is held, a decrease in blood pressure, pulse pressure, and cardiac output occurs.

When the next breath is taken (Valsalva maneuver is interrupted), the intrathoracic pressure is decreased. Venous return increases, refilling the pulmonary bed and resulting in recovery of the cardiac output and stroke volume. This process is repeated with each pushing effort.

Immediately after birth, cardiac output peaks with an 80% increase over prelabor values. Then in the first 10 minutes it decreases 20% to 25%. Cardiac output further decreases in the first hour after the birth. However, these decreases still leave the woman with an elevated cardiac output for at least 24 hours after the birth (Cunningham et al., 2012).

Blood Pressure

As a result of increased cardiac output, systolic blood pressure rises during uterine contractions. In the first stage, systolic pressure may increase by 35 mmHg, and there may be further increases in the second stage during pushing efforts. Diastolic pressure also increases by about 25 mmHg in the first stage and 65 mmHg in the second stage. These increases begin just before the uterine contraction, with a return to baseline as soon as the contraction ends (Cunningham et al., 2012). Blood pressure may also rise as a result of fear, apprehension, and pain (Gabbe et al., 2012).

Blood pressure may drop precipitously when the woman lies in a supine position and experiences aortocaval compression. In addition to hypotension, there is an increase in the pulse rate, diaphoresis, nausea, weakness, and air hunger. These changes are attributed to the decreased cardiac output and a subsequent drop in stroke volume.

Women with hydramnios, women with multiple gestation, and obese women have the highest risk of developing aortocaval compression. Other predisposing factors include hypovolemia, dehydration, hemorrhage, metabolic acidosis, administration of narcotics (which results in vasodilation and inhibits compensatory mechanisms), and administration of epidural anesthesia, which results in *sympathetic blockade* (blocking of the sympathetic nervous system, leading to vasodilation and hypotension).

Fluid and Electrolyte Balance

Profuse perspiration (diaphoresis) occurs during labor. Hyperventilation also occurs, altering electrolyte and fluid balance from insensible water loss. The muscle activity elevates the body temperature, which increases sweating and evaporation from the skin. As the woman responds to the work of labor, the rise in the respiratory rate increases the evaporative water volume because each breath of air must be warmed to the body temperature and humidified. With the increased evaporative water volume, maintaining adequate oral fluids/hydration is important. Parenteral intravenous fluids may be used to maintain fluid and electrolyte balance.

Respiratory System

Oxygen demand and consumption increase at the onset of labor because of the presence of uterine contractions. Approximately 50% of the increased oxygen is used by the placenta, the uterus, and the fetus (Gabbe et al., 2012). As anxiety and pain from uterine contractions increase, hyperventilation frequently occurs. With hyperventilation there is a fall in $PaCO_2$, and respiratory alkalosis results (Cunningham et al., 2012).

As labor progresses and contractions become more frequent, stronger, and prolonged, the workload, tension, and anxiety of the woman continue to change. A mild increase in the respiratory rate is normal in labor and is related to the increase in metabolism (Gabbe et al., 2012).

By the end of the first stage most women have developed a mild metabolic acidosis compensated by respiratory alkalosis. As she pushes in the second stage of labor, the woman's $PaCO_2$ levels may rise along with blood lactate levels (due to muscular activity), and mild respiratory acidosis occurs. By the time the baby is born (end of second stage), there is metabolic acidosis uncompensated by respiratory alkalosis (Cunningham et al., 2012).

The changes in acid–base status that occur in labor are quickly reversed in the fourth stage because of changes in the woman's respiratory rate. Acid–base levels return to pregnancy levels by 24 hours after birth, and non-pregnant values are attained a few weeks after birth.

Renal System

During labor there is an increase in maternal renin, plasma renin activity, and angiotensinogen. This elevation is thought to be important in the control of uteroplacental blood flow during birth and the early postpartum period (Cunningham et al., 2012).

Polyuria is common during labor. This results from the increase in cardiac output, which causes an increase in the glomerular filtration rate and renal plasma flow. Slight proteinuria occurs in one half to one third of women in labor (Posner et al., 2012).

Structurally, the base of the bladder is pushed forward and upward when engagement occurs. The pressure from the presenting part may impair blood and lymph drainage from the base of the bladder, leading to edema of the tissues (Cunningham et al., 2012). Hematuria may be present as a result of trauma to the lower urinary tract.

Gastrointestinal System

During labor, gastric motility and absorption of solid food are reduced. Gastric emptying time is prolonged, and gastric volume (amount of contents that remain in the stomach) remains over 25 mL, regardless of the time the last meal was taken. This is even more marked in women who have received analgesia agents (Cunningham et al., 2012). These women may be at risk for aspiration should general anesthesia need to be used. During labor, anaerobic and aerobic carbohydrate metabolism rises due to an increase in skeletal muscle activity and maternal anxiety (Gabbe et al., 2012).

The fluid requirements of women in labor have not been clearly established. In some instances oral hydration is the primary goal. In other situations a saline lock may be inserted so that intravenous access is available if needed. If intravenous fluids are used, it is important to remember that when hypertonic glucose infusions are used, there is an increase in maternal blood glucose; this can lead to fetal hyperglycemia and hyperinsulinemia and to hypoglycemia in the newborn.

Immune System and Other Blood Values

The white blood cell (WBC) count increases to 25,000/mm^3 to 30,000/mm^3 during labor and early postpartum (Posner et al., 2012). The change in WBC count is due mostly to increased neutrophils resulting from a physiologic response to stress. The increased WBC count makes it difficult to identify the presence of an infectious process.

Maternal blood glucose levels decrease because glucose is used as an energy source during uterine contractions. The decreased blood glucose levels lead to a decrease in insulin requirements (Cunningham et al., 2012). Glucose levels can drop significantly during a prolonged or difficult labor.

Pain

Pain during labor comes from a complexity of physical causes. Each woman will experience and cope with pain differently. Multiple factors affect a woman's reaction to labor pain.

PAIN DURING LABOR

The pain associated with the first stage of labor is unique in that it accompanies a normal physiologic process. Even though perception of the pain is determined to some extent by cultural patterning, there is unquestionably a physiologic basis for pain during labor. Pain during the first stage of labor arises from (1) dilatation of the cervix, (2) hypoxia of the uterine muscle cells during contraction, (3) stretching of the lower uterine segment, and (4) pressure on adjacent structures. The primary source of pain is dilatation or stretching of the cervix. Nerve impulses travel through the uterine plexus, to the pelvis through hypogastric plexuses, and then into the lumbar sympathetic chain (Figure 20–15 ●). They enter the spinal cord through the posterior roots of the 10th through 12th thoracic and 1st lumbar nerves.

As with other visceral pain, pain from the uterus is also directly referred to the dermatomes supplied by the 10th through 12th thoracic nerves. The areas of referred pain include the lower abdominal wall and the areas over the lower lumbar region and the upper sacrum (Figure 20–16 ●).

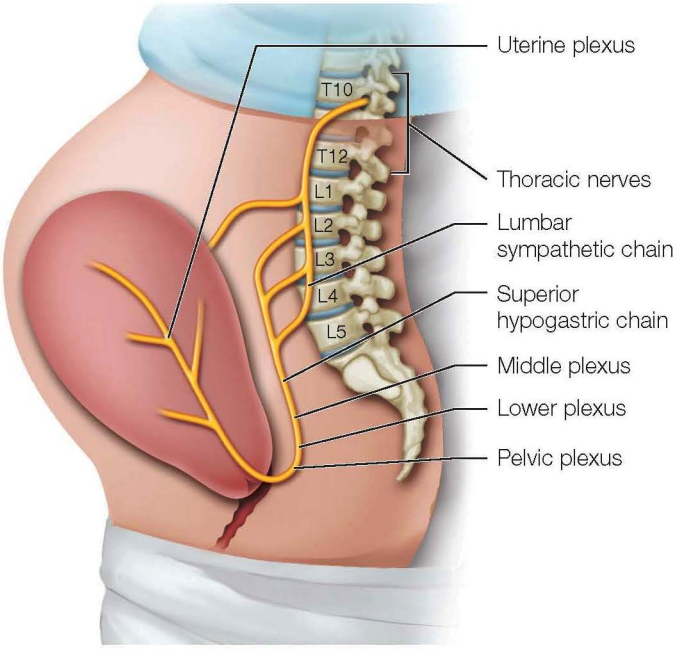


Figure 20–15 ● Pain pathway from uterus to spinal cord. Nerve impulses travel through the uterine plexus; pelvic plexus; lower, middle, and superior hypogastric plexuses; and lumbar sympathetic chain. They enter the neuroaxis through the 10th, 11th, and 12th thoracic and 1st lumbar spinal segments.

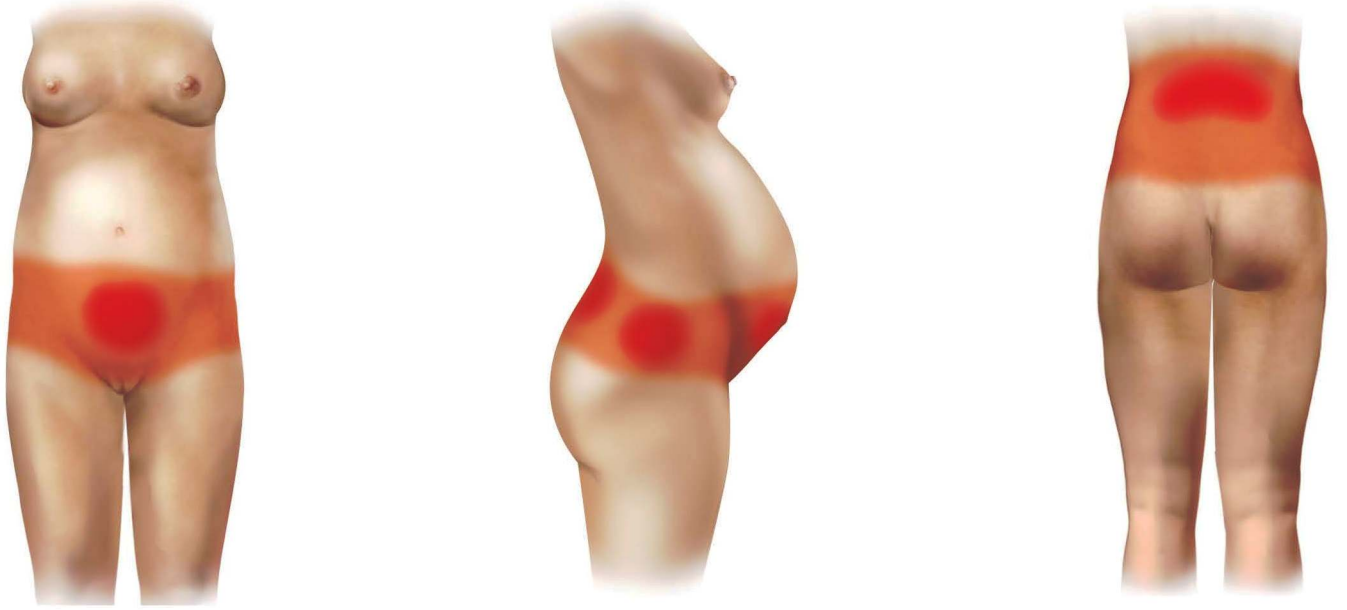


Figure 20–16 ● Area of reference of labor pain during the first stage. Pain is most intense in the darker colored areas.

During the second stage of labor, pain is due to (1) hypoxia of the contracting uterine muscle cells, (2) distention of the vagina and perineum, and (3) pressure on adjacent structures including the lower back, buttocks, and thighs. The nerve impulses from the vagina and perineum are transmitted by way of the pudendal nerve plexus and enter the spinal cord through the posterior roots of the 2nd through 4th sacral nerves. The area of pain increases as shown in Figure 20–17●.

Pain during the third stage results from uterine contractions and cervical dilatation as the placenta is expelled. Sensations of pain are felt above the symphysis pubis bone in the perineal area and in the lower back (Figure 20–18●). The mechanism for the transmission of nerve impulses is the same as for the first stage of labor. The third stage of labor is short, and after this phase anesthesia is needed primarily for episiotomy repair.

FACTORS AFFECTING RESPONSE TO PAIN

Many factors affect the individual's perception of pain impulses. Some psychologic and environmental influences particularly appropriate to labor are discussed here.

Preparation for childbirth has been shown to reduce the need for analgesia during labor. Preparing for labor and birth through reading, talking with others, or attending a childbirth preparation class frequently has positive effects for the laboring woman and her partner. The woman who knows what to expect and what techniques she may use to increase comfort tends to be less anxious during the labor. A tour of the birthing center and an opportunity to see and feel the environment also help reduce anxiety, because during admission (especially with the first child) many new things are happening and they seem to occur all at once. The more the woman and her partner learn during classes and through their own efforts, the more likely they will reduce some anxiety.

Individuals tend to respond to painful stimuli in the way that is acceptable in their culture. In some cultures, it is natural to communicate pain, no matter how mild, whereas members of other cultures stoically accept pain out of fear or because it is expected. Nurses need to be aware of cultural norms and demonstrate culturally sensitive care to women and their families in the intrapartum setting (Spector, 2012).

Families will react to the healthcare system based on their own cultural beliefs. Nurses need to identify specific cultural norms with each individual family so appropriate care can be provided. Whenever possible, requests that include the family's cultural preferences should be incorporated into the woman's care. Nurses should avoid making generalizations about specific cultures. Instead, individual preferences and beliefs should be explored.

Another factor that may influence response to pain is *fatigue* and *sleep deprivation.* The fatigued woman has less energy and ability to use such strategies as distraction or imagination to deal with pain. As a result, she may lose her ability to cope with labor and choose analgesics or other medications to relieve the discomfort.

The woman's *previous experience* with pain also affects her ability to manage current and future pain. Those who have had experience with pain seem more sensitive to painful stimuli than those who have not.

Anxiety can affect a woman's response to pain. Unfamiliar surroundings and events can increase anxiety, as does separation from family and loved ones. The woman's anticipation of discomfort and concerns about whether she can cope with the contractions may also increase her anxiety level. It is not uncommon for laboring women to worry about their partners or other family members. Reassurance from family members that things are being "taken care of at home" can help.

Both attention and distraction have an influence on the perception of pain. When pain sensation is the focus of attention, the perceived intensity is greater. A sensory stimulus such as a backrub can be a distraction that focuses the woman's attention on the stimulus rather than the pain. The nurse can offer suggestions to support persons on interventions to initiate physical distractions for the laboring woman.

The healthcare professional is most likely to interpret pain according to the norms of the healthcare culture, although various other cultures have different ways of responding to pain. The absence of crying and moaning does not necessarily mean that pain is absent, nor does the presence of crying and moaning necessarily mean that pain relief is desired at that moment. It is very important for the nurse to accept and respect the fact that the pain is whatever the woman says it is and to assist her in coping with it.

FETAL RESPONSE TO LABOR

When the fetus is normal, the mechanical and hemodynamic changes of normal labor have no adverse effects.

Heart Rate Changes

Fetal heart rate decelerations can occur with intracranial pressures of 40 to 55 mmHg. The currently accepted explanation of this early deceleration is hypoxic depression of the central nervous system, which is under vagal control. The absence of these head compression decelerations (early decelerations) in some fetuses during labor is explained by the existence of a threshold that is reached more gradually in the presence of intact membranes and lack of maternal resistance. Early decelerations are harmless in the normal fetus.

Acid–Base Status in Labor

The blood flow to the fetus is slowed during the acme of the contraction, which leads to a slow decrease in the fetal pH. During the second stage, as uterine contractions become stronger and last longer and the woman pushes with each contraction, there is a more rapid decrease in fetal pH. There is also an increase in fetal base deficit and in $PaCO_2$ and a drop in fetal oxygen saturation. Persistent acid–base imbalance can lead to multi-organ dysfunction in the infant, including neurologic impairment.

Hemodynamic Changes

The adequate exchange of nutrients and gases in the fetal capillaries and intervillous spaces depends in part on the fetal blood pressure. Fetal blood pressure is a protective mechanism for the normal fetus during the anoxic periods caused by the contracting uterus during labor. The fetal and placental reserve is enough to see the fetus through these anoxic periods unharmed.

Behavioral States

The human fetus develops behavioral states between 36 and 38 weeks of gestation. The behavioral states seem to continue during labor even in the presence of uterine contractions. Two sleep states (quiet and active) are most prevalent, although quiet and active awake states are occasionally observed. A decrease in fetal heart rate variability accompanies the quiet sleep state, and there is also a decrease in fetal breathing movements and other general body activity. The quiet sleep state generally lasts less than 40 minutes.

Fetal Sensation

Beginning at about 37 or 38 weeks' gestation (full term), the fetus is able to experience sensations of light, sound, and touch. Fetal hearing begins to develop at 23 to 24 weeks but is not considered reliable until 28 weeks (Blackburn, 2013). Even in utero, the fetus is sensitive to light and will move away from a bright light source. Additionally, the term baby is aware of pressure sensations during labor such as the touch of the caregiver during a vaginal exam or pressure on the head as a contraction occurs. Although the fetus may not be able to process this input, as the woman labors the fetus is experiencing the labor as well.

FOCUS YOUR STUDY

- Most childbirth classes include information on body-conditioning exercises, relaxation techniques, and breathing methods.
- Five factors that continually interact during labor and birth are the birth passage, the birth passenger (fetus), the relationship between the birth passage and the fetus, the physiologic forces of labor, and factors associated with the woman's psychosocial status.
- Four types of pelvises have been identified, and each has a different effect on labor. The diameters of gynecoid and anthropoid pelvises are usually large enough for labor and birth to progress normally. In the android and platypelloid types, the pelvic diameters are diminished (smaller than in gynecoid and anthropoid). Labor is more likely to be difficult (longer) and a cesarean birth is more likely.
- Important dimensions of the maternal pelvis include the diameters of the pelvic inlet, pelvic cavity, and pelvic outlet.
- The fetal head contains bones in the top portion (cranial vault) that are not fused. This allows them to overlap somewhat in response to the pressures on the fetal head during labor. The pressure and overlapping of the sutures, which are membranous spaces between the cranial bones, result in a change in the shape of the head called molding.
- Fetal attitude refers to the relation of the fetal parts to one another. The head is usually held in midline and not to one side or the other, and the extremities are usually flexed and held close to the body because there is little extra room within the uterine cavity.

- Fetal lie refers to the relationship of the cephalocaudal (head to sacral area) axis of the fetus to the maternal spine. The fetal lie is either longitudinal (both the maternal and fetal spines are vertical) or transverse (the fetal spine is at a right angle to the maternal spine).
- Fetal presentation is determined by the body part lying closest to the inlet of the maternal pelvis. In a longitudinal lie the fetal presentation is usually cephalic (head first) but may also be breech (buttocks or one or both feet first). In a transverse lie the fetal shoulder is usually closest to the pelvic inlet.
- Engagement of the presenting part occurs when the largest diameter of the fetal presenting part reaches or passes through the pelvic inlet.
- Station refers to the relationship of the presenting part to an imaginary line drawn between the maternal ischial spines, which are in the midpoint of the pelvic cavity. The fetal presenting part enters the pelvic inlet at what is termed about a –5 and descends toward the ischial spines, where it is called a 0 (zero) station. Further descent from 0 to +4 occurs as the presenting part descends below the ischial spines toward the vaginal opening.
- Fetal position is the relationship of a specified landmark on the presenting fetal part to the sides, front, or back of the maternal pelvis. Once the position is known, the positions of the fetal head and back can be determined.
- Each uterine contraction has an increment, acme, and decrement.
- Contraction frequency is the time from the beginning of one contraction to the beginning of the next contraction.
- Duration of contractions refers to the period of time from the beginning to the end of one contraction.
- Intensity of contractions refers to the strength of the contraction during acme. Intensity of contractions is termed mild, moderate, or strong.
- Labor stresses the coping skills of women. Women with prenatal education about childbirth usually report more positive responses to labor.
- Women with support persons tend to use their coping skills more effectively than those who lack support.
- Premonitory signs of labor include lightening, Braxton Hicks contractions, cervical softening and effacement, bloody show, sudden burst of energy, weight loss, and, sometimes, rupture of membranes.
- True labor contractions occur regularly with an increase in frequency, duration, and intensity. The contractions usually start in the back and radiate around the abdomen. The discomfort is not relieved by ambulation, rest, or warm tub baths. False labor contractions do not produce progressive cervical effacement and dilatation. They are irregular and do not increase in intensity. The discomfort may be relieved by ambulation, rest, or warm tub baths.
- Possible causes of labor onset include the progesterone withdrawal hypothesis, the prostaglandin hypothesis, and the corticotropin-releasing hormone hypothesis.
- There are four stages of labor and birth. The first stage is from beginning of true labor to complete dilatation of the cervix. The second stage is from complete dilatation of the cervix to birth. The third stage is from birth to expulsion of the placenta. The fourth stage is from expulsion of the placenta to a period of 1 to 4 hours after.
- The fetus accommodates to the maternal pelvis in a series of movements called the cardinal movements of labor, which include descent, flexion, internal rotation, extension, restitution, external rotation, and expulsion.
- Placental separation is indicated by lengthening of the umbilical cord, a small spurt of blood, change in uterine shape, and a rise of the fundus in the abdomen.
- The placenta is expelled by the Schultze or Duncan mechanism. This is determined by the way it separates from the uterine wall.
- Maternal systemic responses to labor involve the cardiovascular, respiratory, renal, gastrointestinal, and immune systems. Cardiac output and blood pressure increase, as do oxygen demand and consumption. Polyuria is common, and gastric motility and absorption are reduced. The white blood cell count increases, and blood glucose levels decrease.
- Factors that affect the response to labor pain include education, cultural beliefs, fatigue and sleep deprivation, personal significance of pain, previous experience, anxiety, and the availability of coping techniques.
- The fetus is usually able to tolerate the labor process with no untoward changes.

CLINICAL REASONING IN ACTION

Ann Nelson, a 28-year-old, G2, P0010 at 41 weeks' gestation, is admitted to the birthing unit where you are working. She is here for cervical ripening and induction of labor due to postdate pregnancy and decreased amniotic fluid volume. A review of her prenatal chart reveals a pertinent history of infertility (Clomid-induced pregnancy) and asthma (treated with inhalers on a PRN basis). The Doppler picks up a fetal heart rate of 120 beats/min. You place Ann on the electronic fetal monitor and obtain the following data: BP 126/76, T 98°F, P 82, R 16; vaginal exam reveals a 20% effaced cervix, 1 cm dilatation in the posterior position, and vertex at –2 station. The fetal monitor shows a fetal heart rate baseline of 120 to 128 with occasional variable decelerations, accelerations to 140 with fetal activity. No contractions are noted on the monitor or palpated. Ann asks you what to expect with "cervical ripening" using prostaglandin gel.

1. Discuss the action of prostaglandin gel.
2. Ann asks you why cervical ripening and induction of labor are recommended for her and her baby. How would you best respond to her?
3. Ann asks how she will know if she is getting contractions. How would you answer her?
4. Discuss the difference between mild, moderate, and strong contractions.
5. Describe the latent phase of labor.

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