Nursing Care of a Newborn and Family

Key Terms

acrocyanosis
caput succeda-
   neum
cavernous
   hemangioma
central
   cyanosis
cephal-
   hematoma
conduction
convection
erythema
   toxicum
evaporation
hemangioma
jaundice
kangaroo care
kernicterus
lanugo
meconium
milia
mongolian spot

natal teeth
neonatal
   period
neonate
nevus
   flammeus
physiologic
   jaundice
pseudomen-
   struation
radiation
strawberry
   heman-
   gioma
subconjunc-
   tival
   hem-
   orrhage
thrush
transitional
   stool
vernix
   caseosa

Objectives

After mastering the contents of this chapter, you should be able to:

1. Describe the normal characteristics of a term newborn.
2. Assess a newborn for normal growth and development.
3. Formulate nursing diagnoses related to a newborn or the family of a newborn.
4. Identify expected outcomes for a newborn and family during the first 4 weeks of life.
5. Plan nursing care to augment normal development of a newborn, such as ways to aid parent–child bonding.
6. Implement nursing care of a normal newborn, such as administering a first bath or instructing parents on how to care for their newborn.
7. Evaluate expected outcomes to determine effectiveness of nursing care and outcome achievement.
8. Identify National Health Goals related to newborns that nurses could help the nation achieve.
9. Identify areas related to newborn assessment and care that could benefit from additional nursing research or application of evidence-based practice.
10. Use critical thinking to analyze ways that the care of a term newborn can be more family centered.
11. Integrate knowledge of newborn growth and development and immediate care needs with the nursing process to achieve quality maternal and child health nursing care.

*C*arlotta Ruiz has just given birth to her second child, a 6-lb, 5-oz baby girl she named Beth. Newborn Apgar scores at 1 and 5 minutes were 6 and 8. Vital signs are: temperature (axillary), 98.2°F (36.8°C); heart rate, 136 bpm; respirations, 74 breaths per minute. She is 18.5 inches long, with a head circumference of 34 cm and a chest circumference of 32 cm. She has a small port-wine birthmark on her right thigh.

While Jose, Carlotta's husband, is in the room, Carlotta tells you she is a "veteran" at baby care. Jose adds, "Little Joe {their 3-year-old} will be so excited to see his new sister. That's all he's been talking about lately."

When Carlotta is alone, you notice she seems a little apprehensive about caring for her new daughter. She tells you, "She's so much smaller than Joe was. And why does it sound like she has a cold? And what is this rash all over her? Isn't it bad enough she has a birthmark?"

Previous chapters described the care of the pregnant woman and family during the antepartal, intrapartal, and postpartal periods. This chapter adds information about caring for a newborn and family to your knowledge base.

Does Carlotta know as much about newborns as she thought? What additional teaching does this family need?

After you've studied this chapter, access the accompanying website. Read the patient scenario and answer the questions to further sharpen your skills, grow more familiar with RN-CLEX types of questions, and reward yourself with how much you have learned.

Newborns undergo profound physiologic changes at the moment of birth (and, probably, psychological changes as well), as they are released from a warm, snug, dark, liquid-filled environment that has met all of their basic needs, into a chilly, unbounded, brightly lit, gravity-based, outside world.

Within minutes after being plunged into this strange environment, a newborn's body must initiate respirations and accommodate a circulatory system to extrauterine oxygenation. Within 24 hours, neurologic, renal, endocrine, gastrointestinal, and metabolic functions must be operating competently for life to be sustained.

How well a newborn makes these major adjustments depends on his or her genetic composition, the competency of the recent intrauterine environment, the care received during the labor and birth period, and the care received during the newborn or **neonatal period** (from birth through the first 28 days of life). National Health Goals related to the first days of life are shown in Box 24.1. Nurses can play a major role in achieving these goals.

Two thirds of all deaths that occur during the first year of life occur in the neonatal period. More than half occur in the first 24 hours after birth—an indication of how hazardous this time is for an infant. Close observation of a newborn for indications of distress is essential during this period (National Center for Health Statistics, 2005).

Nursing Process Overview

For Health Promotion of the Term Newborn

● *Assessment*

Assessment of a newborn or **neonate** (a baby in the neonatal period) includes a review of the mother's pregnancy history; physical examination of the infant; analysis of laboratory reports such as hematocrit and blood type, if indicated; and assessment of parent–child interaction for the beginning of bonding. Assessment begins immediately after birth and is continued at every contact during a newborn's hospital or birthing center stay, early home visits, and well-baby visits. Teaching parents to make assessments concerning their infant's temperature, respiratory rate, and overall health is crucial so that they can continue to monitor their infant's health at home (Box 24.2).

● *Nursing Diagnosis*

Nursing diagnoses associated with a newborn often center on the problems of establishing respirations, beginning nutrition, and assisting with parent–newborn bonding. Examples are the following:

• Ineffective airway clearance related to mucus in airway
• Ineffective thermoregulation related to heat loss from exposure in birthing room

BOX 24.1 FOCUS ON . . .

NATIONAL HEALTH GOALS

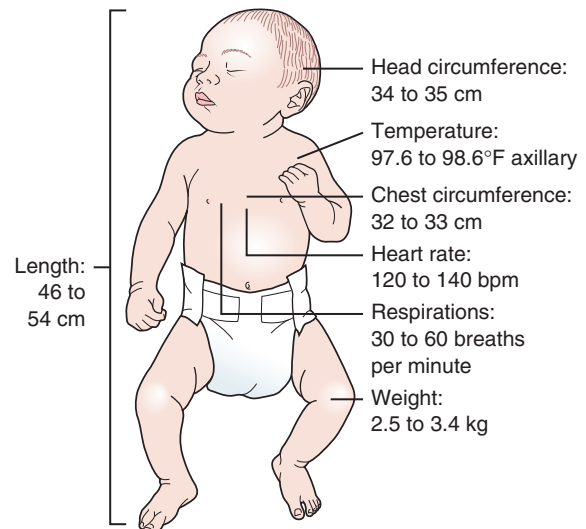A number of National Health Goals deal directly with the newborn period (DHHS, 2000):

• Increase to at least 75% the proportion of mothers who breast-feed their babies in the early postpartal period, from a baseline of 64%.
• Increase to at least 50% the proportion of women who continue breast-feeding until their babies are 5 to 6 months old, from a baseline of 29%.
• Increase to 70% the percentage of healthy full-term infants who are put to sleep on their backs, from a baseline of 35%.
• Increase to at least 75% the proportion of parents and caregivers who use feeding practices that prevent baby-bottle tooth decay.
• Reduce the neonatal mortality rate to no more than 2.9 per 1,000 live births, from a baseline of 4.8 per 1,000 live births.

Nurses can help the nation achieve these goals, by encouraging women not only to begin breast-feeding but also to continue it through the first 6 months of life; by advising parents on the advantage of placing infants on their backs to sleep and on the danger of tooth decay from letting a baby drink from a bottle of milk or juice while falling asleep; and by discussing with parents who use formula the proper methods for preparation so that gastrointestinal illness does not occur.

Areas that could benefit from additional nursing research include identifying the reasons why some women end breast-feeding shortly after discharge from a health care agency and investigating common methods of encouraging sleep in infants other than by a bottle-feeding.

BOX 24.2 ASSESSMENT

Assessing the Average Newborn

Head circumference: 34 to 35 cm
Temperature: 97.6 to 98.6°F axillary
Chest circumference: 32 to 33 cm
Heart rate: 120 to 140 bpm
Respirations: 30 to 60 breaths per minute
Weight: 2.5 to 3.4 kg
Length: 46 to 54 cm

- Imbalanced nutrition, less than body requirements, related to poor sucking reflex
- Readiness for enhanced family coping related to birth of planned infant
- Health-seeking behaviors related to newborn needs

If a minor deviation from the normal is present, such as a hemangioma, a diagnosis such as "Parental fear related to hemangioma on left thigh of newborn" might be relevant.

● *Outcome Identification and Planning*

Planning nursing care should take into account both the newborn's needs during this transition period and the mother's need for adequate rest during the postpartal period. Try to adapt teaching time to the schedules of the mother and her newborn. Although the woman must learn as much as possible about newborn care, she also must go home from the health care setting with enough energy to practice what she has learned. Important planning measures for newborns include helping them regulate their temperature and helping them grow accustomed to breast- or bottle-feeding.

● *Implementation*

A major portion of implementation in the newborn period is role modeling to help new parents grow confident with their newborn. Be aware how closely parents observe you for guidance in newborn care. Conserving newborn warmth and energy, to help prevent hypoglycemia and respiratory distress, should be an important consideration to accompany all interventions.

● *Outcome Evaluation*

Evaluation of expected outcomes should reveal that the parents are able to give beginning newborn care with confidence. Be certain parents make arrangements for continued health supervision for their newborn, so that evaluation can be continued and the family's long-term health needs can be met. Examples indicating achievement of outcomes are the following:

- Infant establishes respirations of 30 to 60 per minute.
- Infant maintains temperature at 97.8°F to 98.6°F (36.5°C to 37°C).
- Infant breast-feeds for a minimum of 10 minutes every 3 hours.

PROFILE OF A NEWBORN

It is not unusual to hear the comment "all newborns look alike" from people viewing a nursery full of babies. In actuality, every child is born with individual physical and personality characteristics that make him or her unique right from the start (Fig. 24.1).

Some newborns are born stocky and short, some large and bony, some thin and rangy. Some have a temperament that causes them to feed greedily, protest procedures loudly, and respond to their parent's inexperienced handling with restlessness and spitting up. Other newborns sleep soundly, make no protest over procedures or diaper changes, and seem passive in accepting this new step in life. With experience in working with newborns, it be-

FIGURE 24.1 Personality is apparent in a newborn from the start. Note the alert, searching interest.

comes easier to differentiate newborns who are merely demonstrating the extremes of normal behavior from those whose behavior or appearance indicates a need for more skilled care than is available in typical rooming-in surroundings.

Vital Statistics

Vital statistics for a newborn include weight, length, and head and chest circumference. The technique for obtaining these is shown in Chapter 33, along with other aspects of health assessment. Be sure all health care providers involved with newborns are aware of safety issues specific to newborn care when taking these measurements (e.g., not leaving a newborn unattended on a bed or scale).

Weight

The birth weight of newborns varies depending on the racial, nutritional, intrauterine, and genetic factors that were present during conception and pregnancy. The weight in relation to the gestational age should be plotted on a standard neonatal graph, such as the one shown in Appendix E. Plotting weight helps identify newborns who are at risk because of their small size. This information also separates those who are small for their gestational age (newborns who have suffered intrauterine growth restriction) from preterm infants (infants who are healthy but small only because they were born early). These first measurements also establish a baseline for future evaluation.

Plotting weight in conjunction with height and head circumference is also helpful because it highlights disproportionate measurements (see Appendix E). All three of these measurements should fall near the same percentile in an individual child. For example, a newborn who falls within the 50th percentile for height and weight but whose head circumference is in the 90th percentile may have abnormal head growth. A newborn who is in the 50th percentile for

weight and head circumference but in the 3rd percentile for height may have a growth problem.

Second-born children usually weigh more than first-borns. Birth weight continues to increase with each succeeding child in a family.

The average birth weight (50th percentile) for a white, mature female newborn in the United States is 3.4 kg (7.5 lb); for a white, mature male newborn, it is 3.5 kg (7.7 lb). Newborns of other races weigh approximately 0.5 lb less. The arbitrary lower limit of normal for all races is 2.5 kg (5.5 lb). Birth weight exceeding 4.7 kg (10 lb) is unusual, but weights as high as 7.7 kg (17 lb) have been documented. If a newborn weighs more than 4.7 kg, a maternal illness, such as diabetes mellitus, must be suspected (Katz, 2003).

A newborn loses 5% to 10% of birth weight (6 to 10 oz) during the first few days after birth. This weight loss occurs because the newborn is no longer under the influence of salt- and fluid-retaining maternal hormones. Diuresis begins to remove a part of the infant's high fluid load during the second to third day of life. A newborn also voids and passes stool, all measures that reduce weight, because approximately 75% to 90% of a newborn's weight is fluid. In addition, breast-fed newborns have a limited intake until about the third day of life because of the relatively low caloric content and amount of colostrum. If newborns are formula-fed, their intake during this time is also limited because of the time needed to establish effective sucking.

After this initial loss of weight, a newborn has 1 day of stable weight, then begins to gain weight. The breast-fed newborn recaptures birth weight within 10 days; a formula-fed infant accomplishes this gain within 7 days. After this, a newborn begins to gain about 2 lb/month (6 to 8 oz/week) for the first 6 months of life.

Length

The average birth length (50th percentile) of a mature female neonate is 53 cm (20.9 in). For mature males, the average birth length is 54 cm (21.3 in). The lower limit of normal length is arbitrarily set at 46 cm (18 in). Although rare, babies with lengths as great as 57.5 cm (24 in) have been reported.

Head Circumference

In a mature newborn, the head circumference is usually 34 to 35 cm (13.5 to 14 in). A mature newborn with a head circumference greater than 37 cm (14.8 in) or less than 33 cm (13.2 in) should be carefully investigated for neurologic involvement, although occasionally a well newborn falls within these limits. Head circumference is measured with a tape measure drawn across the center of the forehead and around the most prominent portion of the posterior head (the occiput; see Fig. 18.2 in Chapter 18).

Chest Circumference

The chest circumference in a term newborn is about 2 cm (0.75 to 1 in) less than head circumference. This is measured at the level of the nipples. If a large amount of breast tissue or edema of breasts is present, this measurement will not be accurate until the edema has subsided.

Vital Signs

Vital sign measurements begin to change from those present in intrauterine life at the moment of birth.

Temperature

The temperature of newborns is about 99°F (37.2°C) at birth because they have been confined in an internal body organ. The temperature falls almost immediately to below normal because of heat loss and immature temperature-regulating mechanisms. The temperature of birthing rooms, approximately 68°F to 72°F (21°C to 22°C), can add to this loss of heat.

Newborns lose heat by four separate mechanisms: convection, conduction, radiation, and evaporation (Fig. 24.2).

Convection is the flow of heat from the newborn's body surface to cooler surrounding air. The effectiveness of convection depends on the velocity of the flow (a current of air cools faster than nonmoving air). Eliminating drafts, such as from windows or air conditioners, reduces convection heat loss.

Conduction is the transfer of body heat to a cooler solid object in contact with a baby. For example, a baby placed on a cold counter or on the cold base of a warming unit quickly loses heat to the colder metal surface. Covering surfaces with a warmed blanket or towel helps to minimize conduction heat loss.

Radiation is the transfer of body heat to a cooler solid object not in contact with the baby, such as a cold window or air conditioner. Moving an infant as far from the cold surface as possible helps reduce this type of heat loss.

Evaporation is loss of heat through conversion of a liquid to a vapor. Newborns are wet, and they lose a great deal of heat as the amniotic fluid on their skin evaporates. To prevent this heat loss, dry newborns as soon as possible, especially their face and hair, which will not be covered by clothing. The head, a large surface area in a newborn, can be responsible for a great amount of heat loss. Covering the hair with a cap after drying it further reduces the possibility of evaporation cooling.

A newborn not only loses heat easily by the means just described but also has difficulty conserving heat under any circumstance. Insulation, an efficient means of conserving heat in adults, is not effective in newborns because they have little subcutaneous fat to provide insulation. Shivering, a means of increasing metabolism and thereby providing heat in adults, is also rarely seen in newborns.

Newborns can conserve heat by constricting blood vessels and moving blood away from the skin. *Brown fat,* a special tissue found in mature newborns, apparently helps to conserve or produce body heat by increasing metabolism. The greatest amounts of brown fat are found in the intrascapular region, thorax, and perirenal area. Brown fat is thought to aid in controlling newborn temperature similar to temperature control in a hibernating animal. In later life, it may influence the proportion of body fat retained.

Newborns exposed to cool air tend to kick and cry to increase their metabolic rate and produce more heat. This re-
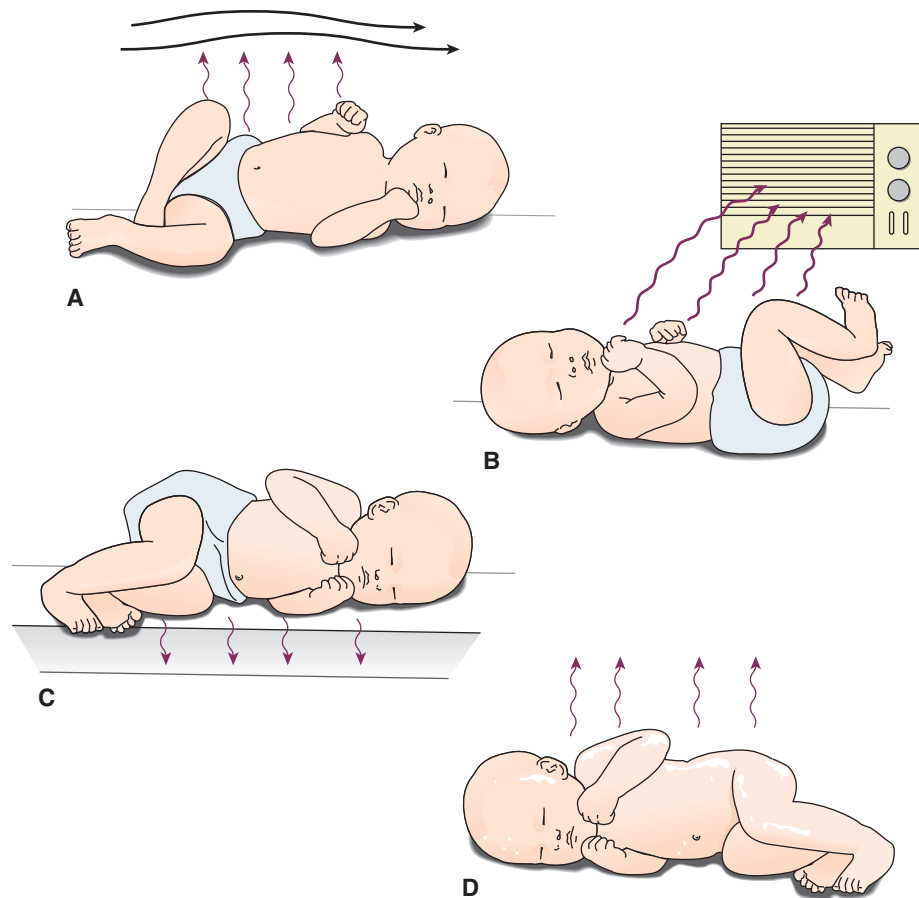
FIGURE 24.2 Heat loss in the newborn. (**A**) Convection. (**B**) Radiation. (**C**) Conduction. (**D**) Evaporation.

action, however, also increases their need for oxygen and their respiratory rate. An immature newborn with poor lung development has trouble making such an adjustment. Newborns who cannot increase their respiratory rate in response to increased needs will be unable to deliver sufficient oxygen to their systems. The resultant anaerobic catabolism of body cells releases acid. Every newborn is born slightly acidotic. Any new buildup of acid may lead to severe, life-threatening acidosis. In addition, a newborn becomes fatigued by rapid breathing, placing additional strain on an already stressed cardiovascular system.

Drying and wrapping newborns and placing them in warmed cribs, or drying them and placing them under a radiant heat source, are excellent mechanical measures to help conserve heat. In addition, placing a newborn against the mother's skin and then covering the newborn also helps to transfer heat from the mother to the newborn; this is termed **kangaroo care** (Anderson et al., 2005).

All early care of newborns should be done speedily to avoid exposing the newborn unnecessarily. Any procedure during which a newborn must be uncovered (e.g., resuscitation, circumcision) should be done under a radiant heat source to prevent damaging heat loss. If chilling is prevented, a newborn's temperature stabilizes at 98.6°F (37°C) within 4 hours after birth.

In contrast to an adult, a newborn with a bacterial infection may run a subnormal temperature. Therefore, if a newborn's temperature does not stabilize shortly after birth, the cause must be investigated so that corrective measures can be taken.

Pulse

The heart rate of a fetus in utero averages 120 to 160 bpm. Immediately after birth, as the newborn struggles to initiate respirations, the heart rate may be as rapid as 180 bpm. Within 1 hour after birth, as the newborn settles down to sleep, the heart rate stabilizes to an average of 120 to 140 bpm.

The heart rate of a newborn often remains slightly irregular because of immaturity of the cardiac regulatory center in the medulla. Transient murmurs may result from the incomplete closure of fetal circulation shunts. During crying, the rate may rise again to 180 bpm. In addition, heart rate can decrease during sleep, ranging from 90 to 110 bpm.

You should be able to palpate femoral pulses in a newborn, but the radial and temporal pulses are more difficult to palpate with any degree of accuracy. Therefore, a newborn's heart rate is always determined by listening for an apical heartbeat for a full minute, rather than assessing a pulse in an extremity. Always palpate for femoral pulses, because their absence suggests possible coarctation (narrowing) of the aorta, a cardiovascular abnormality.

Respiration

The respiratory rate of a newborn in the first few minutes of life may be as high as 80 breaths per minute. As respiratory activity is established and maintained, this rate settles to an average of 30 to 60 breaths per minute when the newborn is at rest. Respiratory depth, rate, and rhythm are

likely to be irregular, and short periods of apnea (without cyanosis), sometimes called *periodic respirations,* are normal. Respiratory rate can be observed most easily by watching the movement of a newborn's abdomen, because breathing primarily involves the use of the diaphragm and abdominal muscles.

Coughing and sneezing reflexes are present at birth to clear the airway. Newborns are obligate nose-breathers and show signs of acute distress if their nostrils become obstructed. Short periods of crying, which increase the depth of respirations and aid in aerating deep portions of the lungs, may be beneficial to a newborn. Long periods of crying, however, exhaust the cardiovascular system and serve no purpose.

Blood Pressure

The blood pressure of a newborn is approximately 80/46 mm Hg at birth. By the 10th day, it rises to about 100/50 mm Hg. Because measurement of blood pressure in a newborn is somewhat inaccurate, it is not routinely measured unless a cardiac anomaly is suspected. For an accurate reading, the cuff width used must be no more than two thirds the length of the upper arm or thigh. Blood pressure tends to increase with crying (and a newborn cries when disturbed and manipulated by such procedures as taking blood pressure). A Doppler method may be used to take blood pressure (see Chapters 33 and 36). Hemodynamic monitoring is helpful when continuous assessment is necessary.

✔ **Checkpoint Question 1**

Beth Ruiz, like all newborns, can lose body heat by conduction. Under which condition is this most apt to occur?

a. If the nursery is cooled by air conditioning.
b. If the infant is wet from amniotic fluid.
c. If there is a breeze from an open window.
d. If Beth is placed in a cold bassinet.

Physiologic Function

Just as changes occur in vital signs after birth, so do changes occur in all the major body systems.

Cardiovascular System

Changes in the cardiovascular system are necessary after birth because now the lungs must oxygenate the blood that was formerly oxygenated by the placenta. When the cord is clamped, a neonate is forced to take in oxygen through the lungs. As the lungs inflate for the first time, pressure decreases in the chest generally, and in the pulmonary artery specifically (the artery leading to the lungs). This decrease in pressure in the pulmonary artery plays a role in promoting closure of the ductus arteriosus, a fetal shunt. As pressure increases in the left side of the heart from increased blood volume, the foramen ovale between

the two atria closes because of the pressure against the lip of the structure (permanent closure does not occur for weeks). With the remaining fetal circulatory structures (umbilical vein, two umbilical arteries, and ductus venosus) no longer receiving blood, the blood within them clots, and the vessels atrophy over the next few weeks.

Figure 24.3 shows the respiratory and cardiovascular changes that occur at birth, beginning with the first breath.

The peripheral circulation of a newborn remains sluggish for at least the first 24 hours. It is common to observe cyanosis in the infant's feet and hands (**acrocyanosis**) and for the feet to feel cold to the touch at this time.

Blood Values. A newborn's blood volume is 80 to 110 mL per kilogram of body weight, or about 300 mL total. The oxygen dissociation curve is shifted to the left; that is, the quantity of oxygen bound to hemoglobin and the partial pressure of oxygen are greater in fetal blood than in a newborn's.

Because of the nature of fetal circulation, a baby is born with a high erythrocyte count, about 6 million cells per cubic millimeter. Hemoglobin level averages 17 to 18 g/100 mL of blood. The hematocrit is between 45% and 50%. Capillary heel sticks may reveal a falsely high hematocrit or hemoglobin value because of sluggish peripheral circulation. Before obtaining a blood specimen from a heel, warm the foot by wrapping it in a warm cloth. This increases circulation and improves the accuracy of this value.

Once proper lung oxygenation has been established, the need for the high erythrocyte count diminishes. Therefore, within a matter of days, a newborn's red cells begin to
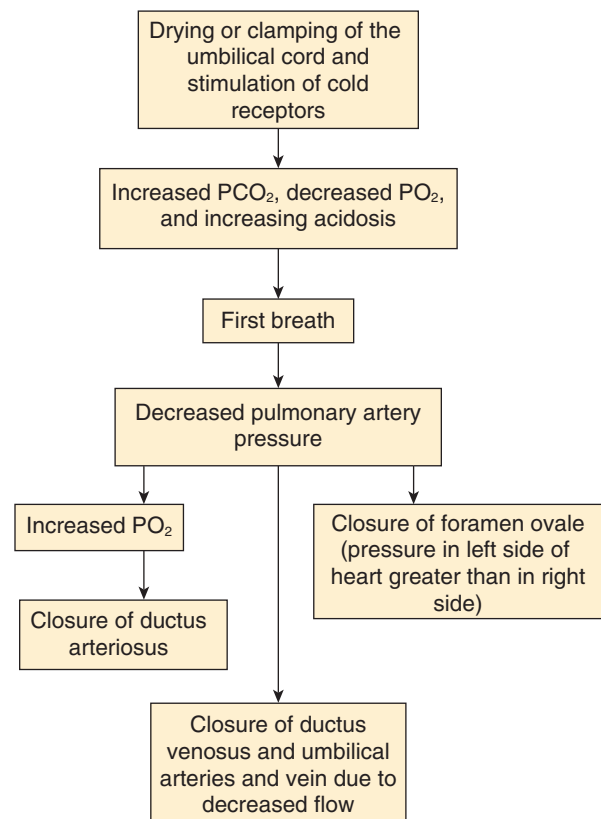
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Drying or clamping of the
umbilical cord and
stimulation of cold
receptors
        ↓
Increased PCO₂, decreased PO₂,
and increasing acidosis
        ↓
    First breath
        ↓
Decreased pulmonary artery
pressure
     ↓              ↓
Increased PO₂    Closure of foramen ovale
     ↓           (pressure in left side of
Closure of ductus   heart greater than in right
arteriosus              side)
                        ↓
              Closure of ductus
              venosus and umbilical
              arteries and vein due to
              decreased flow
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FIGURE 24.3 Circulatory events at birth.

deteriorate. An indirect bilirubin level at birth is 1 to 4 mg/100 mL. Any increase over this amount reflects the release of bilirubin as excessive red blood cells begin their breakdown (Boyd, 2004).

A newborn has an equally high white blood cell count at birth, about 15,000 to 30,000 cells/mm³. Values as high as 40,000 cells/mm³ may be seen if the birth was stressful. Polymorphonuclear cells (neutrophils) account for a large part of this leukocytosis, but by the end of the first month, lymphocytes become the predominant cell type. This leukocytosis is a response to the trauma of birth and is nonpathogenic; an increased white blood cell count should not be taken as evidence of infection. On the other hand, although the high white blood cell count makes infection difficult to prove in a newborn, infection must not be dismissed as a possibility if other signs of infection (e.g., pallor, respiratory difficulty, cyanosis) are present. Usual blood values in a newborn are summarized in Appendix F.

Blood Coagulation. Because most newborns are born with a lower than normal level of vitamin K, they have a prolonged coagulation or prothrombin time. Vitamin K, synthesized through the action of intestinal flora, is necessary for the formation of factor II (prothrombin), factor VII (proconvertin), factor IX (plasma thromboplastin component), and factor X (Stuart-Prower factor). Because a newborn's intestine is sterile at birth unless membranes were ruptured more than 24 hours before birth, it takes about 24 hours for flora to accumulate and for vitamin K to be synthesized. Because almost all newborns can be predicted to have this diminished blood coagulation ability, vitamin K (e.g., AquaMEPHYTON) is administered intramuscularly into the lateral anterior thigh, the preferred site for all injections in a newborn, immediately after birth.

Respiratory System

A first breath is a major undertaking because it requires a tremendous amount of pressure (about 40 to 70 cm H_2O). It is initiated by a combination of cold receptors; a lowered partial pressure of oxygen (PO_2), which falls from 80 to as low as 15 mm Hg before a first breath; and an increased partial carbon dioxide pressure (PCO_2), which rises as high as 70 mm Hg before a first breath. All newborns have some fluid in their lungs from intrauterine life that eases the surface tension on alveolar walls and allows alveoli to inflate more easily than if the lung walls were dry. About a third of this fluid is forced out of the lungs by the pressure of vaginal birth. Additional fluid is quickly absorbed by lung blood vessels and lymphatics after the first breath.

Once the alveoli have been inflated with a first breath, breathing becomes much easier for a baby, requiring only about 6 to 8 cm H_2O pressure. Within 10 minutes after birth, most newborns have established a good residual volume. By 10 to 12 hours of age, vital capacity is established at newborn proportions. The heart in a newborn takes up proportionately more space than in an adult, so the amount of lung expansion space available is proportionately limited.

A baby born by cesarean birth does not have as much lung fluid expelled at birth as one born vaginally and may have more difficulty establishing effective respirations, because excessive fluid blocks air exchange space. Newborns who are immature and whose alveoli collapse each time they exhale (because of the lack of pulmonary surfactant) have difficulty establishing effective residual capacity and respirations. If the alveoli do not open well, a newborn's cardiac system becomes compromised, because closure of the foramen ovale and ductus arteriosus depends on free blood flow through the pulmonary artery and good oxygenation of blood. Therefore, a newborn who has difficulty establishing respirations at birth should be examined closely in the postpartal period for a cardiac murmur or other indication that he or she still has patent cardiac structures, especially a patent ductus arteriosus.

Gastrointestinal System

Although the gastrointestinal tract is usually sterile at birth, bacteria may be cultured from the intestinal tract in most babies within 5 hours after birth and from all babies at 24 hours of life. Most of these bacteria enter the tract through the newborn's mouth from airborne sources. Others may come from vaginal secretions at birth, from hospital bedding, and from contact at the breast. Accumulation of bacteria in the gastrointestinal tract is necessary for digestion and for the synthesis of vitamin K. Because milk, the infant's main diet for the first year, is low in vitamin K, this intestinal synthesis is necessary for blood coagulation.

Although a newborn's stomach holds about 60 to 90 mL, a newborn has limited ability to digest fat and starch because the pancreatic enzymes, lipase and amylase, remain deficient for the first few months of life. A newborn regurgitates easily because of an immature cardiac sphincter between the stomach and esophagus. Immature liver functions may lead to lowered glucose and protein serum levels.

Stools. The first stool of a newborn is usually passed within 24 hours after birth. It consists of **meconium,** a sticky, tarlike, blackish-green, odorless material formed from mucus, vernix, lanugo, hormones, and carbohydrates that accumulated during intrauterine life. If a newborn does not pass a meconium stool by 24 to 48 hours after birth, the possibility of meconium ileus, imperforate anus, or bowel obstruction should be suspected.

About the second or third day of life, newborn stool changes in color and consistency, becoming green and loose. This is termed **transitional stool,** and it may resemble diarrhea to the untrained eye. By the fourth day of life, breast-fed babies pass three or four light yellow stools per day. They are sweet smelling, because breast milk is high in lactic acid, which reduces the amount of putrefactive organisms in the stool. A newborn who receives formula usually passes two or three bright yellow stools a day. These have a slightly more noticeable odor, compared with the stools of breast-fed babies.

A newborn placed under phototherapy lights as a treatment for jaundice has bright green stools because of increased bilirubin excretion. Newborns with bile duct obstruction have clay-colored (gray) stools, because bile pigments are not entering the intestinal tract. Blood-flecked

stools usually indicate an anal fissure. Occasionally, a newborn has swallowed some maternal blood during birth and either vomits fresh blood immediately after birth or passes a black tarry stool after two or more days. Maternal blood may be differentiated from fetal blood by a dipstick Apt test. If the stools remain black or tarry, intestinal bleeding should be suspected. If mucus is mixed with stool or the stool is watery and loose, a milk allergy, lactose intolerance, or some other condition should be suspected.

Urinary System

The average newborn voids within 24 hours after birth. A newborn who does not take in much fluid for the first 24 hours may void later than this, but the 24-hour point is a good general rule. Newborns who do not void within this time should be examined for the possibility of urethral stenosis or absent kidneys or ureters.

The possibility of obstruction in the urinary tract can be assessed by observing the force of the urinary stream in both male and female infants. Males should void with enough force to produce a small projected arc; females should produce a steady stream, not just continuous dribbling. Projecting urine farther than normal also may signal urethral obstruction, because it indicates that urine is being forced through a narrow channel.

The kidneys of newborns do not concentrate urine well, making newborn urine usually light-colored and odorless. The infant is about 6 weeks of age before much control over reabsorption of fluid in tubules and concentration of urine becomes evident.

A single voiding in a newborn is only about 15 mL and may be easily missed in a thick diaper. Specific gravity ranges from 1.008 to 1.010. The daily urinary output for the first 1 or 2 days is about 30 to 60 mL total. By week 1, total daily volume rises to about 300 mL. The first voiding may be pink or dusky because of uric acid crystals that were formed in the bladder in utero; this is an innocent finding. A small amount of protein may be normally present in voidings for the first few days of life, until the kidney glomeruli are more fully mature. Diapers can be weighed to determine the amount and timing of voidings.

Immune System

Because they have difficulty forming antibodies against invading antigens until about 2 months of age, newborns are prone to infection. This inability to form antibodies is the reason that most immunizations against childhood diseases are not given to infants younger than 2 months of age. Newborns do have some immunologic protection, because they are born with passive antibodies (immunoglobulin G) from the mother that crossed the placenta. In most instances, these include antibodies against poliomyelitis, measles, diphtheria, pertussis, chickenpox, rubella, and tetanus. Newborns are routinely administered hepatitis B vaccine during the first 12 hours after birth to protect against this disease (American Academy of Pediatrics [AAP], 2005). Little natural immunity is transmitted against herpes simplex. Any health care personnel with herpes simplex eruptions (cold sores) should not care for newborns until the lesions have crusted. Once this occurs,

these personnel should use excellent handwashing technique, because, without antibody protection, herpes simplex infections can become systemic or create a rapidly fatal form of the disease in a newborn.

Neuromuscular System

Mature newborns demonstrate neuromuscular function by moving their extremities, attempting to control head movement, exhibiting a strong cry, and demonstrating newborn reflexes. Limpness or total absence of a muscular response to manipulation is never normal and suggests narcosis, shock, or cerebral injury. A newborn occasionally makes twitching or flailing movements of the extremities in the absence of a stimulus because of the immaturity of the nervous system. Newborn reflexes can be tested with consistency by using simple maneuvers.

Blink Reflex.   A blink reflex in a newborn serves the same purpose as it does in an adult—to protect the eye from any object coming near it by rapid eyelid closure. It may be elicited by shining a strong light such as a flashlight or otoscope light on an eye. A sudden movement toward the eye sometimes can elicit the blink reflex.

Rooting Reflex.   If the cheek is brushed or stroked near the corner of the mouth, a newborn infant will turn the head in that direction. This reflex serves to help a newborn find food: when a mother holds the child and allows her breast to brush the newborn's cheek, the reflex makes the baby turn toward the breast. The reflex disappears at about the sixth week of life. At about this time, newborn eyes focus steadily, so a food source can be seen, and the reflex is no longer needed.

Sucking Reflex.   When a newborn's lips are touched, the baby makes a sucking motion. The reflex helps a newborn find food: when the newborn's lips touch the mother's breast or a bottle, the baby sucks and so takes in food. The sucking reflex begins to diminish at about 6 months of age. It disappears immediately if it is never stimulated (e.g., in a newborn with a tracheoesophageal fistula who cannot take in oral fluids). It can be maintained in such an infant by offering the child a non-nutritive sucking object such as a pacifier (after the fistula has been corrected by surgery and until oral feedings can be given).

Swallowing Reflex.   The swallowing reflex in a newborn is the same as in the adult. Food that reaches the posterior portion of the tongue is automatically swallowed. Gag, cough, and sneeze reflexes also are present to maintain a clear airway in the event that normal swallowing does not keep the pharynx free of obstructing mucus.

Extrusion Reflex.   A newborn extrudes any substance that is placed on the anterior portion of the tongue. This protective reflex prevents the swallowing of inedible substances. It disappears at about 4 months of age. Until then, the infant may seem to be spitting out or refusing solid food placed in the mouth.

Palmar Grasp Reflex.   Newborns grasp an object placed in their palm by closing their fingers on it (Fig. 24.4). Mature newborns grasp so strongly that they can be raised from a supine position and suspended momentarily from an

FIGURE 24.4 Palmar grasp reflex.

examiner's fingers. This reflex disappears at about 6 weeks to 3 months of age. A baby begins to grasp meaningfully at about 3 months of age.

Step (Walk)-in-Place Reflex. Newborns who are held in a vertical position with their feet touching a hard surface will take a few quick, alternating steps (Fig. 24.5). This reflex disappears by 3 months of age. By 4 months, babies can bear a good portion of their weight unhindered by this reflex.

Placing Reflex. The placing reflex is similar to the step-in-place reflex, except that it is elicited by touching the anterior surface of the newborn's leg against a hard surface such as the edge of a bassinet or table. The newborn makes a few quick lifting motions, as if to step onto the table, because of the reflex.

Plantar Grasp Reflex. When an object touches the sole of a newborn's foot at the base of the toes, the toes grasp in the same manner as the fingers do. This reflex disappears at about 8 to 9 months of age in preparation for walking. However, it may be present during sleep for a longer period.

Tonic Neck Reflex. When newborns lie on their backs, their heads usually turn to one side or the other. The arm and the leg on the side toward which the head turns extend, and the opposite arm and leg contract (Fig. 24.6). The movement is most evident in the arms but may also be observed in the legs. If you turn a newborn's head to the opposite side, he or she will often change the extension and contraction of legs and arms accordingly. This is also called a boxer or fencing reflex, because the position simulates that of someone preparing to box or fence. Unlike many other reflexes, the tonic neck reflex does not appear to have a function. It does stimulate eye coordination, because the extended arm moves in front of the face. It may signify handedness. The reflex disappears between the second and third months of life.

Moro Reflex. A Moro (startle) reflex (Fig. 24.7) can be initiated by startling a newborn with a loud noise or by jarring the bassinet. The most accurate method of eliciting the reflex is to hold newborns in a supine position and allow their heads to drop backward about 1 inch. In response to this sudden head movement, they abduct and extend their arms and legs. Their fingers assume a typical "C" position.

FIGURE 24.5 Step-in-place reflex.

FIGURE 24.6 Tonic neck reflex.

FIGURE 24.7 Moro reflex.

FIGURE 24.8 Babinski reflex. When the examiner moves her finger upward, the newborn's toes will fan outward.

Finally, they swing their arms into an embrace position and pull up their legs against their abdomen (adduction). The reflex simulates the action of someone trying to ward off an attacker, then covering up to protect himself. It is strong for the first 8 weeks of life and then fades by the end of the fourth or fifth month, at the same time an infant can roll away from danger.

Babinski Reflex. When the side of the sole of the foot is stroked in an inverted "J" curve from the heel upward, a newborn fans the toes (positive Babinski sign) (Fig. 24.8). This is in contrast to the adult, who flexes the toes. This reaction occurs because nervous system development is immature. It remains positive (toes fan) until at least 3 months of age, when it is supplanted by the down-turning or adult flexion response.

Magnet Reflex. If pressure is applied to the soles of the feet of a newborn lying in a supine position, he or she pushes back against the pressure. This and the two following reflexes are tests of spinal cord integrity.

Crossed Extension Reflex. If one leg of a newborn lying supine is extended and the sole of that foot is irritated by being rubbed with a sharp object, such as a thumbnail, the infant raises the other leg and extends it, as if trying to push away the hand irritating the first leg.

Trunk Incurvation Reflex. When newborns lie in a prone position and are touched along the paravertebral area by a probing finger, they flex their trunk and swing their pelvis toward the touch (Fig. 24.9).

Landau Reflex. A newborn who is held in a prone position with a hand underneath, supporting the trunk, should demonstrate some muscle tone. Babies may not be able to lift their head or arch their back in this position (as they

will at 3 months of age), but neither should they sag into an inverted "U" position. The latter response indicates extremely poor muscle tone, the cause of which should be investigated.

Deep Tendon Reflexes. A patellar reflex can be elicited in a newborn by tapping the patellar tendon with the tip of the finger. The lower leg moves perceptibly if the infant has an intact reflex. To elicit a biceps reflex, place the thumb of your left hand on the tendon of the biceps muscle on the inner surface of the elbow. Tap the thumb as it rests on the tendon. You are more likely to feel the tendon contract than to observe movement. A biceps reflex

FIGURE 24.9 Trunk incurvation reflex. When the paravertebral area is stroked, the newborn flexes his or her trunk toward the direction of the stimulation.

is a test for spinal nerves C5 and C6; a patellar reflex is a test for spinal nerves L2 through L4.

✔ **Checkpoint Question 2**

A Moro reflex is the single best assessment of neurologic ability in a newborn. What is the best way to test this reflex?

a. Observe the infant while she is on her abdomen to see whether she can turn her head.
b. Lift the infant's head while she is supine and allow it to fall back 1 inch.
c. Shake the infant's crib until the infant responds by flailing her arms.
d. Make a sharp noise, such as clapping your hands, to wake the infant.

The Senses

The senses in newborns are already developed at birth.

Hearing. A fetus is able to hear in utero even before birth. As soon as amniotic fluid drains or is absorbed from the middle ear by way of the eustachian tube—within hours after birth—hearing becomes acute. Newborns appear to have difficulty locating sound, however, and do not turn toward it consistently. Perhaps they must learn to interpret small differences among sounds arriving at their ears at different times. They respond with generalized activity to a sound such as a bell ringing a short distance from their ear. A newborn who is actively crying when the bell is rung stops crying and seems to attend. Similarly, newborns calm in response to a soothing voice and startle at loud noises. They recognize their mother's voice almost immediately, as if they have heard it in utero.

Vision. Newborns see as soon as they are born and possibly have been "seeing" light and dark in utero for the last few months of pregnancy, as the uterus and the abdominal wall were stretched thin. Newborns demonstrate sight at birth by blinking at a strong light (blink reflex) or by following a bright light or toy a short distance with their eyes. Because they cannot follow past the midline of vision, they lose track of objects easily. This is why parents sometimes think and report that their newborn does not see. Newborns focus best on black and white objects at a distance of 9 to 12 in. A pupillary reflex or ability to contract the pupil is present from birth.

Touch. The sense of touch is also well developed at birth. Newborns demonstrate this by quieting at a soothing touch and by positive sucking and rooting reflexes, which are elicited by touch. They also react to painful stimuli.

Taste. A newborn has the ability to discriminate taste, because taste buds are developed and functioning even before birth. A fetus in utero, for example, will swallow amniotic fluid more rapidly than usual if glucose is added to sweeten its taste. The swallowing decreases if a bitter flavor is added. A newborn turns away from a bitter taste such as salt but readily accepts the sweet taste of milk or glucose water.

Smell. The sense of smell is present in newborns as soon as the nose is clear of mucus and amniotic fluid. Newborns turn toward their mothers' breast partly out of recognition of the smell of breast milk and partly as a manifestation of the rooting reflex. Their ability to respond to odors can be used to document alertness.

Physiologic Adjustment to Extrauterine Life

All newborns seem to move through periods of irregular adjustment in the first 6 hours of life, before their body systems stabilize. These periods were first described by Desmond in 1963 and are termed periods of reactivity (Desmond, 1963). The first phase lasts about half an hour. During this time, the baby is alert and exhibits exploring, searching activity, often making sucking sounds. Heart beat and respiratory rate are rapid. This is called the *first period of reactivity.*

Next comes a quiet *resting period.* Heartbeat and respiratory rates slow, and the newborn typically sleeps for about 90 minutes. The *second period of reactivity,* between 2 and 6 hours of life, occurs when the baby wakes again, often gagging and choking on mucus that has accumulated in the mouth. He or she is again alert and responsive and interested in the surroundings.

These three periods are summarized in Table 24.1. Newborns who are ill or who had difficulty at birth may not pass through these typical stages; they may never have periods of alertness or periods of quiet. Their vital signs may not fall and rise again but remain rapid; their temperature may remain subnormal. Demonstration of this typical reactivity pattern, therefore, is an indication that the newborn is healthy and adjusting well to extrauterine life. The ability to transition from one period to another is an important indicator of neurologic status.

APPEARANCE OF A NEWBORN

Although all newborns have similar physical findings, there are individual differences.

Skin

General inspection of a newborn's skin reveals many characteristic findings.

Color

Most term newborns have a ruddy complexion because of the increased concentration of red blood cells in blood vessels and a decrease in the amount of subcutaneous fat, which makes the blood vessels more visible. This ruddiness fades slightly over the first month. Infants with poor central nervous system control may appear pale and cyanotic. A gray color in newborns generally indicates infection. Twins may be born with a twin transfusion phenomenon, in which one twin is larger and has good color and the smaller twin has pallor (Duncombe et al., 2003).

Cyanosis. Generalized mottling of the skin is common. A newborn's lips, hands, and feet are likely to appear blue

TABLE 24.1

Periods of Reactivity: Normal Adjustment to Extrauterine Life

Assessment	First Period (First 15–30 Min)	Resting Period (30–120 Min)	Second Period (2–6 H)
Color	Acrocyanosis	Color stabilizing	Quick color changes occur with movement or crying
Temperature	Temperature begins to fall from intrauterine temperature of about 100.6°F (38.1°C)	Temperature stabilizes at about 99°F (37.2°C)	Temperature increases to 99.8°F (37.6°C)
Heart rate	Rapid, as much as 180 bpm while crying	Slowing to 120–140 bpm	Wide swings in rate with activity
Respirations	Irregular; 30–90 breaths per min while crying; some nasal flaring, occasional retraction may be present	Slowing to 30–50 breaths per min; barreling of chest occurs	Becoming irregular again with activity
Activity	Alert; watching	Sleeping	Awakening
Ability to respond to stimulation	Vigorous reaction	Difficult to arouse	Becoming responsive again
Mucus	Visible in mouth	Small amount present while sleeping	Mouth full of mucus, causing gagging
Bowel sounds	Can be heard after first 15 min	Present	Often passage of first meconium stool

Desmond, M. N., et al. (1963). The clinical behavior of the newly born: The term infant. *Journal of Pediatrics, 62*(3), 307–309.

from immature peripheral circulation. Acrocyanosis (blueness of hands and feet) is so prominent in some newborns that it appears as if some stricture were cutting off circulation, with usual skin color on one side and blue on the other. Acrocyanosis is a normal phenomenon in the first 24 to 48 hours after birth; however, **central cyanosis,** or cyanosis of the trunk, is always a cause for concern. Central cyanosis indicates decreased oxygenation. It may be the result of a temporary respiratory obstruction or an underlying disease state.

Mucus obstructing a newborn's respiratory tract causes sudden cyanosis and apnea. Suctioning of the mucus relieves the condition. Always suction the mouth of a newborn before the nose, because suctioning the nose first may trigger a reflex gasp, possibly leading to aspiration if there is mucus in the posterior throat. Follow mouth suctioning with suction to the nose, because the nose is the chief conduit for air in a newborn.

? *What if...* Ms. Ruiz inspects her new baby and says to you, "Her hands are cold and blue. Is something wrong with her hands?" How should you answer?

Hyperbilirubinemia. Hyperbilirubinemia leads to **jaundice,** or yellowing of the skin. This occurs on the second or third day of life in about 50% of all newborns, as a result of the breakdown of fetal red blood cells (**physiologic jaundice**). The infant's skin and the sclerae of the eyes appear noticeably yellow. This happens because the high red blood cell count built up in utero is destroyed, and heme and globin are released. Globin is a protein component that is reused by the body and is not a factor in the developing jaundice. Heme is further broken down into iron (which is also reused and not involved in the jaundice) and protoporphyrin. Protoporphyrin is further broken down into indirect bilirubin. Indirect bilirubin is fat soluble and cannot be excreted by the kidneys in this state. For removal from the body, it is converted by the liver enzyme glucuronyl transferase into direct bilirubin, which is water soluble. This is incorporated into stool and then excreted in feces. Many newborns have such immature liver function that indirect bilirubin cannot be converted to the direct form; it therefore remains indirect. As long as the bilirubin remains in the circulatory system, the red coloring of the blood cells covers the yellow tint of the bilirubin. After the level of this indirect bilirubin has risen to more than 7 mg/100 mL, however, bilirubin permeates the tissue outside the circulatory system and causes the infant to appear jaundiced.

Observe infants who are prone to extensive bruising (large, breech, or immature babies) carefully for jaundice, because bruising leads to hemorrhage of blood into the subcutaneous tissue or skin. As this blood is broken down, jaundice can occur.

Cephalhematoma, a collection of blood under the periosteum of the skull bone, can lead to the same phenomenon. As the bruising heals and the red blood cells are hemolyzed, additional indirect bilirubin is released.

If intestinal obstruction is present and stool cannot be evacuated, intestinal flora may break down bile into its

basic components, leading to the release of indirect bilirubin into the bloodstream again. Early feeding of newborns promotes intestinal movement and excretion of meconium and helps prevent indirect bilirubin buildup from this source.

The level of jaundice in newborns may be judged grossly by estimating the extent to which it has progressed on the surface of the infant's body, starting in the head and spreading to the rest of the body.

Various commercial devices (transcutaneous bilirubinometry devices) are available to measure skin tone for jaundice and help in estimating jaundice levels. Although use of these devices rarely replaces serum measurements, they can be used to identify infants who need serum bilirubin determinations. The technique for obtaining a serum bilirubin specimen by heel puncture is shown in Chapter 36.

Treatment for physiologic jaundice or the routine rise in bilirubin in newborns is rarely necessary, except for measures such as early feeding to speed passage of feces through the intestine and prevent reabsorption of bilirubin from the bowel.

Above-normal indirect bilirubin levels are potentially dangerous because, if enough indirect bilirubin (about 20 mg/100 mL) leaves the bloodstream, it can interfere with the chemical synthesis of brain cells, resulting in permanent cell damage, a condition termed **kernicterus.** If this occurs, permanent neurologic damage, including cognitive challenge, may result.

There is no set level at which indirect serum bilirubin requires treatment, because other factors, such as age, maturity, and breast-feeding status, affect this determination. If the level rises to more than 10 to 12 mg/100 mL, treatment is usually considered. Phototherapy (exposure of the infant to light to initiate maturation of liver enzymes) may be used (see Chapter 26). If this is necessary, the incubator and light source can be moved to the mother's room so that the mother is not separated from her baby. Some infants need continued therapy after discharge and receive phototherapy at home (Walls, 2004).

Compared with formula-fed babies, a small proportion of breast-fed babies may have more difficulty converting indirect bilirubin to direct bilirubin, because breast milk contains pregnanediol (a metabolite of progesterone), which depresses the action of glucuronyl transferase (Reiser, 2004). However, breast-feeding rarely causes enough jaundice to warrant therapy. The decision to stop nursing in the first 2 weeks of life must never be made lightly, because it could interfere with breast filling and the breast milk supply.

Pallor. Pallor in newborns is usually the result of anemia. This may be caused by (1) excessive blood loss when the cord was cut, (2) inadequate flow of blood from the cord into the infant at birth, (3) fetal–maternal transfusion, (4) low iron stores caused by poor maternal nutrition during pregnancy, or (5) blood incompatibility in which a large number of red blood cells were hemolyzed in utero. It also may be the result of internal bleeding. The baby should be watched closely for signs of blood in stool or vomitus.

Harlequin Sign. Occasionally, because of immature circulation, a newborn who has been lying on his or her side appears red on the dependent side of the body and pale on the upper side, as if a line had been drawn down the center of the body. This is a transient phenomenon; although startling, it is of no clinical significance. The odd coloring fades immediately if the infant's position is changed or the baby kicks or cries vigorously.

Birthmarks

Several common types of birthmarks occur in newborns. It is important to be able to differentiate the various types of hemangiomas that occur, so that you neither give false reassurance to parents nor worry them unnecessarily about these lesions.

Hemangiomas. The **hemangiomas** are vascular tumors of the skin. Three types of hemangiomas occur.

Nevus Flammeus. **Nevus flammeus** (Fig. 24.10*A*) is a macular purple or dark-red lesion (sometimes called a *port-wine stain* because of its deep color) that is present at birth. These lesions typically appear on the face, although they are often found on the thighs as well. Those above the bridge of the nose tend to fade; the others are less likely to fade. Because they are level with the skin surface (macular), they can be covered by a cosmetic preparation later in life or removed by laser therapy, although lesions may reappear after treatment (Waner, 2003).

Nevus flammeus lesions also occur as lighter, pink patches at the nape of the neck, known as *stork's beak marks* (see Fig. 24.10*B*). These do not fade, but they are covered by the hairline and therefore are of no consequence. They occur more often in females than in males.

Strawberry Hemangioma. **Strawberry hemangiomas** are elevated areas formed by immature capillaries and endothelial cells (see Fig. 24.10*C*). Most are present at birth in the term neonate, although they may appear up to 2 weeks after birth. Typically, they are not present in the preterm infant because of the immaturity of the epidermis. Formation is associated with the high estrogen levels of pregnancy. They may continue to enlarge from their original size up to 1 year of age. After the first year, they tend to be absorbed and shrink in size. By the time the child is 7 years old, 50% to 75% of these lesions have disappeared. A child may be 10 years old before the absorption is complete. Application of hydrocortisone ointment may speed the disappearance of these lesions by interfering with the binding of estrogen to its receptor sites.

Be certain parents understand that the mark may grow in their child's early years. Otherwise, they may confuse it with cancer (a skin lesion increasing in size is one of the seven danger signals of cancer). Be sure they also understand that the mark will eventually disappear, so that they do not think of their child as imperfect or disfigured. Surgery to remove strawberry hemangiomas is rarely recommended because it can lead to secondary infection, resulting in scarring and permanent disfigurement. Laser therapy may be used to remove the lesion (Waner, 2003).

Cavernous Hemangioma. **Cavernous hemangiomas** (see Fig. 24.10*D*) are dilated vascular spaces. They are usually raised and resemble a strawberry hemangioma in appearance. However, they do not disappear with time as

FIGURE 24.10 Types of hemangiomas found on a newborn. (**A**) Nevus flammeus (port-wine stain) formed of a plexus of newly formed capillaries in the papillary layer of the corium. It is deep red to purple, does not blanch on pressure, and does not fade with age. (**B**) A telangectasia or Stork's beak mark, commonly occurring on nape of neck. It blanches on pressure; although it does not fade, it is not noticeable as it becomes covered by hair. (**C**) Strawberry hemangiomas consist of dilated capillaries in entire dermal and subdermal layers. They continue to enlarge after birth but usually disappear by age 10 years. (**D**) Cavernous hemangiomas consist of a communicating network of venules in subcutaneous tissue and do not fade with age.

the strawberry hemangiomas do. Subcutaneous infusions of interferon-alfa-2a can be used to reduce these lesions in size (Greene et al., 2004), or they can be removed surgically. Children who have a skin lesion may have additional ones on internal organs. Blows to the abdomen, such as those from childhood games, can cause bleeding from internal hemangiomas. For this reason, children with cavernous hemangiomas usually have their hematocrit levels assessed at health maintenance visits, to evaluate for possible internal blood loss.

Mongolian Spots. **Mongolian spots** are collections of pigment cells (melanocytes) that appear as slate-gray patches across the sacrum or buttocks and possibly on the arms and legs. They tend to occur in children of Asian, Southern European, or African extraction (Constantinou, 2003). They disappear by school age without treatment. Be sure to inform parents that these are not bruises.

Otherwise, they may worry their baby sustained a birth injury.

Vernix Caseosa

Vernix caseosa is a white, cream cheese–like substance that serves as a skin lubricant. Usually, it is noticeable on a term newborn's skin, at least in the skin folds, at birth. Document the color of vernix, because it takes on the color of the amniotic fluid. For example, a yellow vernix implies that the amniotic fluid was yellow from bilirubin; green vernix indicates that meconium was present in the amniotic fluid.

Until the first bath, when vernix is washed away, handle newborns with gloves to protect yourself from exposure to body fluids. Never use harsh rubbing to wash away vernix. A newborn's skin is tender, and breaks in the skin caused by too vigorous attempts at removal may open portals of entry for bacteria.

Lanugo

Lanugo is the fine, downy hair that covers a newborn's shoulders, back, and upper arms. It may be found also on the forehead and ears. A baby born after 37 to 39 weeks of gestation has more lanugo than a newborn of 40 weeks' gestational age. Postmature infants (more than 42 weeks of gestation) rarely have lanugo. Lanugo is rubbed away by the friction of bedding and clothes against the newborn's skin. By 2 weeks of age, it has disappeared.

Desquamation

Within 24 hours after birth, the skin of most newborns has become extremely dry. The dryness is particularly evident on the palms of the hands and soles of the feet. This results in areas of peeling similar to those caused by sunburn. This is normal, however, and needs no treatment. Parents may apply hand lotion to prevent excessive dryness if they wish.

Newborns who are postmature and have suffered intrauterine malnutrition may have extremely dry skin, with a leathery appearance and cracks in the skin folds. This should be differentiated from normal desquamation.

Milia

All newborn sebaceous glands are immature. At least one pinpoint white papule (a plugged or unopened sebaceous gland) can be found on the cheek or across the bridge of the nose of every newborn. Such lesions, termed **milia** (Fig. 24.11), disappear by 2 to 4 weeks of age, as the sebaceous glands mature and drain. Teach parents to avoid scratching or squeezing the papules, to prevent secondary infections.

Erythema Toxicum

In most normal mature infants, a newborn rash called **erythema toxicum** can be observed (Fig. 24.12). This usually appears in the first to fourth day of life, but may appear up to 2 weeks of age. It begins with a papule, increases in severity to become erythema by the second day, and then disappears by the third day. It is sometimes called a *flea-bite rash* because the lesions are so minuscule. One of the chief characteristics of the rash is its lack of pattern. It occurs sporadically and unpredictably, and may last hours rather than days. It is caused by a newborn's eosinophils reacting to the environment as the immune system matures. It requires no treatment.

Forceps Marks

If forceps were used for birth, there may be a circular or linear contusion matching the rim of the blade of the forceps on the infant's cheek (Fig. 24.13). This mark disappears in 1 to 2 days, along with the edema that accompanies it. The mark is the result of normal forceps use and does not denote unskilled or too vigorous application of forceps. Closely assess the facial nerve while a newborn is at rest and during crying episodes, to detect any potential facial nerve compression requiring further evaluation.

FIGURE 24.11 Milia are unopened sebaceous glands frequently found on the nose, chin, or cheeks of a newborn.

Skin Turgor

Newborn skin should feel resilient if the underlying tissue is well hydrated. If a fold of the skin is grasped between the thumb and fingers, it should feel elastic. When it is released, it should fall back to form a smooth surface. If severe dehydration is present, the skin will not smooth out again but will remain in an elevated ridge. Poor turgor is seen in newborns who suffered malnutrition in utero, who have difficulty sucking at birth, or who have certain metabolic disorders such as adrenogenital syndrome.

✔ **Checkpoint Question 3**

Beth Ruiz has milia on her nose. What is the necessary therapy for this?

a. Ice packs to reduce inflammation.
b. Warm heat to increase circulation.
c. No therapy is necessary for milia.
d. Lancing the lesions so they drain.

FIGURE 24.12 Erythema toxicum is found on almost all newborns. The reddish rash consists of sporadic pinpoint papules on an erythematous base. It fades spontaneously in a few days.

Head

A newborn's head appears disproportionately large because it is about one fourth of the total body length; in an adult, the head is one eighth of total height. The forehead of a newborn is large and prominent. The chin appears to be receding, and it quivers easily if the infant is startled or cries. Well-nourished newborns have full-bodied hair; poorly nourished and preterm infants have thin, lifeless hair. If internal fetal monitoring was used during labor, the newborn may exhibit a pinpoint ulcer at the point where the monitor was attached.

FIGURE 24.13 Forceps marks are commonly found in newborns born by forceps. Such marks are transient and disappear in a day or two.

Fontanelles

The fontanelles are the spaces or openings where the skull bones join. The anterior fontanelle is located at the junction of the two parietal bones and the two fused frontal bones. It is diamond shaped and measures 2 to 3 cm (0.8 to 1.2 in) in width and 3 to 4 cm (1.2 to 1.6 in) in length. The posterior fontanelle is located at the junction of the parietal bones and the occipital bone. It is triangular and measures about 1 cm (0.4 in) in length.

The anterior fontanelle can be felt as a soft spot. It should not appear indented (a sign of dehydration) or bulging (a sign of increased intracranial pressure) when the infant is positioned upright at an angle of 45° to 90°. The fontanelle may bulge if the newborn strains to pass a stool or cries vigorously or is lying supine. With vigorous crying, a pulse may additionally be seen in the fontanelle. The anterior fontanelle normally closes at 12 to 18 months of age.

In some newborns, the posterior fontanelle is so small that it cannot be palpated readily. The posterior fontanelle closes by the end of the second month.

Sutures

The skull *sutures,* the separating lines of the skull, may override at birth because of the extreme pressure exerted on the head during passage through the birth canal. If the sagittal suture between the parietal bones overrides, the fontanelles are less perceptible than usual. The overriding subsides in 24 to 48 hours.

Suture lines should never appear widely separated in newborns. Wide separation suggests increased intracranial pressure due to abnormal brain formation, abnormal accumulation of cerebrospinal fluid in the cranium (hydrocephalus), or an accumulation of blood from a birth injury (e.g., subdural hemorrhage). Fused suture lines also are abnormal; they require radiographic confirmation and further evaluation, because they will prevent the head from expanding with growth.

Molding

The part of the infant's head that engages the cervix (usually the vertex) is molded to fit the cervix contours. After birth, this area appears prominent and asymmetric. Molding may be so extreme in the baby of a primiparous woman that the baby's head looks like a dunce cap (Fig. 24.14). The head will be restored to its normal shape within a few days after birth.

Caput Succedaneum

Caput succedaneum (Fig. 24.15*A*) is edema of the scalp at the presenting part of the head. It may involve wide areas of the head, or it may be the size of a large egg. The edema, which crosses the suture lines, is gradually absorbed and disappears at about the third day of life. It needs no treatment.

Cephalhematoma

A *cephalhematoma* is a collection of blood between the periosteum of a skull bone and the bone itself; it is caused
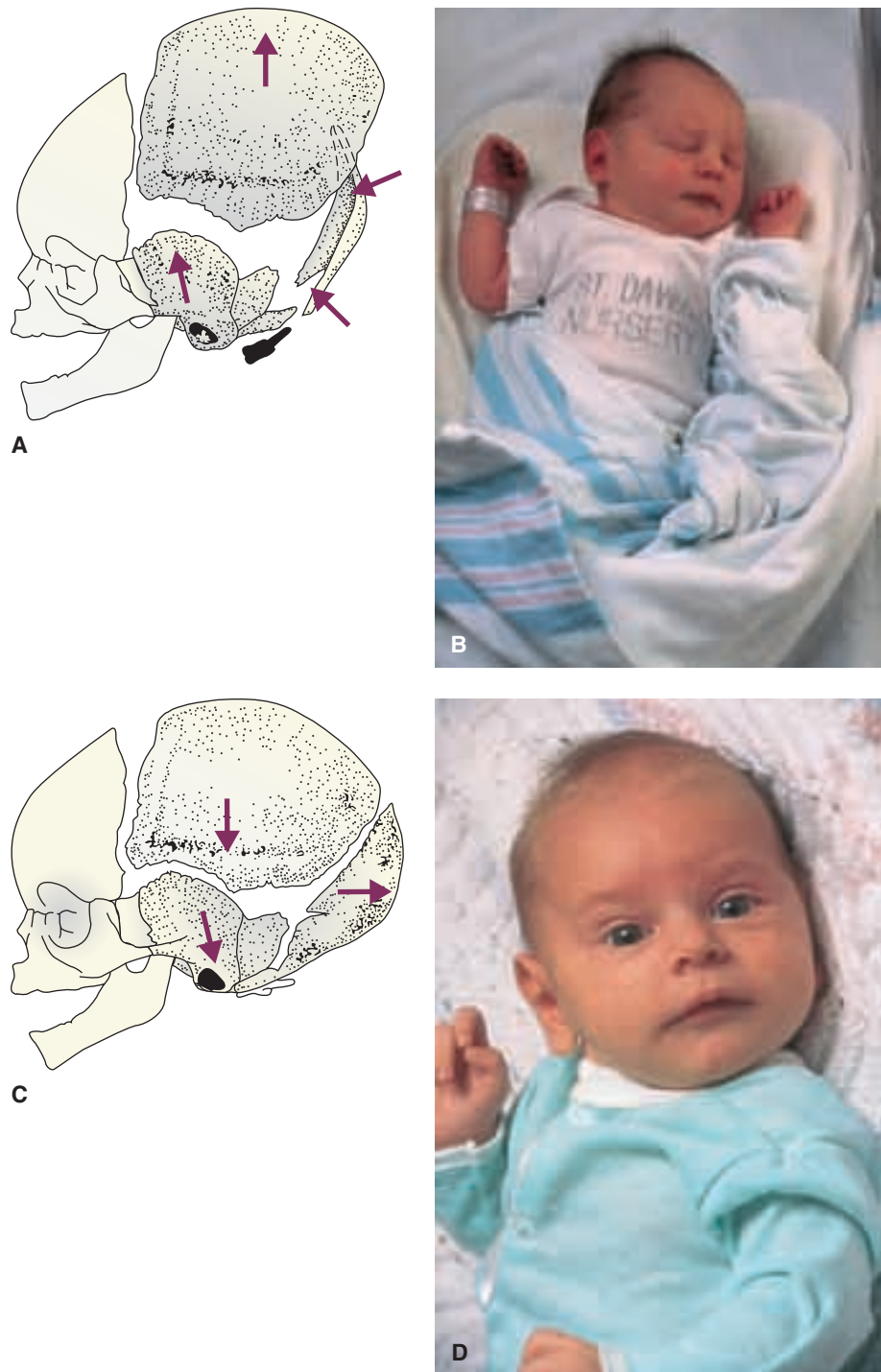
FIGURE 24.14 Molding. (**A, B**) The infant head molds to fit the birth canal more easily. On palpation, the skull sutures will be felt to be overriding. (**C, D**) The head shape returns to normal within 1 week.

by rupture of a periosteal capillary due to the pressure of birth (see Fig. 24.15*B*). It usually appears 24 hours after birth. Although the blood loss is negligible, the swelling is usually severe and is well outlined as an egg shape. It may be discolored (black and blue) because of the presence of coagulated blood. A cephalhematoma is confined to an individual bone, so the associated swelling stops at the bone's suture line.

It often takes weeks for a cephalhematoma to be absorbed. It might be supposed that the blood could be aspi-

rated to relieve the condition. However, such a procedure would introduce the risk of infection and is unnecessary, because the condition will subside by itself. As the blood captured in the space is broken down, a great amount of indirect bilirubin may be released, leading to jaundice.

Craniotabes

Craniotabes is a localized softening of the cranial bones that is probably caused by pressure of the fetal skull against
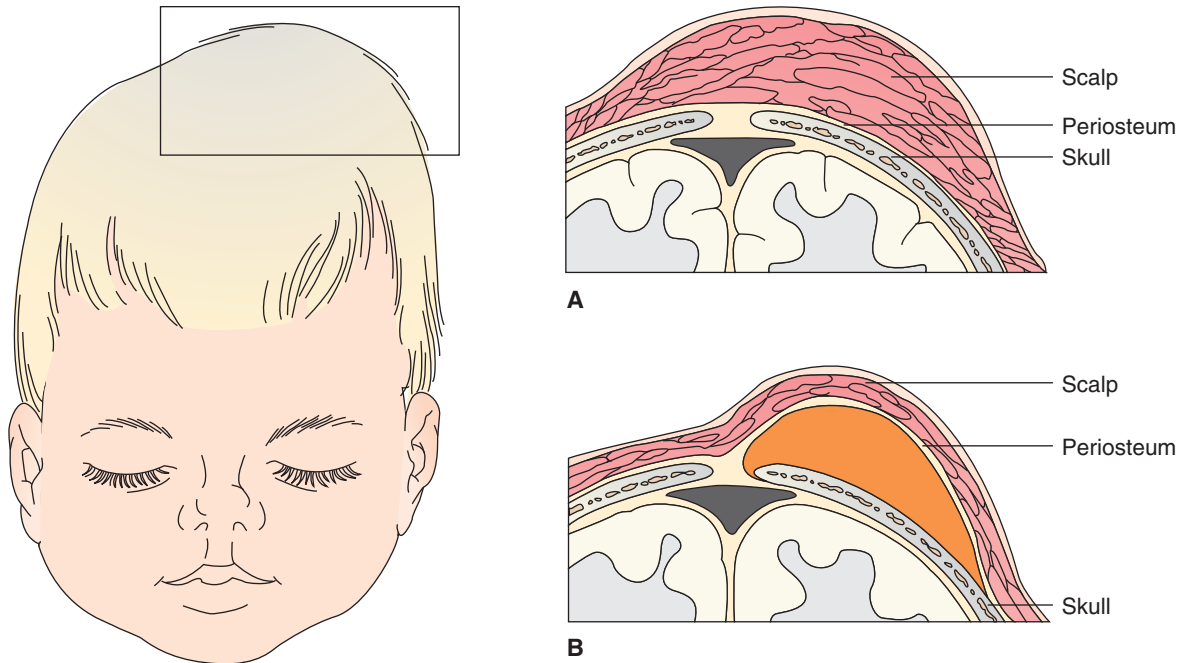
FIGURE 24.15 (A) Caput succedaneum. From pressure of the birth canal, an edematous area is present beneath the scalp. Note how it crosses the midline of the skull. **(B)** Cephalhematoma. A small capillary beneath the periosteum of the skull bone has ruptured, and blood has collected under the periosteum of the bone. Note how the swelling now stops at the midline. Because the blood is contained under the periosteum, it is necessarily stopped by a suture line.

the mother's pelvic bone in utero. It is more common in first-born infants than in infants born later, because of the lower position of the fetal head in the pelvis during the last 2 weeks of pregnancy in primiparous women. With craniotabes, the skull is so soft that the pressure of an examining finger can indent it. The bone returns to its normal contour after the pressure is removed. The condition corrects itself without treatment after a few months, as the infant takes in calcium in milk. It is an example of a condition that is normal in a newborn but would be pathologic in an older child or adult (in whom it probably would be the result of faulty metabolism or kidney dysfunction).

Eyes

Newborns usually cry tearlessly, because their lacrimal ducts do not fully mature until about 3 months of age. Almost without exception, the irises of the eyes of newborns are gray or blue; the sclera may be blue due to its thinness. Infant eyes assume their permanent color between 3 and 12 months of age.

To inspect the eyes, lay the newborn in a supine position and lift the head. This maneuver causes the baby to open his or her eyes. A newborn's eyes should appear clear, without redness or purulent discharge. Occasionally, the administration of an antibiotic ointment such as erythromycin at birth, to protect against *Chlamydia* infection as well as ophthalmia neonatorum (gonorrheal conjunctivitis), has caused a purulent discharge that lasts for the first 24 hours of life.

Pressure during birth sometimes ruptures a conjunctival capillary of the eye, resulting in a small **subconjunctival hemorrhage.** This appears as a red spot on the sclera, usually on the inner aspect of the eye, or as a red ring around the cornea. The bleeding is slight, requires no treatment, and is completely absorbed within 2 or 3 weeks. You can reassure the parents that these hemorrhages are normal variations. Otherwise, they may assume that their baby is bleeding from within the eye and that his or her vision will be impaired.

Edema is often present around the orbit or on the eyelids. This remains for the first 2 or 3 days, until the newborn's kidneys are capable of evacuating fluid more efficiently.

The cornea of the eye should appear round and proportionate in size to that of an adult eye. A cornea that appears larger than usual may be the result of congenital glaucoma. An irregularly shaped pupil or discolored iris may denote disease (see Chapter 33). The pupil should be dark. A white pupil suggests the presence of a congenital cataract.

Ears

A newborn's external ear is not as completely formed as it will be eventually, so the pinna tends to bend easily. In the term newborn, however, the pinna should be strong enough to recoil after bending.

The level of the top part of the external ear should be on a line drawn from the inner canthus to the outer canthus of the eye and back across the side of the head (see

Chapter 33). Ears that are set lower than this are found in infants with certain chromosomal abnormalities, particularly trisomy 18 and 13, syndromes in which low-set ears and other physical defects are coupled with varying degrees of cognitive challenge (see Chapters 7 and 54).

A small tag of skin is sometimes found just in front of an ear. Although these tags may be associated with chromosomal abnormalities or kidney disease, they usually are isolated findings that are of no consequence. They can be removed by ligation immediately or when the child is 1 week old. A preauricular dermal sinus may be present directly in front of the ear as well. Always inspect in front of newborns' ears for pinpoint-size openings that reveal these sinuses. The sinus is usually small and can be removed surgically without consequence when the child is near school age.

Visualization of the tympanic membrane of the ear in a newborn is difficult and usually is not attempted, because amniotic fluid and flecks of vernix still fill the canal, obliterating the drum and its accompanying landmarks.

A good practice is to test a newborn's hearing by ringing a bell held about 6 inches from each ear. A hearing infant who is crying will stop momentarily at the sound. If quiet, a newborn who can hear will blink the eyes, appear to attend to the sound, and possibly startle. Although this method of testing is not highly accurate, a negative response (lack of response) is unusual. Infants with negative responses should be retested later. In many health care facilities, all newborns are tested by a commercial standardized response to sound before discharge (Brennan, 2004).

Nose

A newborn's nose tends to appear large for the face. As the infant grows, the rest of the face grows more than the nose does, and this discrepancy disappears.

Test for choanal atresia (blockage at the rear of the nose) by closing the newborn's mouth and compressing one naris at a time with your fingers. Note any discomfort or distress with breathing. Also record any evidence of milia on the nose.

Mouth

A newborn's mouth should open evenly when he or she cries. If one side of the mouth moves more than the other, cranial nerve injury is suggested. A newborn's tongue appears large and prominent in the mouth. Because the tongue is short, the frenulum membrane is attached close to the tip of the tongue, creating the impression that the infant is "tongue tied." At one time, it was almost routine to snip a newborn's frenulum membrane to lengthen it. Now this procedure is regarded as harmful, because it leaves a portal of entry for infection, risks hemorrhage because of the low level of vitamin K in most newborns, and causes feeding difficulties by making the tongue sore and irritated. And is unnecessary because, as the tongue grows, the frenulum recedes to its adult placement.

Inspect the palate of a newborn to be sure it is intact. Occasionally, one or two small round, glistening, well-circumscribed cysts (Epstein's pearls) are present on the palate, a result of the extra load of calcium that was de-posited in utero. Be sure to inform parents that these pearl-like cysts are insignificant, require no treatment, and will disappear spontaneously within 1 week. Otherwise, a parent may mistake them for **thrush,** a *Candida* infection, which usually appears on the tongue and sides of the cheeks as white or gray patches.

All newborns have some mucus in their mouths. Newborns delivered by cesarean birth usually have an increased amount. If a newborn is placed on the side, the mucus drains from the mouth and results in no distress. If the mouth is filled with so much mucus that the neonate seems to be blowing bubbles, a tracheoesophageal fistula is suspected. This must be confirmed or ruled out before the newborn is fed; otherwise, formula can be aspirated into the lungs from the inadequately formed esophagus.

Small, white epithelial pearls (benign inclusion cysts) may be present on the gum margins. No therapy is necessary for these.

It is unusual for a newborn to have teeth, but sometimes one or two (called **natal teeth**) will have erupted. Any teeth that are present must be evaluated for stability. If loose, they should be extracted to prevent possible aspiration during feeding. Also, any natal teeth not covered by the gum membrane should be removed, because they can loosen, increasing the risk for aspiration.

Neck

The neck of a newborn is short and often chubby, with creased skin folds. The head should rotate freely on it. If there is rigidity of the neck, congenital torticollis, caused by injury to the sternocleidomastoid muscle during birth, might be present (see Chapter 39). In newborns whose membranes were ruptured more than 24 hours before birth, nuchal rigidity suggests meningitis.

The neck of a newborn is not strong enough to support the total weight of the head. In a sitting position, a newborn should make a momentary effort at head control. When lying prone, newborns can raise the head slightly, usually enough to lift the nose out of mucus or spit-up formula. If they are pulled into a sitting position from a supine position, the head will lag behind considerably. Again, however, they should make some effort to control and steady the head as they reach the sitting position.

The trachea may be prominent on the front of the neck, and the thymus gland may be enlarged because of the rapid growth of glandular tissue (in comparison with other body tissues) early in life. The thymus gland will triple in size by 3 years of age; it remains at that size until the child is about 10 years old, and then shrinks. Although the thymus may appear to be bulging in a newborn, it is rarely a cause of respiratory difficulty, as was previously believed.

Chest

The chest in some newborns looks small because the head is large in proportion. Not until a child is 2 years of age does the chest measurement exceed that of the head.

In both female and male infants, the breasts may be engorged. Occasionally, the breasts of newborn babies secrete a thin, watery fluid popularly termed *witch's milk.* Engorgement develops in utero as a result of the

influence of the mother's hormones. As soon as the hormones are cleared from the infant's system (about 1 week), the engorgement and any fluid that is present subside. Fluid should never be expressed from infants' breasts, because the manipulation could introduce bacteria and lead to mastitis.

The chest of a neonate is approximately 2 inches smaller in circumference than the head, and as wide in the anteroposterior diameter as it is across. The clavicles should be straight. A crepitus or actual separation on one or the other clavicle may indicate that a fracture occurred during birth and calcium is now being deposited at that point. As the area heals, it may be possible to palpate a lump on the clavicle caused by temporary calcium overgrowth. Overall, a newborn's chest should appear symmetric side to side. Respirations are normally rapid (30 to 60 breaths per minute) but not distressed. A supernumerary nipple (usually found below and in line with the normal nipples) may be present. If so, it may be removed later for cosmetic purposes.

Retraction (drawing in of the chest wall with inspiration) should not be present. An infant with retractions (Fig. 24.16) is using such strong force to pull air into the respiratory tract that he or she is pulling in the anterior chest muscle.

Because a newborn's lung alveoli open slowly over the first 24 to 48 hours and the baby invariably has mucus in the back of the throat, listening to lung sounds often reveals the sounds of rhonchi—the harsh, innocent sound of air passing over mucus. An abnormal sound, such as grunting, suggests respiratory distress syndrome; a high, crowing sound on inspiration suggests stridor or immature tracheal development.

Abdomen

The contour of a newborn abdomen looks slightly protuberant. A scaphoid or sunken appearance may indicate missing abdominal contents or a diaphragmatic hernia. Bowel sounds should be present within 1 hour after birth.

FIGURE 24.16 Sternal retractions are a sign of respiratory distress requiring immediate intervention, such as mechanical ventilation or increased oxygen.

The edge of the liver is usually palpable 1 to 2 cm below the right costal margin. The edge of the spleen may be palpable 1 to 2 cm below the left costal margin. Tenderness is difficult to determine in a newborn. If it is extreme, however, palpation will cause the infant to cry, thrash about, or tense the abdominal muscles to protect the abdomen.

For the first hour after birth, the stump of the umbilical cord appears as a white, gelatinous structure marked with the red and blue streaks of the umbilical vein and arteries. When the cord is first cut, the vessels are counted to be certain that one vein and two arteries are present. In 0.5% of births (3.5% of twin births), there is only a single umbilical artery, and in one third of such infants, this single artery is associated with a congenital heart or renal abnormality. Because these heart and kidney anomalies may not be readily apparent, any child with a single umbilical artery needs close observation and assessment until anomalies are ruled out.

Inspect the cord clamp to be certain it is secure. After the first hour of life, the cord begins to dry and shrink, and it turns brown like the dead end of a vine. By the second or third day, it has turned black. It breaks free by day 6 to 10, leaving a granulating area a few centimeters wide that heals during the following week.

There should be no bleeding at the cord site. Bleeding suggests that the cord clamp has become loosened or the cord has been tugged loose by the friction of the bedclothes. The base of the cord should appear dry. A moist or odorous cord suggests infection. If present, infection should receive immediate treatment or it may enter a newborn's bloodstream and cause septicemia. Moistness at the base of the cord also may indicate a patent urachus (a canal that connects the bladder and the umbilicus), which will drain urine at the cord site until it is surgically repaired.

Inspect the base of the cord to be sure no abdominal wall defect (e.g., umbilical hernia) is present. If there is a fascial (abdominal wall) defect smaller than 2 cm in diameter, it usually closes on its own by school age; a larger defect will probably require surgical correction. Taping or putting buttons or coins on the cord are home remedies that do not help defects to close. In fact, heavy taping may worsen the condition by preventing the development of good muscle tone in the abdominal wall. Tape also tends to keep the cord moist, making infection more likely than when it is dry (Box 24.3).

Because a newborn's voiding only demonstrates there is at least one kidney, not that there are two, attempt to verify the presence of kidneys by deep palpation of the right and left abdomen within the first few hours after birth. After this time, the intestines fill with air, making palpation more difficult. The right kidney (at least its lower pole) can usually be palpated, because it is located lower than the left; the left kidney is more difficult to locate, because the intestine is bulkier on the left side and the left kidney is higher in the retroperitoneal space. Nonetheless, try to locate it. Placing one hand behind the infant while you palpate offers a firmer base and helps when evaluating kidney size (newborn kidneys are about the size of a walnut). An enlarged kidney suggests a polycystic kidney or pooling of urine from a urethral obstruction.

To finish the abdominal assessment, elicit an abdominal reflex. Stroking each quadrant of the abdomen will

DIVERSITY OF CARE

Newborn care is not universal but varies among cultures. For example, although it is usually a sound policy to point out the positive aspects of a child to parents to aid parent–child bonding, in some areas of the world, such as traditional Cambodia and Laos, newborns are not given compliments this way. It is believed that compliments will leave them vulnerable to evil spirits.

In the traditional Haitian culture, infants are not named immediately, but only after a full month. In some cultures, it is important for newborns to have an amulet (good-luck charm) tied around their neck or wrist. Respect these and leave them in place when bathing the infant. Oiling the infant's body and placing a belly band over the umbilical cord also are common care procedures. Being aware of cultural variations in newborn care such as these helps you plan care that is specific and meaningful to individual parents and can aid parent–child bonding.

FIGURE 24.17 Press the nondominant hand against the inguinal ring when palpating testes.

cause the umbilicus to move or "wink" in that direction. This superficial abdominal reflex is a test of spinal nerves T8 through T10. The reflex may not be demonstrable in newborns until the 10th day of life.

Anogenital Area

Inspect the anus of the newborn to be certain it is present, patent, and not covered by a membrane (imperforate anus). Test for anal patency by gently inserting the tip of your little finger, gloved and lubricated. Also note the time after birth at which the infant first passes meconium. If a newborn does not do so in the first 24 hours, suspect imperforate anus or meconium ileus.

Male Genitalia

The scrotum in most male newborns is edematous and has rugae. It may be deeply pigmented in African-American or dark-skinned newborns.

Both testes should be present in the scrotum. If one or both testicles are not present (cryptorchidism), further referral is needed to establish the extent of the problem. This condition could be caused by agenesis (absence of an organ), ectopic testes (the testes cannot enter the scrotum because the opening to the scrotal sac is closed), or undescended testes (the vas deferens or artery is too short to allow the testes to descend). Newborns with agenesis of the testes are usually referred for investigation of kidney anomalies, because the testes arise from the same germ tissue as the kidneys. Make a practice of pressing your nondominant hand against the inguinal ring before palpating for testes, so they do not slip upward and out of the scrotal sac as you palpate (Fig. 24.17).

The cremasteric reflex is elicited by stroking the internal side of the thigh. As the skin is stroked, the testis on

that side moves perceptibly upward. This is a test for the integrity of spinal nerves T8 through T10. The response may be absent in newborns who are younger than about 10 days old.

The penis of newborns appears small, approximately 2 cm long. If it is less than this, the newborn should be referred for evaluation by an endocrinologist. Inspect the tip of the penis to see that the urethral opening is at the tip of the glans, not on the dorsal surface (epispadias) or on the ventral surface (hypospadias).

In most newborns, the prepuce (foreskin) slides back poorly from the meatal opening, so this should not be done. Although today most male newborns are circumcised, the necessity for this operation can be questioned unless it is for religious reasons, because it is rare to find an infant who physically requires it (i.e., has a foreskin so constricted that it interferes with voiding or circulation) (Katz, 2003). In addition, surgery this early in life poses the risk of hemorrhage and infection. Circumcision should not be done if hypospadias or epispadias is present, because the surgeon may want to use the foreskin as tissue when repairing these conditions (see later discussion).

Female Genitalia

The vulva in female newborns may be swollen because of the effect of maternal hormones. Some female newborns have a mucus vaginal secretion, which is sometimes blood-tinged (**pseudomenstruation**). Again, this is caused by the action of maternal hormones. The discharge disappears as soon as the infant's system has cleared the hormones. The discharge should not be mistaken for an infection or taken as an indication that trauma has occurred.

Back

The spine of a newborn typically appears flat in the lumbar and sacral areas. The curves seen in an adult appear only after the child is able to sit and walk. Inspect the base of a newborn's spine carefully to be sure there is no pinpoint opening, dimpling, or sinus tract in the skin, which would suggest a dermal sinus or spinal bifida occulta.

A newborn normally assumes the position maintained in utero, with the back rounded and the arms and legs flexed on the abdomen and chest. A child who was born in a frank breech position tends to straighten the legs at the knee and bring them up next to the face. The position of a baby with a face presentation sometimes simulates opisthotonos for the first week, because the curve of the back is deeply concave.

Extremities

The arms and legs of a newborn appear short. The hands are plump and clenched into fists. Newborn fingernails are soft and smooth, and usually long enough to extend over the fingertips. Test the upper extremities for muscle tone by unflexing the arms for approximately 5 seconds. If tone is good, the arm should return immediately to its flexed position after being released. Hold the arms down by the sides and note their length. The fingertips should cover the proximal thigh. Unusually short arms may signify achondroplastic dwarfism. Observe for unusual curvature of the little finger, and inspect the palm for a simian crease (a single palmar crease, in contrast to the three creases normally seen in a palm). Although curved fingers and simian creases can occur normally, they are commonly associated with Down syndrome (Chung, 2003).

A newborn's arms and legs should move symmetrically (unless the infant is demonstrating a tonic neck reflex). An arm that hangs limp and unmoving suggests possible birth injury, such as injury to a clavicle or to the brachial or cervical plexus or fracture of a long bone. Assess for webbing (syndactyly), extra toes or fingers (polydactyly), or unusual spacing of toes, particularly between the big toes and the others (this finding is present in certain chromosomal disorders, although it is also a normal finding in some families). Test to see whether the toenails fill immediately after blanching from pressure.

Normally, newborn legs are bowed as well as short. The sole of the foot appears flat because of an extra pad of fat in the longitudinal arch. The foot of a term newborn has many crisscrossed lines on the sole, covering approximately two thirds of the foot. If these creases cover less than two thirds of the foot or are absent, suspect immaturity.

Move the ankle through a range of motion to evaluate whether the heel cord is unusually tight. Check for ankle clonus by supporting the lower leg in one hand and dorsiflexing the foot sharply two or three times by pressure on the sole of the foot with the other hand. After the dorsiflexion, one or two continued movements are normal. Rapid alternating contraction and relaxation (clonus) is abnormal, suggesting neurologic involvement. The feet of many newborns turn in (varus deviation) because of their former intrauterine position. This simple deviation needs no correction if the feet can be brought into the midline position by easy manipulation. When the infant begins to bear weight, the feet will align themselves. If a foot does not align readily or will not turn to a definite midline position, a talipes deformity (clubfoot) may be present. This condition needs investigation, because congenital problems of this kind are best treated in the newborn period.

FIGURE 24.18 Hip abduction in a newborn—both hips should abduct so completely they lie almost flat against the mattress (180 degrees).

With a newborn in a supine position, both hips can be flexed and abducted to such an extent (180°) that the knees touch or nearly touch the surface of the bed (Fig. 24.18). If the hip joint seems to lock short of this distance (160° to 170°), hip subluxation (a shallow and poorly formed acetabulum) is suggested (Weinstein et al., 2003). Test for subluxation by holding the infant's leg with the fingers on the greater and lesser trochanters and then abducting the hip; if subluxation is present, a "clunk" of the femur head striking the shallow acetabulum can be heard (Ortolani's sign). If the hip can be felt to actually slip in the socket, this is Barlow's sign. Subluxated hip may be bilateral but is usually unilateral. It is important that hip subluxation be discovered as early as possible, because correction is most successful if it is initiated early.

When lying on the abdomen, newborns are capable of bringing their arms and legs underneath them and raising the stomach off the bed high enough for a hand to be slipped underneath. This ability helps to prevent pressure or rubbing at the cord site, because the cord does not actually touch the bedding when in this position. The preterm newborn does not have this ability, so it is an indication of maturity.

ASSESSMENT FOR WELL-BEING

There are a number of traditional standardized assessments to evaluate a newborn quickly at birth.

Apgar Scoring

At 1 minute and 5 minutes after birth, newborns are observed and rated according to an Apgar score, an assessment scale used as a standard since 1958 (Apgar et al., 1958). As shown in Table 24.2, heart rate, respiratory ef-

TABLE 24.2

Apgar Scoring Chart

		Score	
Sign	*0*	*1*	*2*
Heart rate	Absent	Slow (<100)	>100
Respiratory effort	Absent	Slow, irregular; weak cry	Good; strong cry
Muscle tone	Flaccid	Some flexion of extremities	Well flexed
Reflex irritability:			
Response to catheter in nostril, *or*	No response	Grimace	Cough or sneeze
Slap to sole of foot	No response	Grimace	Cry and withdrawal of foot
Color	Blue, pale	Body normal pigment, extremities blue	Normal skin coloring

Apgar, V., et al. (1958). Evaluation of the newborn infant: Second report. *JAMA: Journal of the American Medical Association, 16*(82), 1985–1988. Copyright 1958, American Medical Association.

fort, muscle tone, reflex irritability, and color of the infant are each rated 0, 1, or 2; the five scores are then added. A newborn whose total score is less than 4 is in serious danger and needs resuscitation. A score of 4 to 6 means that the infant's condition is guarded and the baby may need clearing of the airway and supplementary oxygen. A score of 7 to 10 is considered good, indicating that the infant scored as high as 70% to 90% of all infants at 1 to 5 minutes after birth (10 is the highest score possible).

The Apgar score standardizes infant assessment at birth and serves as a baseline for future evaluations. There is a high correlation between low 5-minute Apgar scores and mortality and morbidity, particularly neurologic morbidity (Katz, 2003). The following points should be considered in obtaining an Apgar rating.

Heart Rate. Auscultating a newborn heart with a stethoscope is the best way to determine heart rate; however, heart rate also may be obtained by observing and counting the pulsations of the cord at the abdomen if the cord is still uncut.

Respiratory Effort. Respirations are counted by watching respiratory movements. A mature newborn usually cries and aerates the lungs spontaneously at about 30 seconds after birth. By 1 minute, he or she maintains regular, although rapid, respirations. Difficulty with breathing might be anticipated in a newborn whose mother received large amounts of analgesia or a general anesthetic during labor or birth (Box 24.4).

Muscle Tone. Mature newborns hold their extremities tightly flexed, simulating their intrauterine position. Muscle tone is tested by observing their resistance to any effort to extend their extremities.

Reflex Irritability. One of two possible cues is used to evaluate reflex irritability in a newborn: response to a suction catheter in the nostrils and response to having the soles of the feet slapped. A baby whose mother was heavily sedated will probably demonstrate a low score in this category.

Color. All infants appear cyanotic at the moment of birth. They grow pink with or shortly after the first breath, which makes the color of newborns correspond to how well they are breathing. Acrocyanosis (cyanosis of the hands and feet) is so common in newborns that a score of 1 in this category can be thought of as normal.

Respiratory Evaluation

Good respiratory function obviously has the highest priority in newborn care, so assessment for it is ongoing at every newborn contact. The Silverman and Andersen index, originally devised in 1956 (Silverman & Andersen, 1956), can be used to estimate degrees of respiratory distress in newborns. For this assessment, a newborn is observed and then scored on each of five criteria (Fig. 24.19). Each item is given a value of 0, 1, or 2; the values are then added. A total score of 0 indicates no respiratory distress. Scores of 4 to 6 indicate moderate distress. Scores of 7 to 10 indicate severe distress. (The scores of this index run opposite to those of the Apgar: an Apgar score of 7 to 10 would indicate a well infant.)

✔ **Checkpoint Question 4**

Beth Ruiz had Apgar scores of 6 and 8. The five areas assessed with Apgar scoring are:

a. Heart rate, respiratory effort, muscle tone, reflex irritability, and color.
b. Respiratory rate, abdominal tone, reflex irritability, color, head circumference.
c. Color, breathing rate, cry, amount of brown fat, response to an adult voice.
d. **A**bdominal tone, **p**ersistence, **g**astric acidity, **a**rterial pressure, **r**esponse to pain.

BOX 24.4: Focus on Nursing Care Planning

A Multidisciplinary Care Map for A Term Newborn

Carlotta Ruiz has just given birth to her second child, a 6-lb, 5-oz baby girl. While Jose, Carlotta's husband, is in the room, Carlotta tells you she is a "veteran" at baby care. Jose adds, "Little Joe [their 3-year-old] will be so excited to see his new sister. That's all he's been talking about lately." When Carlotta is alone, you notice she seems a little apprehensive about caring for her new daughter. She tells you, "She's so much smaller than Joe was. And why does it sound like she has a cold? And what is this rash all over her? Isn't it bad enough she has a birthmark?"

Family Assessment
Family is composed of two parents, a 3-year-old sibling, and newborn. They live in a three-bedroom flat over a drycleaning store. Father clerks in a grocery store; mother works as a school bus driver. Finances rated as "Hanging in there."

Client Assessment
Apgar score: 6 at 1 minute; 8 at 5 minutes. Birth from LOA position. Breathed at 30 seconds after birth after administration of blow-by oxygen. Respiratory rate, 74 breaths per minute with mild substernal retractions; rhonchi in upper lobes bilaterally; no grunting or nasal flaring present. Vital signs: temperature (axillary), 98.2°F (36.8°C); heart rate, 136 bpm. Length, 18.5 inches; head circumference, 34 cm; chest circumference, 32 cm. She has a 2×3 cm red pigmented area on outer right thigh. Mother attempted breast-feeding in birthing room, but newborn had difficulty sucking because of rapid respirations. Remainder of physical examination within acceptable parameters.

Nursing Diagnosis
Risk for ineffective parenting related to infant's smaller than expected size and birthmark.
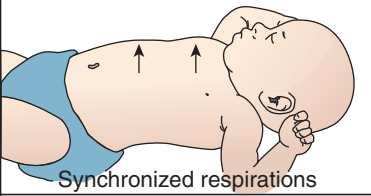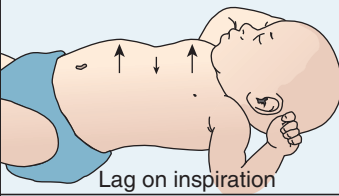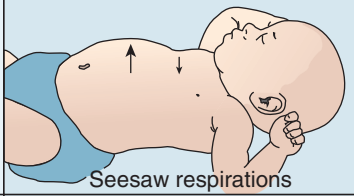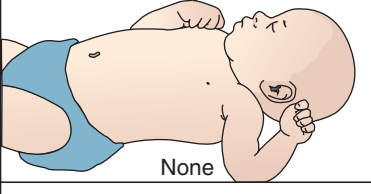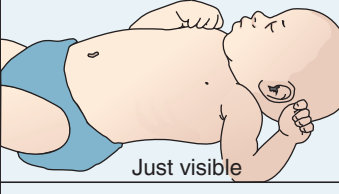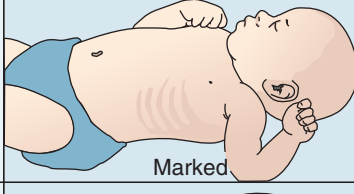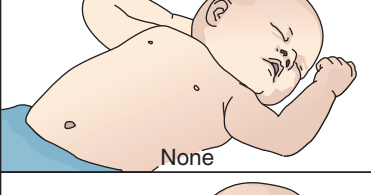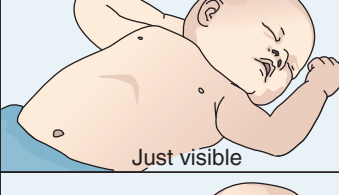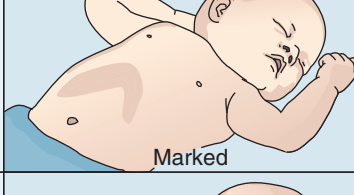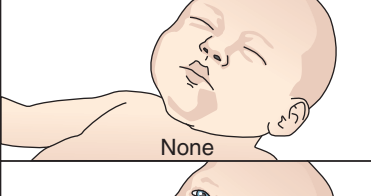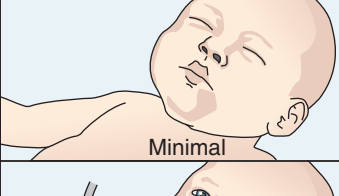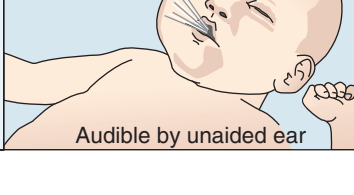
Outcome Criteria
Respiratory rate is decreased to 30 to 50 breaths per minute; retractions, nasal flaring, and grunting are absent; lungs are clear to auscultation.

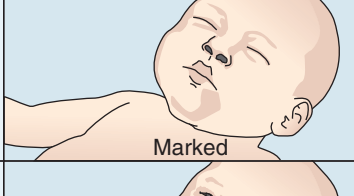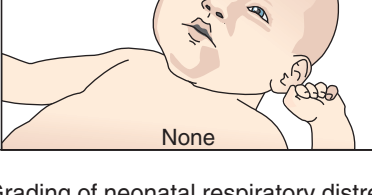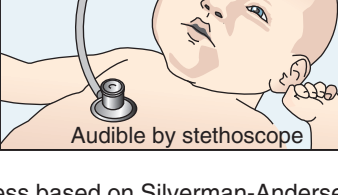| Team Member Responsible	Assessment	Intervention	Rationale	Expected Outcome
Activities of Daily Living				
Nurse	Assess respiratory rate every 15 min. for 1 hr.	Report increase in rate, retractions, or development of nasal flaring or grunting.	Increases in respiratory rate and retractions, accompanied by nasal flaring and grunting, may indicate respiratory distress.	Infant gradually decreases respiratory rate to 30–50/min by 24 hr.
Nurse	Monitor newborn's temperature every hour.	Keep infant warm via radiant warmer. Wrap loosely in a blanket and place a cap on her head.	Newborns have difficulty conserving body heat. Exposure to cold increases metabolic rate, increasing need for oxygen and a higher respiratory rate.	Infant's temperature remains at 98.2°F axillary.

Team Member Responsible	Assessment	Intervention	Rationale	Expected Outcome
Consultations				
Nurse/ Physician	Assess whether parents would like a dermatology consultation for child's birthmark.	Refer parents to dermatology consultant if desired.	A second opinion can help assure parents birthmark is no more than a birthmark.	Parents visit with consultant if desired; state they understand the prognosis for port-wine lesions.
Procedures/Medications				
Nurse	Assess whether infant's lung sounds reveal fluid.	Position newborn on her side with head slightly lower than body; suction mouth and then nose with bulb syringe as indicated.	Positioning facilitates drainage of secretions from airway. Gentle suctioning removes secretions. Suctioning mouth before nose prevents possible aspiration of oral secretions.	Infant appears comfortable in chosen position; need for suctioning becomes infrequent.
Nutrition				
Nurse	Assess mother's knowledge of breast-feeding techniques.	Assist mother with breast-feeding as needed; remind her that rapid respirations make sucking difficult.	Breast milk is the preferred milk for human newborns; a mother may need assistance if an infant sucks poorly.	Infant and mother establish mutually enjoyable breast-feeding by hospital discharge.
Patient/Family Education				
Nurse/ Physician	Review with parents what were their expectations of new child (bigger? prettier? more relaxed?)	Inform parents that a rapid respiratory rate is common in newborns because of unabsorbed lung fluid. Help them mold expectations with reality.	Providing information helps to allay parents' anxieties and fears.	Parents state they understand their infant's condition.
Psychosocial/Spiritual/Emotional Needs				
Nurse	Assess what is parents' greatest concern about taking newborn home.	Explain that the presence of a birthmark, rapid respirations, and smaller than expected size are normal variations of newborns.	Explanation of normal range of infant variation provides information to help allay parents' fears and concerns.	Parents state they were initially surprised by baby's appearance, but are adjusting to new image.
Nurse	Assess infant for general physical condition.	Point out positive attributes of newborn, such as pretty eyes, alert expression.	Pointing out positive areas helps parents focus attention on the unique and special qualities of their child.	Parents state they appreciate learning more about their newborn from health care professionals.
Discharge Planning				
Nurse	Assess whether parents have made plans for hospital discharge.	Remind parents about importance of car seat, falls, and aspiration.	Safety awareness plays a big role in preventing early-age accidents.	Parents state they feel ready to begin parenting their new infant.

Feature observed	Score		
	0	1	2
Chest movement	Synchronized respirations	Lag on inspiration	Seesaw respirations
Intercostal retraction	None	Just visible	Marked
Xiphoid retraction	None	Just visible	Marked
Nares dilatation	None	Minimal	Marked
Expiratory grunt	None	Audible by stethoscope	Audible by unaided ear

FIGURE 24.19 Grading of neonatal respiratory distress based on Silverman-Andersen index. (Silverman, W. A., & Andersen, D. H. [1956]. A controlled clinical trial of effects of water mist on obstructive respiratory signs, death rate and necroscopy findings among premature infants. *Pediatrics, 17*[4], 1–9.)

Physical Examination

A newborn is given a preliminary physical examination immediately after birth, to establish gestational age and to detect any observable condition such as difficulty breathing, a congenital heart anomaly, meningocele, cleft lip or palate, hydrocephalus, a birthmark, imperforate anus, tracheoesophageal atresia, or bowel obstruction (Table 24.3). This assessment may be the responsibility of the delivering physician, nurse practitioner, nurse-midwife, pediatrician, or nurse. This health assessment is done quickly, to prevent overexposing the newborn, yet not so swiftly that important findings are overlooked.

Height and Weight

Assuming newborns are breathing well, they are weighed nude and without a blanket immediately after birth in the birthing room (Fig. 24.20). Measurements such as body length and head, chest, and abdominal circumferences can be obtained in a newborn or transitional nursery. Performing these measurements while an infant is still damp only exposes the newborn unnecessarily to chilling.

Newborn weight helps to determine maturity and establishes a baseline against which other weights can be compared. An infant is weighed nude once a day, at approximately the same time every day, during a hospital or birthing center stay. Compare the weight obtained each day with that of the preceding day to be certain an infant is not losing more than the normal physiologic amount (5% to 10% of birthweight). Abnormal loss of weight may be the first indication that a newborn has an inborn error of metabolism, such as adrenogenital syndrome (salt-dumping type), or is becoming dehydrated.

TABLE 24.3

Congenital Anomaly Appraisal

Procedure	Abnormalities Considered
Inquire for hydramnios or oligohydramnios	Presence of hydramnios suggests congenital gastrointestinal obstruction. Oligohydramnios suggests genitourinary obstruction or extreme prematurity.
Appearance of abdomen	Distended abdomen suggests ascites or tumor. Empty abdomen suggests diaphragmatic hernia.
Passage of nasogastric tube (No. 8 feeding catheter) through nares into stomach	Failure to pass nasogastric tube through nares on either side establishes choanal atresia. Failure to pass it into the stomach confirms presence of esophageal atresia.
Aspiration of stomach with recording of color and amount of fluid obtained	With excess of 20 mL of fluid, or yellow fluid, duodenal or ileal atresia is suspected.
Insertion of rectal catheter	Failure to obtain meconium suggests imperforate anus or higher obstruction.
Counting of umbilical arteries	The presence of one artery suggests possible congenital urinary or cardiac anomalies or chromosomal trisomy (if other portions of examination are consistent).

Van Leeuwen, G. & Glenn, L. (1968). Screening for hidden congenital anomalies. *Pediatrics, 41*(6), 147–152. Copyright American Academy of Pediatrics, 1968.

FIGURE 24.20 Weighing a newborn. Notice the protective hand held over the infant.

Laboratory Studies

After the first hour of undisturbed rest, depending on health agency policy, newborns may have heel-stick tests for hematocrit, hemoglobin, and hypoglycemia determinations. Heel-sticks require a minimum of blood, and, although not pain free, they cause minimal trauma to a baby. In some settings, these tests are not routine but are reserved only for newborns with symptoms of anemia, polycythemia, or hypoglycemia.

Hematocrit and hemoglobin determinations are done to detect newborn anemia, because it is difficult to appreciate that anemia is present by clinical observation alone. Anemia can be caused by hypovolemia due to bleeding from placenta previa or abruptio placentae or by a cesarean birth that involved incision into the placenta. Another condition as dangerous as anemia is the presence of an excess of red blood cells (polycythemia), probably caused by excessive flow of blood into an infant from the umbilical cord. A heel-stick hematocrit reveals both of these conditions, and treatment then can be instituted. A normal hematocrit at 1 hour of life is about 50% to 55%.

Hypoglycemia may also produce few symptoms, so it is determined by a heel-stick glucose measurement. If a blood glucose heel-stick reading is less than 40 mg/100 mL of blood (30 mg/100 mL in the first 3 days of life), hypoglycemia is present (Fischback, 2004). To correct this condition, the infant is prescribed oral glucose or infant formula to be given immediately. This elevates the infant's blood sugar to a safe level. It is important to treat hypoglycemia quickly because, if brain cells become completely depleted of glucose, brain damage can result. If a newborn exhibits symptoms of hypoglycemia (jitteriness, lethargy, seizures) in addition to the low laboratory test results, intravenous glucose probably will be prescribed. A continuous intravenous infusion of glucose may be necessary if the newborn is unable to maintain glucose levels higher than 40 mg/100 mL.

Assessment of Gestational Age

Specific findings on physical assessment provide clues to a newborn's gestational age. As early as 1966, Usher and colleagues (1966) proposed five criteria to evaluate gestational maturity (Table 24.4). These quick criteria can be used for assessment of all newborns.

Dubowitz Maturity Scale

Dubowitz and colleagues (1970) devised a gestational rating scale that uses more extensive criteria. All newborns appearing to be immature by Usher's criteria or who are light in weight at birth or early by dates should

TABLE 24.4

Clinical Criteria for Gestational Assessment

Finding	Gestation Age (wk)		
	0–36	*37–38*	*39 and Over*
Sole creases	Anterior transverse crease only	Occasional creases in anterior two thirds	Sole covered with creases
Breast nodule diameter (mm)	2	4	7
Scalp hair	Fine and fuzzy	Fine and fuzzy	Coarse and silky
Ear lobe	Pliable; no cartilage	Some cartilage	Stiffened by thick cartilage
Testes and scrotum	Testes in lower canal; scrotum small; few rugae	Intermediate	Testes pendulous, scrotum full; extensive rugae

Usher, R., et al. (1966). Judgment of fetal age. *Pediatric Clinics of North America, 13*(4), 835–840.

be assessed by means of these more definitive criteria. Although completing a Dubowitz assessment takes practice, it can yield important results; it can help determine whether a newborn needs immediate high-risk nursery intervention.

During the 1970s and again in the 1990s, Ballard modified the Dubowitz scale (Ballard et al., 1991) to an assessment scale that can be completed in 3 to 4 minutes. The assessment consists of two portions: physical maturity and neuromuscular maturity (Fig. 24.21). The first is a series of observations about skin texture, color, lanugo, foot creases, genitalia, ear, and breast maturity. Each designated body part is inspected and given a score of 0 to 5, as described in Figure 24.21A. This observational scoring should be done as soon as possible after birth, because skin assessment becomes much less reliable after 24 hours. Illustrations of mature and immature body features for Ballard scale use are shown in Chapter 26 as part of the discussion of the preterm infant.

To complete the second half of the gestational examination, observe or position a newborn as shown in Figure 24.21B. Again, score the child's response numerically from 0 to 5.

To establish a baby's gestational age, the total score obtained (on both sections) is compared with the rating scale in Figure 24.21C. An infant with a total score of 5 is at 26 weeks' gestational age; a total score of 10 reveals a gestational age of about 28 weeks; a total score of 40 points is found in infants at term or 40 weeks' gestation.

Using such a standard method to rate maturity is helpful in detecting infants who are small for gestational age (they are light in weight, but the neuromuscular and physical observation scales are adequate for their weeks in utero) and differentiating them from newborns who are immature because of a miscalculated due date. An infant who is found to be less than 35 weeks' gestation requires close observation, usually in a special care nursery.

Assessment of Behavioral Capacity

Term newborns are physically active and emotionally prepared to interact with the people around them. They are people oriented from the beginning—how much so can be demonstrated by the way they immediately attune to human voices or concentrate on their mother's face (Fig. 24.22).

Brazelton Neonatal Behavioral Assessment Scale

The *Brazelton Neonatal Behavioral Assessment Scale* is a rating scale devised by Brazelton in the early 1970s (Brazelton, 1973) to evaluate a newborn's behavioral capacity or ability to respond to set stimuli. Six major categories of behavior—habituation, orientation, motor maturity, variation, self-quieting ability, and social behavior—are assessed.

To perform an assessment using the scale requires training to ensure that it is used consistently from one individual to another. Unlike many assessment scales, the infant is scored on best performance rather than on average performance. A total evaluation takes 20 to 30 minutes to complete. It is useful for comparing different groups of infants, such as those exposed or not exposed to cocaine in utero (Myers et al., 2003).

The information supplied by this scale has provided concrete evidence that newborns are not passive, nonhearing, unseeing, unresponsive, or even all alike. An important finding from the scale is that newborns are able to quiet themselves after crying. Many of the items tested on the scale, such as how infants alert (eyes widen, head held as if listening) or orient to sound (turn toward the direction of the parent's voice or appear to listen to the sound of a voice) and how they naturally cuddle when held next to their parent, are excellent examples of newborn behavior to point out to parents. If parents perceive a newborn as passive and unresponsive, they are likely to talk or

A

	0	1	2	3	4	5
SKIN	gelatinous red, transparent	smooth pink, visible veins	superficial peeling &/or rash, few veins	cracking pale area, rare veins	parchment, deep cracking, no vessels	leathery, cracked, wrinkled
LANUGO	none	abundant	thinning	bald areas	mostly bald	
PLANTAR CREASES	no crease	faint red marks	anterior transverse crease only	creases ant. 2/3	creases cover entire sole	
BREAST	barely percept.	flat areola, no bud	stippled areola, 1–2 mm bud	raised areola, 3–4 mm bud	full areola, 5–10 mm bud	
EAR	pinna flat, stays folded	sl. curved pinna, soft with slow recoil	well-curv. pinna, soft but ready recoil	formed & firm with instant recoil	thick cartilage, ear stiff	
GENITALS Male	scrotum empty, no rugae		testes descending, few rugae	testes down, good rugae	testes pendulous, deep rugae	
GENITALS Female	prominent clitoris & labia minora		majora & minora equally prominent	majora large, minora small	clitoris & minora completely covered	

B

	0	1	2	3	4	5
Posture						
Square Window (Wrist)	90°	60°	45°	30°	0°	
Arm Recoil	180°		100°–180°	90°–100°	<90°	
Popliteal Angle	180°	160°	130°	110°	90°	<90°
Scarf Sign						
Heel to Ear						

C

Score	Wks
5	26
10	28
15	30
20	32
25	34
30	36
35	38
40	40
45	42
50	44

FIGURE 24.21 Ballard's assessment of gestational age criteria. (**A**) Physical maturity assessment criteria. (**B**) Neuromuscular maturity assessment criteria. *Posture:* With infant supine and quiet, score as follows: arms and legs extended = 0; slight or moderate flexion of hips and knees = 2; legs flexed and abducted, arms slightly flexed = 3; full flexion of arms and legs = 4. *Square Window:* Flex hand at the wrist. Exert pressure sufficient to get as much flexion as possible. The angle between hypothenar eminence and anterior aspect of forearm is measured and scored. Do not rotate wrist. *Arm Recoil:* With infant supine, fully flex forearm for 5 sec, then fully extend by pulling the hands and release. Score as follows: remain extended or random movements = 0; incomplete or partial flexion = 2; brisk return to full flexion = 4. *Popliteal Angle:* With infant supine and pelvis flat on examining surface, flex leg on thigh and fully flex thigh with one hand. With the other hand, extend leg and score the angle attained according to the chart. *Scarf Sign:* With infant supine, draw infant's hand across the neck and as far across the opposite shoulder as possible. Assistance to elbow is permissible by lifting it across the body. Score according to location of the elbow: elbow reaches opposite anterior axillary line = 0; elbow between opposite anterior axillary line and midline of the thorax = 1; elbow at midline of thorax = 2; elbow does not reach midline of thorax = 3; elbow at proximal axillary line = 4. *Heel to Ear:* With infant supine, hold infant's foot with one hand and move it as near to the head as possible without forcing it. Keep pelvis flat on examining surface. (**C**) Scoring for a Ballard assessment scale. The point total from assessment is compared to the left column. The matching number in the right column reveals the infant's age in gestation weeks. (From Ballard, J. L. [1991]. New Ballard score expanded to include extremely premature infants. *Journal of Pediatrics, 119*[3], 417–424.)

look at him or her very little. The more they know about their baby, the more they will be able to understand the baby's cues and determine and meet his or her needs. Performing a Brazelton Assessment and pointing out positive infant behavior can lead to improved parenting ability.

CARE OF A NEWBORN AT BIRTH

Delivery and birthing rooms provide an island for newborn care separate from the supplies needed for the mother's care. Necessary equipment includes a radiant heat table or warmed bassinet; a warm, soft blanket; and equipment for oxygen administration, resuscitation, suction, eye care, identification, and weighing of a newborn.

The philosophy of caring health care providers has always been that newborns should be handled as gently at birth as they are at any other time. The image of an obstetrician holding a newborn up by the heels and spanking to stimulate breathing has existed only in movies. It has long been accepted that holding a baby by the feet and letting the back extend fully is probably painful after the months spent in a flexed position in utero; in addition, a measure such as spanking is not as effective in helping a newborn breathe as is gentle stimulation, such as rubbing the back.

Newborn Identification and Registration

Infant identification is important, because there always exists the possibility that a newborn may be handed to the wrong parents or be switched or kidnapped from a health

FIGURE 24.22 A newborn recognizes her parent's face.

care facility, although these events are rare. The profile of a kidnapper is a woman who has recently lost a pregnancy or had an infant stillborn and therefore desires an infant very much. She often is someone familiar with hospitals; she pretends to be a volunteer or an unlicensed health care worker and says she needs to take a baby out of the nursery or the mother's room for a procedure. Health care agency personnel need to be alert to the potential danger for kidnapping, and not only take measures to prevent this from happening but also alert parents to the danger (Capitulo & Cox, 2004) (Box 24.5).

Identification Band

One traditional form of identification used with newborns is a plastic bracelet with permanent locks that require cutting to be removed. A number that corresponds to the mother's hospital number, the mother's full name, and the sex, date, and time of the infant's birth are printed on the band. If an identification band is attached to a newborn's arm or leg, two bands should be used. This is because a newborn's wrist and hand, as well as the ankle and foot, are not very different in width, and bands can slide off easily. A newer form of identification band has a built-in sensor unit that sounds an alarm, similar to those attached to clothing in department stores to stop shoplifting, if the baby is transported beyond set hospital boundaries (Fig. 24.23).

After identification bands are attached, the infant's footprints may be taken (Fig. 24.24*A*) and thereafter kept with the baby's chart for permanent identification. If footprints will be obtained, take care to secure them, because they will be part of the permanent record (see Fig. 24.24*B*). Babies who are born elsewhere and then admitted to the hospital should have their footprints taken on admission.

BOX 24.5 FOCUS ON . . .

FAMILY TEACHING

Measures to Help Prevent Kidnapping From a Hospital Unit

Q. Beth's mother tells you, "I've heard babies are being kidnapped from hospitals. How can we make sure this doesn't happen to us?"

A. Although kidnapping is rare, it can happen. To minimize the risk, use the following guidelines:

- Review the hospital's newborn identification procedure with a nurse so you are familiar with it and can feel comfortable with the safeguards being taken.
- Check that identification bands are in place on your infant as you care for him or her. These can slide off easily over small newborn hands and feet. If a band or necklace is missing, ask a nurse to replace it immediately.
- Do not allow any person without proper hospital identification to remove your baby from your room.
- Do not leave your baby unattended in your room. Either return the baby to the nursery or have the baby accompany you if you are leaving your room to shower, for example.
- Report the presence of any suspicious person in the unit.
- Be aware that some hospitals use a microchip system embedded in identification bands, similar to the tag used to thwart shoplifting in department stores, that sounds an alarm if a baby is removed from the unit. If this type of band is used, be certain it is removed before hospital discharge, or it will set off the alarm.

Birth Registration

The physician or nurse-midwife who supervised the birth of the infant has the responsibility to see that a birth registration is filed with the Bureau of Vital Statistics of the

FIGURE 24.23 This newborn is wearing a security band, which sets off an alarm and locks exits if an infant is taken off the unit.

FIGURE 24.24 (**A**) Footprinting a newborn for identification. (**B**) Newborn footprints.

state in which the infant was born. The infant's name, the mother's name, the father's name (if the mother chooses to reveal this), and the birth date and place are recorded. Official birth information is important in proving eligibility for school and, later, for voting, passports, Social Security benefits, and so on.

Birth Record Documentation

The infant's chart is also a vital piece of documentation. It serves as a baseline indicating whether the infant was well at birth. Be certain a newborn chart contains the following information:

- Time of birth
- Time the infant breathed
- Whether respirations were spontaneous or aided
- Apgar score at 1 minute and at 5 minutes of life
- Whether eye prophylaxis was given
- Whether vitamin K was administered
- General condition of the infant
- Number of vessels in the umbilical cord
- Whether cultures were taken (they are taken if at some point sterile birth technique was broken or the mother has a history of vaginal or uterine infection)
- Whether the infant voided and whether he or she passed a stool (this information is helpful if, later on, the diagnosis of bowel obstruction or absence of a kidney is considered)

Many nurses indicate a three-vessel cord with the symbol shown in Figure 24.25. Do not mistake this drawing for a "smiling face" and assume that it is not important.
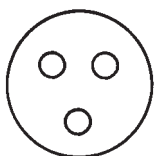
FIGURE 24.25 A chart abbreviation for a three-vessel cord.

NURSING DIAGNOSES AND RELATED INTERVENTIONS

In most health care facilities, the physician or nurse-midwife hands the newborn to the nurse moments after birth to begin care. Be certain to adhere to standard precautions when caring for newborns. To avoid touching the vernix caseosa, hold a warm, sterile blanket, and grasp the infant through the blanket by placing one hand under the back and the other around a leg. Newborns are slippery because they are wet from amniotic fluid and the vernix. Box 24.6 highlights appropriate outcomes and interventions for the care of a newborn, using the terminology identified by the Nursing Outcomes Classification (NOC) and Nursing Interventions Classification (NIC).

Nursing Diagnosis: Risk for ineffective thermoregulation related to newborn's transition to extrauterine environment

Outcome Evaluation: Newborn maintains axillary temperature of 98.6°F (37°C) by 1 hour after birth.
  A number of time-honored procedures help a baby to conserve body heat at birth.

Keep Newborn Warm. Gently rub a newborn dry, so that little body heat is lost by evaporation. Next, swaddle the newborn loosely with a blanket to prevent compromising respiratory effort, and place a cap on the infant's head (Fig. 24.26).
  Ask which parent wants to hold the child, and place the infant in the parent's arms. This helps conserve heat and encourages bonding. The period immediately after birth is an important time for

BOX 24.6

Nursing Outcomes Classification (NOC) and Nursing Interventions Classification (NIC)

Caring for the Newborn

NOC: Thermoregulation, Neonate

Thermoregulation, neonate is defined as the balance among heat production, heat gain, and heat loss during the neonatal period (Johnson, Mass, & Moorhead, 2000). Some specific indicators suggesting that this outcome has been achieved include evidence of the following in the neonate:

- Body temperature within normal limits
- Absence of respiratory distress, restlessness, and lethargy
- Skin color changes and weight gain within accepted parameters
- Adequate hydration
- Blood glucose and bilirubin levels and acid-base balance within normal limits
- Ability to assume heat retention and heat dissipation postures as necessary

NIC: Newborn Monitoring

Newborn monitoring is defined as the measurement and interpretation of physiologic status of the neonate in the first 24 hours after delivery (McCloskey & Bulechek, 2000). Some important activities involved when implementing this intervention include the following:

- Performing Apgar scoring at 1 and 5 minutes after birth
- Assessing color, temperature, heart rate, respiratory rate, and breathing pattern
- Assessing the neonate's ability to suck and first feeding
- Evaluating umbilical cord site
- Monitoring weight and intake and output

- Recording first voiding and bowel movement
- Monitoring for signs and symptoms of respiratory distress and hyperbilirubinemia

NIC: Newborn Care

Newborn care is defined as the management of the neonate during the transition to extrauterine life and subsequent period of stabilization (McCloskey & Bulechek, 2000). Some important activities involved when implementing this intervention include the following:

- Obtaining weight and measurements of length and head circumference, estimating gestational age, and comparing measurements with estimated gestational age.
- Clearing the airway of mucus and elevating the head of the mattress to promote respiratory function
- Maintaining warm body temperature with frequent monitoring of newborn, drying immediately after birth, wrapping in warm blanket, applying cap to head, and placing in isolette or under warmer as needed
- Putting the neonate to the mother's breast and monitoring sucking reflex
- Bathing neonate once temperature has stabilized
- Swaddling neonate to promote sleep and sense of security
- Providing umbilical cord site care, keeping the site dry and exposed to air
- Protecting neonate from sources of infection
- Providing a quiet, soothing environment
- Responding to cues and making eye contact when giving care

parents to begin interaction with their child. New-borns are alert (first period of activity) and respond well to the parents' first tentative touches or inter-actions with them. Although the temperature of newborns who are dried, wrapped, and then held by their parents immediately after birth apparently falls slightly lower than that of infants placed in heated cribs, their core temperature does not fall below safe limits. If a mother wishes to begin breast-feeding immediately after birth, encourage her to do this. Accomplish all nursing care as quickly as possible, with minimal exposure of the newborn to chilling air. Any extensive procedures, such as resuscitation, should be done under a radiant heat source to reduce heat loss.

At the end of the first hour of life, reassess the newborn's temperature. Axillary rather than rectal temperatures are recommended for newborns, to

FIGURE 24.26 A newborn wrapped and capped to con-serve body heat.

prevent accidental bowel perforation. If the temperature is subnormal and the baby is in a bassinet, he or she should be placed in a heated bassinet or under a radiant warmer for additional heat. If the temperature is normal, a newborn can be bathed quickly to remove excess vernix caseosa and blood, then dressed in a shirt and diaper, reswaddled in a snug blanket (to give the baby a familiar feeling of the tight confines of the uterus), and placed in a bassinet or returned to the mother's side.

During the first day of life, a newborn's temperature is usually taken every 4 to 8 hours. Thereafter, unless the temperature is elevated or subnormal, or the infant appears to be in distress, measurement once a day while in the health care facility is enough.

Nursing Diagnosis: Risk for ineffective airway clearance related to presence of mucus in mouth and nose at birth

Outcome Evaluation: Neonate maintains a respiratory rate of 30 to 60 breaths per minute without evidence of retraction or grunting by 5 minutes after birth.

Promote Adequate Breathing Pattern and Prevent Aspiration. Mucus is suctioned from a newborn's mouth by a bulb syringe as soon as the head is born. As soon as the body is born, he or she should be held for a few seconds with the head slightly dependent, for further drainage of secretions. It is important that mucus be removed from the mouth and pharynx before the first breath this way to prevent aspiration of the secretions. If the infant continues to have an accumulation of mucus in the mouth or nose after these first steps, you may need to suction further after the baby is placed under a warmer (Fig. 24.27). Use a bulb syringe or a soft, small (no. 10 or 12) catheter to suction. Never suction vigorously, because this irritates the mucous mem-

FIGURE 24.27 A newborn is suctioned by means of a bulb syringe to remove mucus from the mouth and nose. The head-down-and-to-the-side position facilitates drainage. Care is given with the infant under a radiant heat source.

brane and could leave a portal of entry for infection. Brisk suctioning also has been associated with bradycardia in newborns because of vagal nerve stimulation. If you use a bulb syringe, decompress the bulb before inserting it into the infant's mouth or nose; otherwise, the force of decompression will push secretions back into the pharynx or bronchi rather than remove them. Although the effectiveness of the procedure is not well documented, when an infant is born with meconium-stained amniotic fluid, intubation may be performed so that deep tracheal suction can be accomplished before the first breath, to help prevent meconium aspiration (Halliday & Sweet, 2005).

Record the First Cry. A crying infant is a breathing infant, because the sound of crying is made by a current of air passing over the larynx. The more lusty the cry, the greater the assurance the newborn is breathing deeply and forcefully. Vigorous crying also helps blow off the extra carbon dioxide that makes all newborns slightly acidotic, so helps to correct this condition. Although gentleness is necessary to make an infant's transition from intrauterine life to extrauterine life as untraumatic as possible, there is no need to completely halt the initial crying of a newborn.

A newborn who does not breathe spontaneously or who takes a few quick, gasping breaths but is unable to maintain respirations needs resuscitation as an emergency measure. An infant with grunting respirations needs careful observation for respiratory distress syndrome (see Chapter 26).

Nursing Diagnosis: Risk for infection related to newly clamped umbilical cord and exposure of eyes to vaginal secretions

Outcome Evaluation: Area around cord is dry and free of erythema. Eyes are free of inflammation and drainage. Axillary temperature is maintained between 97.6°F and 98.6°F (36.5°C and 37°C).

Inspect and Care for Umbilical Cord. The umbilical cord pulsates for a moment after an infant is born as a last flow of blood passes from the placenta into the infant. Two clamps are then applied to the cord about 8 inches from the infant's abdomen, and the cord is cut between the clamps. Some fathers choose to do this as their responsibility. The infant cord is then clamped again by a permanent cord clamp, such as a Hazeltine or a Kane clamp. The clamp on the maternal end of the cord should not be released after the cord is cut, to prevent blood still remaining in the placenta from leaking out. This loss is not important, because the mother's circulation does not connect to the placenta. It is messy, however, and that is why the clamp is left in place.

Every time you handle a newborn, inspect the cord to be certain it is clamped securely. If the clamp loosens before thrombosis obliterates the umbilical vessels, hemorrhage could result. As previously mentioned, the number of cord vessels

should be counted and noted immediately after the cord is cut. Cords begin to dry almost immediately, and the vessels may be obscured by the time of the infant's first thorough physical examination in the nursery.

Within a few minutes after the cord is cut, apply antibiotic ointment or triple dye as required by agency policy to help reduce infection. Until the cord falls off, at about day 7 to 10 of life, it should be kept dry. The newborn should receive sponge baths rather than be immersed in a tub of water. Be certain that diapers are folded below the level of the umbilical cord, so that, when the diaper becomes wet, the cord does not become wet also.

Remind parents to continue to keep the cord dry until it falls off after they return home. The use of creams, lotions, and oils near the cord should be discouraged, because they tend to slow drying of the cord and invite infection. Some health care agencies recommend applying rubbing alcohol to the cord site once or twice a day to hasten drying. Others prefer the cord be left strictly alone, because manipulation could invite infection.

After the cord falls off, a small, pink, granulating area about a quarter of an inch in diameter may remain. This should also be left clean and dry until it has healed (about 24 to 48 more hours). If the ulcerous area has remained as long as 1 week, it may require cautery with silver nitrate to speed healing.

Administer Eye Care. Although the practice may shortly become obsolete (as it is in Europe), every U.S. state still requires that newborns receive prophylactic eye treatment against gonorrheal conjunctivitis (Katz, 2003). Such infections are usually acquired from the mother as the infant passes through the birth canal. Formerly, eye prophylaxis was applied immediately after birth. Many parents today prefer to visit with their infant before the procedure, to be certain their newborn can focus on them without blurry vision caused by ointment or drops. As long as it is completed as soon as possible after birth, either in the birthing room or on arrival in the nursery, the exact time the ointment is administered is unimportant. Silver nitrate was exclusively used for prophylaxis in the past; today, erythromycin ointment is the drug of choice. Erythromycin ointment has the advantage of eliminating not only the organism of gonorrhea but that of chlamydia as well (Box 24.7).

Always use a single-use tube or package of ointment, to avoid transmitting infection from one newborn to another. To instill the ointment, first dry the face of the newborn with a soft gauze square so that the skin is not slippery. The best procedure to open a newborn's eyes is to shade them from the overhead light and open one eye at a time by pressure on the lower and upper lids. Squeeze a line of ointment along the lower conjunctival sac, from the inner canthus outward, and then close the eye to allow the ointment to spread across the conjunctiva.

BOX 24.7 FOCUS ON . . .

PHARMACOLOGY

Erythromycin Ophthalmic Ointment

Classification: Erythromycin ointment is a topical antibiotic.

Action: Erythromycin is effective against gonorrhea and chlamydia organisms, making it the drug of choice for eye prophylaxis at birth (Karch, 2004).

Pregnancy Risk Category: B

Dosage: 0.5–1 cm each eye

Possible Adverse Effects: Mild irritation to conjunctiva; slight blurring of vision.

Nursing Implications
• Use a single-dose application tube.
• After gently pulling down on a newborn's lower eyelid, extrude a line of ointment the length of the lower eyelid from the inner canthus outward.
• Discard any remaining ointment to prevent its being used again.
• Close the child's eyes and count to about 5.
• Wipe away any excess ointment from the child's face.
• If desired, delay application for an hour after birth to allow the infant to view his or her parents for the first time with the clearest vision possible.

Credé, a German gynecologist, first proposed silver nitrate prophylaxis against gonorrheal conjunctivitis in 1884. For this reason, it is often referred to as the *Credé treatment* and may be listed that way on a health care agency form even though silver nitrate is no longer used. Babies born outside hospitals, in homes or in less orthodox settings such as a car or taxi, have the prophylactic treatment administered on admission to the hospital.

General Infection Precautions. Each newborn should have his or her own bassinet. Compartments in the bassinet should hold a supply of diapers, shirts, gowns, and individual equipment for bathing and temperature taking. Avoid sharing of these items, which could lead to the spread of infection.

Health care workers, parents, or siblings caring for newborns should wash their hands and arms to the elbows thoroughly with an antiseptic soap before handling an infant. Agency personnel are usually required to wear cover gowns or nursery uniforms.

Staff members with infections (sore throats, upper respiratory tract infections, skin lesions, or gastrointestinal upsets) should be excluded from caring for mothers or infants until the condition is completely cleared. If a mother might have a contagious illness, her newborn should be excluded from her room until there is no longer a possibility of contagion. An instant photograph can be taken of the baby and shown to the mother so that she can follow the baby's progress. If the infant is breast-fed,

the mother should manually express milk during the time the infant is excluded, to maintain her milk supply. The milk, however, should be discarded. The mother can resume breast-feeding as soon as it is both possible and safe for her infant.

Any baby born outside a hospital or under circumstances conducive to infection (e.g., rupture of membranes more than 24 hours before birth) should be kept in a closed bassinet or in the mother's room until negative cultures show that the newborn is free of infection. Any newborn in whom symptoms of infection develop (e.g., skin lesions, fever) should be removed to an isolation nursery or housed in the mother's room to prevent the spread of infection to other babies. There is no reason for parents not to visit a baby housed in isolation care. In fact, they may have more need to hold a baby who is isolated than average parents do, because they have an extra reason to be worried that something is wrong with their child. To visit in isolation nurseries, parents should be required to use the same infection control techniques that staff members use.

What if... Beth Ruiz had been born by cesarean birth? Would you still administer eye prophylaxis? Or do newborns acquire eye infections only during their transit through the birth canal?

NURSING CARE OF A NEWBORN AND FAMILY IN THE POSTPARTAL PERIOD

Newborns are usually kept in either a birthing room or a transitional nursery for optimal safety in the first few hours of life. During this period of close observation, certain principles of care always apply.

Initial Feeding

A term newborn who is to be breast-fed may be fed immediately after birth. A baby who is to be formula-fed may receive a first feeding at about 2 to 4 hours of age. Both formula-fed and breast-fed infants do best on a demand schedule; many need to be fed as often as every 2 hours in the first few days of life. Chapter 25 covers the elements of breast-feeding and formula-feeding in detail.

Bathing

In most hospitals, newborns receive a complete bath to wash away vernix caseosa within an hour after birth. Thereafter, they are bathed once a day, although the procedure may be limited to washing only the baby's face, diaper area, and skin folds. Wear gloves when handling newborns until the first bath, to avoid exposing your hands to body secretions; babies of mothers with human immunodeficiency virus (HIV) infection should have a thorough bath immediately, to decrease the possibility of HIV transmission.

Bathing of an infant is best done by the parents under a nurse's supervision. Be sure the room is warm (about 75°F [24°C]), to prevent chilling. Bath water should be approximately 98°F to 100°F (37°C to 38°C), a temperature that feels pleasantly warm to the elbow or wrist. If soap is used, it should be mild and without a hexachlorophene base. Bathing should take place before, not after, a feeding, to prevent spitting up or vomiting and possible aspiration.

Equipment necessary for an infant's bath consists of a basin of water, soap, washcloth, towel, comb, and clean diaper and shirt. Assemble these items beforehand, so the baby is not left exposed or unattended while you go for more equipment.

Teach parents that bathing should proceed from the cleanest to the most soiled areas of the body—that is, from the eyes and face to the trunk and extremities and, last, to the diaper area. Wipe a newborn's eyes with clear water from the inner canthus outward, using a clean portion of the washcloth for each eye to prevent spread of infection to the other eye. Wash the face with clear water only (no soap) to avoid skin irritation; soap may be used on the rest of the body.

Teach parents to wash the infant's hair daily with the bath. The easiest way to do this is to first soap the hair with the baby lying in the bassinet. Then, hold the infant in one arm over the basin of water, as you would a football (Fig. 24.28). Splash water from the basin against the head to rinse the hair. Dry the hair well to prevent chilling.

Wash each area of the baby's body, rinse so no soap is left on the skin (soap is drying and newborns are susceptible to desquamation), and then dry the body part. When you wash the skin around the cord, take care not to soak the cord, because a wet cord remains in place longer than a dry one and furnishes a breeding ground for bacteria. Give particular care to the creases of skin, where milk tends to collect if the child spits up after feedings.

In male infants, the foreskin of the uncircumcised penis should not be forced back, or constriction of the penis may result. Wash the vulva of a female infant, wiping from front to back to prevent contamination of the vagina or urethra by rectal bacteria.

FIGURE 24.28 A football hold. Such a position supports the infant's head and back and leaves the nurse's or mother's other hand free for assembling or using equipment.

Most health care agencies do not apply powder or lotion to newborns, because some infants are allergic to these products. In addition, many adult talcum powders contain zinc stearate, which is irritating to the respiratory tract; such preparations should always be avoided. If a newborn's skin seems extremely dry and portals for infection are becoming apparent, a lubricant such as Nivea oil, added to the bath water or applied directly to the baby's skin, should relieve the condition.

Sleeping Position

Stress to parents that a newborn should be positioned on the back for sleep. Sudden infant death syndrome (SIDS) is the sudden, unexplained death of an infant younger than 1 year of age. Although the specific cause of SIDS cannot be explained, placing infants in a supine position has been shown to decrease the incidence of the syndrome (Box 24.8).

BOX 24.8 FOCUS ON . . .

EVIDENCE-BASED PRACTICE

Do Nurses Follow the Recommendation to Put Newborns to Sleep on Their Back?

The American Academy of Pediatrics (AAP) has recommended that all infants be positioned on their back for sleeping, because this position appears to lower the incidence of sudden infant death syndrome (SIDS). To discover what position nurses in newborn nurseries use when they put newborns to sleep, researchers distributed questionnaires to 96 hospital newborn nursery staff and 579 mothers of newborns at eight separate perinatal hospitals. Surprisingly, although 72% of sampled nursery staff identified the supine position as the placement that most lowers the risk for SIDS, only 30% reported most often placing infants to sleep in that position. The most common reason for not using the supine position was fear of aspiration. In addition, only 34% of staff reported advising exclusive supine infant positioning to mothers. When mothers were asked whether they used a supine position for their infant, only 36% reported using this placement exclusively. Mothers' rate of use was influenced by the advice they received as to infant position and the role modeling they observed. Those who used the position most had both received advice and observed role modeling. Nonwhite women used a supine position less often than white women did, and multiparas used it less than primiparas.

This study is important to nurses, because it reveals how important role modeling newborn care is to new mothers as well as how evidence-based interventions are not always used in practice.

Stastny, P. F., et al. (2004). Infant sleep positioning by nursery staff and mothers in newborn hospital nurseries. *Nursing Research, 53*(2), 122–129.

Diaper Area Care

Preventing diaper dermatitis is a practice that parents need to start from the very beginning with their newborns. With each diaper change, the area should be washed with clear water and dried well, to prevent the ammonia in urine from irritating the infant's skin and causing a diaper rash. After cleaning, a mild ointment (e.g., petroleum jelly, A and D ointment) may be applied to the buttocks. The ointment keeps ammonia away from the skin and also facilitates the removal of meconium, which is sticky and tarry. Wear gloves for diaper care as part of standard precautions.

Metabolic Screening Tests

By state law, every infant must be screened for phenylketonuria (PKU; a disease of defective protein metabolism), hypothyroidism, and cystic fibrosis. This is done by means of a simple blood test in which three drops of blood from the heel are dropped onto a special filter paper. Ideally, the baby should have received formula or breast milk for 24 hours (providing an intake of phenylalanine, an essential amino acid found in milk) before the test for PKU will be accurate. If the infant has not received adequate milk before the blood sample is taken, the results may be falsely negative (a child with PKU will test as if normal). If an infant is discharged before this 24-hour period, a second screening test is necessary. Many states require other metabolic tests at birth, such as screening for galactosemia and maple syrup urine disease, that also require filter paper blood tests.

If blood testing was not done before discharge, alert the parents that they must schedule the tests at an ambulatory visit in 2 to 3 days' time. Always assess at the first newborn health supervision visit whether this procedure was done. As with any heel-stick for blood, sampling of this nature is done best by a spring-activated lancet rather than a regular lancet, so that the skin incision is made as quickly and painlessly as possible. Allowing a newborn to suck on a pacifier during painful procedures may be helpful.

Hepatitis B Vaccination

All newborns receive a first vaccination against hepatitis B within 12 hours after birth; a second dose is administered at 1 month and a third at 6 months. Infants whose mothers are positive for the hepatitis B surface antigen (HBsAg) also receive hepatitis B immune globulin (HBIG) at birth (AAP, 2005).

Vitamin K Administration

Newborns are at risk for bleeding disorders during the first week of life because their gastrointestinal tract is sterile at birth and unable to produce vitamin K, which is necessary for blood coagulation. A single dose of 0.5 to 1.0 mg of vitamin K is administered intramuscularly within the first hour of life to prevent such problems (Box 24.9). Infants born outside a hospital also should receive this important protection.

BOX 24.9 FOCUS ON . . .

PHARMACOLOGY

Vitamin K (Phytonadione, AquaMEPHYTON)

Action: Vitamin K is used to prevent and treat hemorrhagic disease in newborns. It is a necessary component for the production of certain coagulation factors (II, VII, IX, and X) and is produced by microorganisms in the intestinal tract (Karch, 2004).

Pregnancy risk category: C

Dosage: Prophylaxis—0.5 to 1.0 mg IM one time immediately after birth; treatment of hemorrhagic disease—1 to 2 mg IM or SC daily.

Possible adverse reactions: Local irritation, such as pain and swelling at the site of injection.

Nursing Implications
- Anticipate the need for injection immediately after birth.
- Administer IM injection into large muscle, such as the anterolateral muscle of a newborn's thigh.
- If giving for treatment, obtain prothrombin time before administration (the single best indicator of vitamin K–dependent clotting factors).
- Assess for signs of bleeding, such as black, tarry stools (different from meconium stools, which have a greenish shade), hematuria, decreased hemoglobin and hematocrit levels, and bleeding from any open wounds or base of the cord. (These signs would indicate that more vitamin K is necessary, because bleeding control has not been achieved.)

Circumcision

Circumcision is the surgical removal of the foreskin of the penis. In only a few babies, constriction (phimosis) of the foreskin is so severe that it obstructs the urinary meatal opening; otherwise, there are few medical indications for circumcision of a male newborn. Circumcision is performed on Jewish boys on the eighth day of life as part of a religious requirement, in a ceremony called a *bris.* In the United States, from the 1920s to the 1960s, circumcision became so popular for aesthetic reasons that virtually all male infants were routinely circumcised at birth. The reasons supporting circumcision include easier hygiene because the foreskin does not have to be retracted during bathing, and possibly fewer urinary tract infections. There also may be an increased incidence of penile cancer in uncircumcised men, as well as increased cervical cancer in their sexual partners. However, because the procedure is not essential and does carry some risk, parents should be well informed about the procedure so they can evaluate carefully whether they wish to have it performed on their son.

Contraindications for circumcision include congenital abnormalities such as hypospadias or epispadias, because the prepuce skin may be needed when a plastic surgeon repairs the defect. Another contradiction is a history of a bleeding tendency in the family.

The procedure is not done immediately after birth, because at that time a newborn's level of vitamin K, which is necessary to prevent hemorrhage, is at a low point and the child would be exposed to unnecessary cold. It is best performed during the first or second day of life, after the baby has synthesized enough vitamin K to reduce the chance of faulty blood coagulation. If parents elect early discharge, they may be asked to return the infant to the hospital or to an ambulatory setting for the surgery. Parents should check that their health insurance plan will reimburse for the procedure if it is done on a return visit, after their newborn has been discharged from the hospital.

For the procedure, an infant is placed in a supine position and restrained either manually or with a commercial swaddling board. In the past the procedure was done without anesthesia, but today the trend is toward use of local or regional block anesthesia to reduce the pain as much as possible (Razmus et al., 2004). Application of EMLA cream (a *e*utectic *m*ixture of *l*ocal *a*nesthetics) is a popular choice for local anesthesia (Taddio et al., 2005).

A specially designed plastic bell (Plastibell) is fitted over the end of the penis. A suture is then tied around the rim of the bell and a circle of the prepuce is cut away so that the foreskin can be easily retracted and the glans will be fully exposed (Fig. 24.29). The rim of the bell, which remains in place for about 1 week and then falls off by itself, protects the healing penis from sticking to the diaper. The bell also helps protect against infection and bleeding. In the past, petrolatum ointment was applied to circumcision incisions. With the bell rim in place, this is no longer necessary, although it still may be applied if desired.

Complications that can occur from circumcision include hemorrhage, infection, and urethral fistula formation. To keep the risk of these complications to a minimum, observe infants closely for about 2 hours after circumcision. Check the infant for bleeding every 15 minutes for the first hour. Also, document that the infant is voiding after the procedure.

Parents should keep the area clean and covered with petrolatum (if used) for about 3 days, until healing is complete. If they see any redness or tenderness, or if the baby cries as if in constant pain, they should report it by telephone. Circumcision sites appear red but should never have a strong odor or discharge. A film of yellowish mucus often covers the glans (similar to a scab) by the second day after surgery. This should not be washed away. The yellow color is from accumulated serum, an innocent finding, and should not be mistaken for the yellow of a purulent exudate.

ASSESSMENT OF FAMILY'S READINESS TO CARE FOR A NEWBORN AT HOME

It is important to assess how prepared each family is to care for their newborn at home, to be sure the newborn remains safe (Box 24.10). Parents may need to make changes in their routine, such as shifting their usual dinner time or work schedule. Sleep schedules are certain to
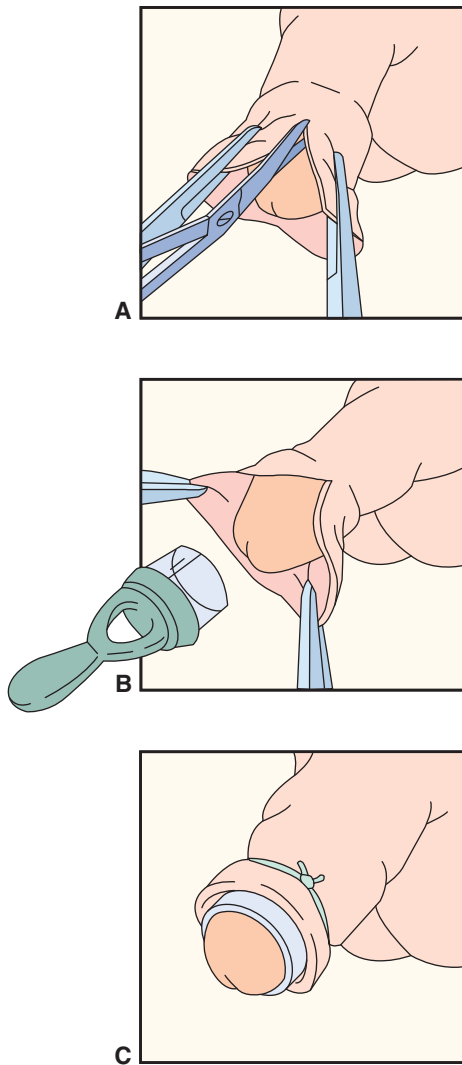
FIGURE 24.29 Technique for performing circumcision using a Plastibell. (**A**) An incision is made in the top of the foreskin. (**B**) The Plastibell is placed over the head of the penis, and the foreskin is pulled over the Plastibell. (**C**) A suture is tied around the foreskin over the tying groove in the Plastibell. Excess skin beyond the suture is trimmed away. The Plastibell falls off in 3 to 7 days. (Courtesy of Hollister Inc., Libertyville, IL.)

be disrupted, because infants wake during the night for one or more feedings for about the first 4 months of life.

The physical environment of the home to which a newborn will be discharged is a good subject to explore with parents. Questions and areas to consider include the following:

- Is it an apartment or a house?
- How many flights of stairs will the mother have to climb when she takes the baby home or when she takes the baby out in a stroller?
- How many other people live in the home? (Infections spread more rapidly in crowded homes.)

BOX 24.10 FOCUS ON . . .

COMMUNICATION

When you enter Beth Ruiz's room, you notice her mother sitting on the side of the bed staring into Beth's face.

Less Effective Communication

Nurse: You seem concerned, Mrs. Ruiz. Is something wrong?
Mrs. Ruiz: Do you think she can tell how little I remember about babies?
Nurse: You're doing a great job. That's the important thing.
Mrs. Ruiz: How long will it take for me to feel like a great mother?
Nurse: You're worrying too much. Relax and enjoy your new baby.

More Effective Communication

Nurse: You seem concerned, Mrs. Ruiz. Is something wrong?
Mrs. Ruiz: Do you think she can tell how little I remember about babies?
Nurse: Is there something special you feel you don't know?
Mrs. Ruiz: My big problem is, I don't feel anything toward her yet. Why do I keep wondering if this whole thing is real?
Nurse: Let's talk about how maternal love develops. It isn't automatic.

Most new mothers have so many questions, it is easy to dismiss a very serious question as "just another question." Resist assuring women that they will be good mothers until you are certain their concern isn't something that could interfere with good mothering.

- Are there any pets in the home? Will a large dog, for example, be a safe pet around the baby?
- Is there a bed for the baby?
- Will the baby be sleeping alone in a room or with older children? Will the baby share a bed with a parent?
- Who will be the primary caregiver?
- Will grandparents or other persons offer support by visiting or helping with care of the child?
- Do the parents have anyone to turn to if they have questions about the baby?
- Is there a refrigerator in which formula or breast milk can be stored?
- Is there adequate heat? An infant needs a temperature of 70°F to 75°F during the day and 60°F to 65°F at night.
- Are the windows draft free and screened to keep out insects?
- If housing is in poor condition, is there a danger that rodents might attack the baby?
- Is there a danger of lead poisoning?
- Does the mother or do the parents have a source of income? If not, what sort of referral should be made so that money can be provided to care for this child?

These are not prying questions but means of determining whether the home will be adequate and safe. Good prenatal and postnatal care is wasted if an infant contracts pneumonia during the first week at home because no one at the hospital or a birthing center took the time to ask the right questions about the home environment. If the home environment is found to be unsafe, a referral to social services may be necessary before the newborn is discharged.

NURSING DIAGNOSES AND RELATED INTERVENTIONS

Nursing Diagnosis: Health-seeking behaviors related to needs of a normal newborn after discharge from the health care facility

Outcome Evaluation: Parents state ways in which they have already altered their home and lifestyle to accommodate their newborn and indicate that they are prepared for other changes; parents voice relative confidence in their ability to care for the newborn and state names of individuals within their family or community who can be resources to them when needed.

Before discharge, the parents should have thought through how they are going to care for their child at home. Many parents have been mulling over these questions throughout the pregnancy, whereas others may not yet have addressed some or any of these important issues. Box 24.11 highlights appropriate outcomes and interventions for safe parent–child attachment, using the terminology identified by the Nursing Outcomes Classification (NOC) and Nursing Interventions Classification (NIC).

Young, single mothers without family support and mothers who did not seek regular prenatal care in particular may be unprepared for the months ahead. With all parents, try to anticipate problems that may be relevant to them. If there are other children at home, discuss whether the parents are aware that sibling jealousy may occur. Pets in the home can cause similar problems with jealousy. Discuss with a mother who is not going to breastfeed what she will use to feed her baby until she has time to buy formula. Most hospitals supply or sell a discharge formula kit to help parents through the first day at home. Be sure the parents have decided when and where they will take their newborn for health supervision. Check the child's identification band against the mother's one final time before discharge, to help prevent the possibility of wrong identification of the infant.

Daily Home Care. Newborns thrive on a gentle rhythm of care, a sense of being able to anticipate

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BOX 24.11

Nursing Outcomes Classification (NOC) and Nursing Interventions Classification (NIC)

Parents and the Neonate

NOC: Parent–infant Attachment
Parent–infant attachment is defined as the behaviors demonstrating an enduring affectionate bond between parents and infant (Johnson, Maas, & Moorhead, 2000). Some specific indicators suggesting that this outcome has been achieved include demonstration of the following behaviors by the parents:

- Verbalizing positive feelings toward the infant.
- Holding the infant close, touching, stroking, patting, and kissing the infant
- Talking to the infant in the en face position and maintaining eye contact
- Smiling, vocalizing, and playing with the infant
- Responding to cues, consoling, and feeding the infant

Also, some specific indicators suggesting achievement of this outcome include demonstration of the following behaviors by the neonate:

- Looking at parents
- Exploring the environment

- Responding to parental cues
- Seeking proximity with the parents

NIC: Environmental Management: Attachment Process
Environmental management, attachment process is defined as manipulation of the surroundings to facilitate development of the parent–infant relationship (McCloskey & Bulechek, 2000). Some important activities involved when implementing this intervention include the following:

- Creating a clean, homelike environment that fosters privacy and consistency of staff
- Individualizing daily routine to meet the family's needs
- Providing comfortable seating, such as a rocking chair, for parents
- Limiting the number of people in the environment, allowing for family visitation as desired
- Preventing and reducing interruptions from visitors, phone calls, and agency personnel
- Maintaining a low level of stimuli in the environment

what is to come next. Based on this, parents can decide what is the best daily at-home routine for them and their new child. There are no fixed rules. There is no set time at which an infant must be bathed, nor even a rule that requires a bath every day. All infants do not have to be in bed for the night by 8 PM. If the father works evenings, it may be important to have the baby awake at midnight so that he has time to spend with his child.

Your aim in helping parents plan their schedule of care is to arrive at one that does the following:

- Offers a degree of consistency (a mother cannot expect an infant to stay awake until midnight five nights a week, then go to sleep at 7 PM on the sixth night)
- Appears to satisfy the infant
- Gives the parents a sense of well-being and contentment with their child

Sleep Patterns.   A newborn sleeps an average of 16 hours of every 24 during the first week home, an average of 4 hours at a time. By 4 months of age, an infant sleeps an average of 15 hours of every 24 and through the night.

It is exhausting for a parent who is already tired from labor and birth to have to awaken during the night to feed a newborn. For this reason, parents may try various methods to induce a baby to sleep through the night much earlier than 4 months. One approach is to introduce solid food (particularly cereal) in the first weeks of life, on the theory that the bulk will fill the infant's stomach so that he or she will not wake up crying to be fed. Actually, there is no correlation between the age at which solid food is introduced and a baby's capability for sustained sleep. Also, a newborn is not developmentally ready to deal with nonliquid food until about the end of the third month. There are also other reasons not to introduce solid food early: large protein molecules from solid foods can pass through a newborn's immature gastrointestinal tract, becoming antigens that may sensitize the newborn for possible allergic reactions. In breast-fed infants, too-early introduction of solid foods may interfere with the desire for breast milk, decrease the newborn's sucking, and subsequently decrease the mother's milk supply.

A baby probably wakes every 4, 5, 6, or 8 hours because of a physiologic need for fluid. Advise parents that, because of this fluid need, they should not try to eliminate night feedings. Knowing their baby is not sick, that you are concerned and willing to listen to their questions, and that every other parent of a newborn is also up at night does not solve the difficulty, but it is a help.

Encourage parents to position infants on the back. Infants should not sleep on the stomach, because there is an association between this sleeping position and SIDS (Livesey, 2005).

Crying.   Many new parents are not prepared for the amount of time a newborn spends crying. When-ever the mother saw the baby at the health care agency, the baby was sleeping; she woke the infant for feeding, and immediately he or she went back to sleep. Infants, however, typically cry an average of about 2 hours of every 24 during the first 7 weeks of life. The frequency seems to peak at age 6 or 7 weeks and then tapers off.

Almost all infants have a period during the day when they are wide awake and invariably fussy. New parents need to recognize this as normal and not worry that it means their child is ill. Parents might use this fussy time for bathing or playing with the infant, arranging their schedules accordingly. It is important to learn the infant's cues and to help the infant learn to self-quiet. The most typical time for wakefulness is between 6 PM and 11 PM, which, unfortunately, is when parents may be tired and least able to tolerate crying.

Whether to use pacifiers to reduce crying is a question parents must decide for themselves, depending on how they feel about them and their infant's needs. It is rare that infants have such a need for sucking they must have a pacifier in their mouth constantly. Discussing a few pros and cons with parents helps clarify the subject.

An infant who completes a feeding and still seems restless and discontented, who actively searches for something to put into the mouth, and who sucks on hands and clothes may need the increased sucking activity a pacifier provides. The major drawback of pacifiers is the problem of cleanliness. They tend to fall on the floor or sidewalk and are then put back into the infant's mouth. Attaching the pacifier to a string worn around the infant's neck prevents this problem but could cause strangulation. A big drawback to pacifier use is that they are associated with an increase in middle ear infections (Cinar, 2004). If parents use pacifiers, be certain they are of one-piece construction, so that loose parts cannot be aspirated.

Parental Concerns Related to Breathing.   Some parents report that their newborns have stuffy noses or make snoring noises in their sleep and that they sneeze frequently. This occurs because most newborns continue to have some mucus in the upper respiratory tract and posterior pharynx for up to 2 weeks after birth. The snoring noise is a result of this mucus, not a cold. In addition, infants continue to breathe irregularly for about the first month. A new parent who did not room with her child at the hospital may wake at night, notice this breathing pattern, and grow alarmed that the child is in respiratory distress. If these are the only symptoms, this is a normal newborn respiratory pattern. If the child has rhinitis (nasal discharge) or a fever, he or she needs to be seen by a health care provider, because these symptoms suggest an upper respiratory tract infection.

Continued Health Maintenance for a Newborn.   Parents do not need to continue to weigh a newborn or take his or her temperature at home. These practices

BOX 24.12 FOCUS ON . . .

FAMILY TEACHING

Determining If a Newborn Is Well

Q. Ms. Ruiz asks you, "Could you review with me how to know if a newborn is well?"

A. The following items are helpful to determine your newborn is well:

- Drinks as if she is hungry
- Possibly spits up a slight amount after feeding, but has no vomiting
- Moves bowels approximately three to four times per day (may be more often if breast-fed), with stools that are loose or semiformed but not runny and watery
- Appears happy overall (despite a fussy period during the day) and sleeps for 2 to 3 hours at a time
- Has a normal temperature
- Breathes more rapidly than an adult, but breathing is easy and not stressed
- Skin lacks appearance of a yellow or blue tone

FIGURE 24.30 Most states require infants and children to ride in car seats. It is the nurse's responsibility to make sure that every parent planning to drive a child home from the health care facility is properly equipped.

only cause worry, because weight fluctuates day by day, and infant activity and clothing can influence temperature. Teach parents to judge their infant's state of health by overall appearance, eagerness to eat, general activity, and disposition, as well as weight gain (Box 24.12).

Make certain that parents make and keep a health care appointment for a first newborn assessment according to their primary care provider's schedule (2 to 6 weeks). The mother was conscientious throughout pregnancy to bring a well child into the world. Parents must now begin a health care program to keep the child well.

Car Safety. Automobile accidents are a safety problem all during childhood. For protection while in automobiles, newborns should always be transported in car seats (National Center for Health Statistics, 2005). Without this protection, if a car stops suddenly, an infant can be thrown onto the floor or, in a collision, thrown out of the car or through the windshield. In an accident, centrifugal force on an infant can be as much as 450 lb, making it impossible for a passenger to hold onto the child. At a speed of only 30 mph, an infant may hit the dashboard with a force equal to a fall from a three-story building. If an adult holding the infant is not wearing a seat belt, the adult can be thrown against the infant, killing the child.

When purchasing a car seat, parents should look at the label to be sure the seat meets federal guidelines. The local health department or Red Cross chapter should have a list of all the car seats available in a particular area as well as details of their comparable features and cost. The AAP web site (*www.aap.org*) lists these as well. Some hospitals

and Red Cross chapters loan infant car seats for temporary use, such as when visiting with grandparents or when first coming home from the hospital. New cars are mandated to be equipped with lower anchors and tethers for car seats.

The best location for a car seat is the back seat of the car; this is especially true if the car has a passenger seat air bag, because the force of an air bag expanding can kill an infant in the front seat. While the infant is less than 21 lb or 26 inches long, the best type of car seat is an "infant-only" seat that, when properly positioned, faces the back of the car (Fig. 24.30). The ideal model has a five-point harness with broad straps, which help spread the force of a collision over the chest and hips, and a shield, which cushions the head.

Parents should dress an infant in clothing with pant legs if he or she is to be placed in a car seat, because the harness crotch strap must pass between the legs for a snug and correct fit. Advise parents not to use a sack sleeper or papoose bunting; nor should they wrap the baby in a bulky blanket so that the straps do not fit securely while the baby is in the seat. To support the baby's head, parents can use a rolled-up receiving blanket, towel, or diaper on each side of the head or purchase commercial head supports. To provide extra warmth, they can cut holes in a blanket for the harness and crotch straps to pass through, place the baby in the seat, fasten the buckles, and then fold the blanket over the child for warmth. A second blanket can be draped over the seat if needed.

Infants should sit in a backward-facing seat until they are able to sit up without support, usually when they weigh about 21 lb. At that point, they are old enough for a toddler seat. Caution parents that plastic car seats grow extremely hot in the summer, so they need to test the temperature of the surface before placing an infant in one. Stress also that it is dangerous to use a car seat improperly, such as not fastening the harness or not securing the seat belt.

✔ **Checkpoint Question 5**

Ms. Ruiz is preparing to take her new daughter home. On about what day of life can she expect her baby's umbilical cord to fall off?

a. Day 1.
b. Day 2 to 3.
c. Day 6 to 10.
d. Day 30.

Key Points

Converting from fetal to adult respiratory function is a major step in adaptation to extrauterine life. Newborns need particularly close observation during the first few hours of life to determine that this adaptation has been made.

Maintaining body heat is a second major problem of newborns. The temperature of the term baby's environment should be about 75°F (24°C). When procedures that require undressing an infant for an extended period are being carried out (e.g., circumcision), a radiant heat source should be used.

Newborns may suffer hypoglycemia in the first few hours of life because they use energy to establish respirations and maintain heat. Signs of jitteriness and a blood glucose level of less than 40 mg/100 mL by heel-stick help to identify hypoglycemia.

Identification bands should be attached securely to newborns; assess these bands carefully before hospital discharge. To help prevent the possibility of kidnapping, be certain of the identification of anyone to whom you give a newborn.

To feel confident with newborn care, parents need to hold and give care in the hospital. Encouraging them to spend as much time as possible with a newborn is a major nursing role.

Critical Thinking Exercises

1. Beth Ruiz is the newborn described at the beginning of the chapter. Her mother is concerned because Beth seems small, is covered by erythema toxicum, and has noisy respirations. You discover that the family has no car seat to transport the baby home. What would you teach the mother to make her feel more comfortable with her newborn? What would you do about the car seat—ask that they stay until they can arrange to rent or borrow one, or discharge them?

2. When you are assessing Beth in her mother's room, what newborn reflexes would you assess? Suppose it is cold in the room, so that you have time to test only one reflex. Which one would you test, and why?

3. Beth has a port-wine stain on her left thigh. Her father tells you he is not concerned about this because he knows that all birthmarks fade by school age. How would you respond to him?

4. Examine the National Health Goals related to newborn care. Most government-sponsored money for nursing research is allotted based on these goals. What would be a possible research topic to explore pertinent to these goals that would be applicable to the Ruiz family and also advance evidence-based practice?

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