



unit
8

The Newborn at Risk



chapter **23**

Nursing Management of the Newborn With Special Needs: Variations in Gestational Age and Birthweight

Key TERMS

appropriate for gestational age
asphyxia
extremely low birthweight
large for gestational age
low birthweight
postterm newborn
preterm newborn
retinopathy of prematurity
small for gestational age
very low birthweight

Learning OBJECTIVES

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

1. Define the key terms.
2. Identify factors that assist in identifying a newborn at risk due to variations in gestational age and birthweight.
3. Describe contributing factors and common complications associated with dysmature infants and their management.
4. Discuss associated conditions and their management that affect the newborn with variations in gestational age and birthweight.
5. Outline the nurse's role in helping parents experiencing perinatal grief or loss.

Guiding a parent's hand to touch a frail or ill newborn demonstrates courage and compassion under very difficult circumstances, a powerful tool in helping to deal with the newborn's special needs.



Most newborns are born between 38 and 40 weeks' gestation and weigh 6 to 8 lb, but variations in gestational age and birthweight can occur, and infants with these variations have special needs. Gestational age at birth is inversely correlated with the risk that the infant will experience physical, neurologic, or developmental sequelae (Tufts, 2004). Some newborns are born very ill and need special advanced care to survive.

When a woman gives birth to a newborn with problems involving immaturity or birthweight, especially one who is considered high risk, she may go through a grieving process in which she mourns the loss of the healthy full-term newborn she had expected. Through this process she learns to come to terms with the experience she now faces.

The development of new technologies and regionalized care centers for the care of newborns with special needs has resulted in significant improvements and success. Nurses need to have a sound knowledge base to identify the newborn with special needs and to provide coordinated care.

The key to identifying a newborn with special needs related to gestational age or birthweight variation is an awareness of the factors that could place a newborn at risk. These factors are similar to those that would suggest a high-risk pregnancy:

- Maternal nutrition (malnutrition or overweight)
- Substandard living conditions
- Low socioeconomic status
- Maternal age of <20 or >35 years old
- Substance abuse
- Failure to seek prenatal care
- Smoking or exposure to passive smoke
- Periodontal disease
- Multiple gestation
- Extreme maternal stress
- Abuse and violence
- Placental complications (placenta previa or abruptio placentae)
- History of previous preterm birth
- Maternal disease (e.g., hypertension or diabetes)
- Maternal infection (e.g., urinary tract infection or chorioamnionitis)
- Exposure to occupational hazards (Gilbert & Harmon, 2003)

Being able to anticipate the birth of a newborn at risk allows the birth to take place at a health care facility equipped with the resources to meet the mother's and newborn's needs. This is important in reducing mortality and morbidity.

Healthy People 2010 has identified preterm births and low birthweight as important national health goals (Healthy People 2010).

This chapter discusses the nursing management of newborns with special needs related to variations in gestational age and birthweight. Selected associated conditions affecting these newborns are also described. Due to the frailty of these newborns, the care of the family experiencing perinatal loss and the role of the nurse in helping the family cope also are addressed.

Birthweight Variations

Fetal growth is influenced by maternal nutrition, genetics, placental function, environment, and a multitude of other

HEALTHY PEOPLE 2010

National Health Goals Related to Newborns With Birthweight and Gestational Age Variations

Objective	Significance
Increase the proportion of very low birthweight (VLBW) infants born at level III hospitals or subspecialty perinatal centers	Will help to promote the delivery of high-risk infants in settings that have the technological capacity to care for them, ultimately reducing the morbidity and mortality rates for these infants
Reduce low birthweight (LBW) from a baseline of 7.6% to a target of 5%; reduce very low birthweight (VLBW) from a baseline of 1.4% to 0.9%	Will help to emphasize the issue of LBW as a risk factor associated with newborn death, helping to promote measures to reduce this risk factor and thus contributing to significant reductions in infant mortality
Reduce the total number of preterm births from a baseline of 11.6% to 7.6%	Will help to emphasize the role of preterm birth as the leading cause of newborn deaths unrelated to birth defects
Reduce the number of live births at 32 to 36 weeks' gestation from a baseline of 9.6% to 6.4%	Will aid in promoting an overall reduction in infant illness, disability, and death
Reduce the number of live births at less than 32 weeks' gestation from a baseline of 2% to 1.1%	

USDHHS, 2000.

factors. Assigning size to a newborn is a way to measure and monitor the growth and development of the newborn at birth. Newborns can be classified according to their weight and weeks of gestation, and knowing the group into which a newborn fits is important.

Appropriate for gestational age characterizes approximately 80% of newborns and describes a newborn with a normal height, weight, head circumference, and Body Mass Index (Venes, 2005). Being in the appropriate-for-gestational-age group confers the lowest risk for any problems. These infants have lower morbidity and mortality than other groups.

Small-for-gestational-age infants typically weigh less than 2,500 g (5 lb 8 oz) at term due to less growth in utero than expected. An infant is also classified as small for gestational age if his or her birthweight is at or below the 10th percentile as correlated with the number of weeks of gestation on a growth chart.

Large-for-gestational-age describes infants whose birthweight is above the 90th percentile on a growth chart and who weigh more than 4,000 g (8 lb 13 oz) at term due to accelerated growth for length of gestation (Cheffer & Rannalli, 2004).

The following terms describe other infants with marginal weights at birth and of any gestational age:

- **Low birthweight:** less than 2,500 g (5.5 lb) (Fig. 23-1)
- **Very low birthweight:** less than 1,500 g (3 lb 5 oz)
- **Extremely low birthweight:** less than 1,000 g (2 lb 3 oz)

Small-for-Gestational-Age Newborns

Newborns are considered small for gestational age (SGA) when they weigh less than two standard deviations for gestational age or fall below the 10th percentile on a growth chart for gestational age. These infants can be preterm, term, or postterm.



● Figure 23-1 A low-birthweight newborn in an isolette.

In some SGA newborns, the rate of growth does not meet the expected growth pattern. Termed intrauterine growth restriction (IUGR), these newborns also are considered at risk, with the perinatal morbidity and mortality rate increased substantially compared to that of the appropriate-for-age newborn (Cunningham et al., 2005). IUGR is the pathologic counterpart of SGA. However, an important distinction to make between SGA and IUGR newborns is that not all who are SGA have IUGR. The converse also is true: not all newborns who have IUGR are SGA. Some SGA infants are constitutionally small: they are statistically small but otherwise healthy.

Conditions altering fetal growth produce insults that affect all organ systems and are known to produce two patterns of growth that depend on the timing of the insult to the developing embryo or fetus. An early insult (typically <28 weeks) results in overall growth restriction, with all organs small. These SGA infants never catch up in size when compared with normal children. An insult later in gestation (>28 weeks) results in intrauterine malnutrition, but optimal postnatal nutrition generally restores normal growth potential and carries a better prognosis than earlier insults (Putman, 2004).

Historically, IUGR has been categorized as symmetric or asymmetric. Symmetric IUGR refers to fetuses with equally poor growth rate of the head, the abdomen, and the long bones. Asymmetric IUGR refers to infants whose head and long bones are spared compared to their abdomen and internal organs. It is now believed that most IUGR is a continuum from asymmetry (early stages) to symmetry (late stages) (Harper & Lam, 2005).

Fetal growth is dependent on genetic, placental, and maternal factors. Cognitive and motor development during infancy forms the basis for children's subsequent development. Newborns who experience nutritional deficiencies in utero and are born SGA are at risk for cognitive deficits that can undermine their academic performance throughout their lives (Black et al., 2004).

The fetus is thought to have an inherent growth potential that, under normal circumstances, yields a healthy newborn of appropriate size. The maternal-placental-fetal units act in harmony to provide for the needs of the fetus during gestation. However, growth potential in the fetus can be limited, and this is analogous to failure to thrive in the infant. The causes of both can be intrinsic or environmental. Factors that can contribute to the birth of an SGA newborn are highlighted in Box 23-1.

Characteristics of a Small-for-Gestational-Age Newborn

The typical appearance of the SGA newborn includes:

- Head disproportionately large compared to rest of body
- Wasted appearance of extremities

BOX 23-1

FACTORS CONTRIBUTING TO THE BIRTH OF SGA NEWBORNS

- Maternal causes
 - Chronic hypertension
 - Diabetes mellitus with vascular disease
 - Autoimmune diseases
 - Living at a high altitude (hypoxia)
 - Smoking
 - Substance abuse (heroin/cocaine/methamphetamines)
 - Hemoglobinopathies (sickle cell anemia)
 - Preeclampsia
 - Chronic renal disease
 - Malnutrition
 - “TORCH” group infections
- Placental factors
 - Abnormal cord insertion
 - Chronic abruption
 - Placenta previa
 - Placental insufficiency
- Fetal factors
 - Trisomy 13, 18, and 21
 - Turner’s syndrome
 - Congenital anomalies
 - Multiple gestation

Sources: Harper & Lam, 2005; Thureen, Deacon, Hernandez, and Hall, 2005; Kenner & Lott, 2004; and Haws, 2004.

- Reduced subcutaneous fat stores
- Decreased amount of breast tissue
- Scaphoid abdomen (sunken appearance)
- Wide skull sutures secondary to inadequate bone growth
- Poor muscle tone over buttocks and cheeks
- Loose and dry skin that appears as if it is oversized
- Thin umbilical cord (Verklan & Walden, 2004)

Common Problems of Small-for-Gestational-Age Newborns

SGA newborns commonly face problems after birth because of the decrease in placental function during utero. These problems include perinatal asphyxia, hypothermia, hypoglycemia, polycythemia, and meconium aspiration.

Perinatal Asphyxia

Perinatal asphyxia is common in SGA infants because they tolerate the stress of labor poorly. As a result, they frequently develop acidosis and hypoxia. Typically they have low Apgar scores (Thureen et al., 2005).

The SGA newborn has lived in a hypoxic environment prior to birth and thus has little to no oxygen reserves available to withstand the stress of labor. Several alterations contribute to this hypoxic environment. Uterine contractions during labor increase hypoxic stress. Glycogen stores may be depleted secondary to the chronic hypoxic state,

leading to fetal distress as manifested by fetal bradycardia. In addition, impaired uteroplacental circulation secondary to maternal and uterine conditions predisposes them to perinatal depression. At birth, this compromised newborn experiences difficulty adjusting to the extrauterine environment. Care focuses on anticipating this problem and immediately initiating resuscitation measures at birth.

Hypothermia

Hypothermia frequently occurs in SGA newborns because they have less muscle mass, less brown fat, less heat-preserving subcutaneous fat, and limited ability to control skin capillaries (Lowdermilk & Perry, 2004). These physiologic conditions are associated with depleted glycogen stores, poor subcutaneous fat stores, and disturbances in central nervous system (CNS) thermoregulation mechanisms secondary to hypoxia (Kenner & Lott, 2004). Hypothermia stresses the SGA newborn metabolically, increasing the newborn’s risk for acidosis and hypoglycemia (Thureen et al., 2005). Maintaining a neutral thermal environment is crucial to allow the newborn to stabilize his or her body temperature and to prevent cold stress, which could exacerbate the acidosis and thus the asphyxia.

Hypoglycemia

Hypoglycemia is prevalent in SGA newborns in the first few hours and days of life due to an increase in metabolic rate and lack of adequate glycogen stores to meet the newborn’s metabolic demands. However, the symptoms of hypoglycemia can be easily overlooked because they are very subtle. Typically, the symptoms include lethargy, tachycardia, respiratory distress, jitteriness, poor feeding, hypothermia, diaphoresis, weak cry, seizures, and hypotonia. Blood glucose levels are below 40 mg/dL in term newborns and below 20 mg/dL in preterm newborns (Kenner & Lott, 2004).

Care focuses on monitoring glucose levels, maintaining fluid and electrolyte balance, observing for changes in the newborn’s condition, such as increasing irritability or respiratory distress, and initiating early oral feedings if applicable. If oral feedings are not accepted, an intravenous infusion with 10% dextrose in water may be needed to maintain the glucose level above 40 mg/dL.

Polycythemia

Polycythemia is defined as a venous hematocrit of greater than 65%. Polycythemia exists because SGA fetuses experience chronic mild hypoxia secondary to placental insufficiency in utero. This hypoxic environment stimulates the release of erythropoietin, which leads to an increased rate of erythrocyte (red blood cell) production. The newborn exhibits a weak sucking reflex, ruddy appearance, tachypnea, jaundice, lethargy, jitteriness, hypotonia, and irritability. The goal of therapy is to reduce the viscosity of the blood via partial exchange transfusions of plasma, albu-

min, or normal saline to increase fluid volume to a hematocrit of approximately 60% (Lessaris, 2005).

Meconium Aspiration

Meconium aspiration occurs as a result of meconium being released into the amniotic fluid prior to birth. Historically, meconium contaminating amniotic fluid at birth was thought to be a sign of “fetal distress” in response to hypoxia. Currently, it is acknowledged as an indication of a normally maturing gastrointestinal tract, or the result of vagal stimulation from umbilical cord compression (Cunningham et al., 2005)

At times meconium-stained amniotic fluid may be a sign of fetal distress, especially if accompanied by diminished amniotic fluid and abnormal fetal heart rate patterns. Meconium-stained amniotic fluid is a signal indicating possible newborn depression at birth. If present, immediate resuscitation measures, including clearing the airway and supporting ventilation, are essential. (For more information on meconium aspiration syndrome, see Chapter 24.)

Large-for-Gestational-Age Newborns

A newborn whose weight is above the 90th percentile on growth charts or two standard deviations above the mean weight for gestational age is defined as large for gestational age (LGA). The range of weight is 4,000 to 5,000 g or more than 9 lb. LGA infants may be preterm, term, or postterm.

Maternal factors that increase the chance of bearing an LGA infant include maternal diabetes mellitus or glucose intolerance, multiparity, prior history of a macrosomic infant, postdates gestation, maternal obesity, male fetus, and genetics (Moses, 2004). Because of the infant’s large size, vaginal birth may be difficult and occasionally results in birth injury. In addition, shoulder dystocia, clavicle fractures, and facial palsies are common. The incidence of cesarean births is very high with LGA infants to avoid arrested labor and birth trauma.

Characteristics of a Large-for-Gestational-Age Newborn

The typical LGA newborn has a large body and appears plump and full-faced. The increase in body size is proportional. However, the head circumference and body length are in the upper limits of intrauterine growth. These newborns have poor motor skills and have difficulty in regulating behavioral states. LGA infants are more difficult to arouse to a quiet alert state (Thureen et al., 2005).

Common Problems of Large-for-Gestational-Age Newborns

An LGA newborn can face several problems after birth: birth trauma due to fetopelvic disproportion, hypoglycemia, polycythemia, and jaundice secondary to hyperbilirubinemia.

Birth Trauma

Birth trauma secondary to the infant’s large size is common. Because of their large size, LGA infants are more likely to be born by operative birth. If born vaginally, forceps or vacuum-assisted births may be necessary to overcome shoulder or body dystocia. Common birth traumas include depressed skull fracture, cephalhematoma, fracture of the clavicle or humerus, brachial plexus injuries, or facial palsy (Putman, 2004).

A thorough assessment of the LGA infant at birth is paramount to identify fractured clavicles, brachial palsy, facial paralysis, phrenic nerve palsy, skull fractures, or hematomas. Observation and documentation of any injuries discovered are essential for early intervention and improved outcomes.

Hypoglycemia

Hypoglycemia in the LGA infant is defined as a blood glucose level below 40 mg/dL. Like the SGA infant at risk for hypoglycemia, clinical signs are often subtle and include lethargy, apathy, irritability, tachypnea, weak cry, temperature instability, jitteriness, seizures, apnea, bradycardia, cyanosis or pallor, feeble suck and poor feeding, hypotonia, and coma. A similar presentation may be seen in several other disorders, including septicemia, severe respiratory distress, and congenital heart disease. Thus, the clinical signs of hypoglycemia are vague and a high index of suspicion is needed to identify it (Cloud & Haws, 2004).

Care of the LGA infant at risk for hypoglycemia includes checking the blood glucose on arrival at the nursery or within 2 hours of birth by reagent test strip (e.g., Dextrostix or Chemstrip BG). Repeat the screening every 2 to 3 hours or before feeds and also immediately in any infant suspected of having or showing clinical signs of hypoglycemia, regardless of age (Townsend, 2005).

Polycythemia

Polycythemia is defined as a venous hematocrit over 65%, resulting in the blood becoming increasingly hyperviscous and thus sluggish to circulate. Polycythemia in the LGA newborn can occur secondary to several events such as fetal hypoxia, trauma with bleeding, increase in fetal erythropoietin production, or delayed cord clamping (Mattson & Smith, 2004). Clinical manifestations include plethora (ruddy appearance), cyanosis, weak suck and feeding difficulties, lethargy, tachycardia, jitteriness, difficult to arouse, irritability, hypotonia, seizures, and jaundice.

Management focuses on decreasing blood viscosity by increasing the fluid volume. This is accomplished by partial exchange transfusion with plasma, normal saline, or albumin. The purpose of a partial exchange transfusion for polycythemia is to lower hematocrit and decrease blood viscosity. Polycythemia and hyperviscosity have been associated with fine and gross motor delays, speech delays, and neurologic sequelae (Gordon, 2003).

Hyperbilirubinemia

Hyperbilirubinemia in the LGA infant commonly accompanies polycythemia and erythrocyte breakdown. With increased numbers of red blood cells in circulation, their breakdown in large amounts predisposes the infant to hyperbilirubinemia and thus jaundice. In addition, many LGA infants cannot tolerate feedings in the first few days of life, thus increasing the enterohepatic circulation of bilirubin. Usually conjugated bilirubin, in the presence of intestinal flora initiated by feedings, is excreted via bile to the intestine and is not absorbed from the intestine back into the blood. In the absence of intestinal flora (due to limited or no feedings), unconjugated bilirubin can be reabsorbed across the intestinal mucosa into the portal circulation and return to the liver. This reabsorption path is referred to as the enterohepatic circulation (Thilo, 2005).

Measures to reduce bilirubin levels consist of hydration, early feedings, and phototherapy. (See Chapter 24 for a more detailed discussion of hyperbilirubinemia and phototherapy.)

Nursing Management of the Newborn With Birthweight Variations

Nursing management for the SGA or LGA infant involves keen observation skills and a solid knowledge base about the common problems each might develop. Since newborns cannot tell the nurse what is wrong, the nurse must maintain a high level of suspicion at all times to identify subtle newborn behaviors that might indicate a problem requiring immediate intervention to prevent a catastrophic event.

Assessment

Assessment of the SGA infant begins by reviewing the maternal history to identify possible risk factors, such as smoking, drug abuse, chronic maternal illness, hypertension, multiple gestation, or genetic disorders. This information allows the nurse to anticipate a possible problem and be prepared to intervene quickly should it occur. At birth, perform a thorough physical examination, closely observing for any congenital malformations, neurologic insults, or indications of infection. Anticipate the need for and provide resuscitation as indicated by the newborn's condition at birth.

Assessment of the LGA infant focuses on detecting any traumatic injuries, such as fractures of clavicle or humerus or facial nerve damage. Perform a neurologic examination to identify any nerve palsies, such as immobility of the upper arm. The maternal history can provide clues as to whether the woman has an increased risk of giving birth to a LGA infant. Also obtain frequent blood glucose levels as ordered to evaluate for hypoglycemia, and assess the LGA infant for subtle signs such as lethargy, jitteriness, seizures, hypotonia, or poor feeding.

Nursing Interventions

Interventions for the SGA infant may include obtaining weight, length, and head circumference, comparing them to standards, and documenting the findings. Perform frequent serial blood glucose measurements as ordered and monitor vital signs, being particularly alert for changes in respiratory status that might indicate respiratory distress. Institute measures to maintain a neutral thermal environment to prevent cold stress and acidosis.

Initiate early and frequent oral feedings unless contraindicated. Weigh the infant daily and ensure that the SGA infant has adequate rest periods to decrease metabolic requirements.

Observe for clinical signs of polycythemia and monitor blood results. If the infant is symptomatic, assist with the partial exchange transfusion procedure.

Provide anticipatory guidance to parents about any treatments and procedures that are being done. Emphasize the need for close follow-up and careful monitoring of the infant's growth in length, weight, and head circumference and feeding patterns throughout the first year of life to confirm any "catch-up" growth taking place.

For the LGA infant, assist in stabilizing the newborn. Monitor blood glucose levels and feeding during the first few hours of life to prevent hypoglycemia. Feedings can be formula or breast milk, with intravenous glucose supplementation as needed.

If the newborn's blood glucose level is below 25 mg/dL, institute immediate treatment with IV glucose, regardless of clinical symptoms (Thureen et al., 2005). Monitor and record intake and output and obtain daily weights to aid in evaluating nutritional intake. Also observe for signs and symptoms of polycythemia and hyperbilirubinemia and report any immediately to the health care provider so that early interventions can be taken to prevent poor long-term neurologic development outcomes. Provide parental guidance about the treatments and procedures being done and about the need for follow-up care for any abnormalities identified.

Gestational Age Variations

The mean duration of pregnancy calculated from the first day of the last normal menstrual period is approximately 280 days, or 40 weeks. Gestational age is typically measured in weeks: a newborn born before completion of 37 weeks is classified as preterm, and one born after completion of 42 weeks is classified as postterm. The infant born from the first day of 38th week through 42 weeks is classified as term. Precise knowledge of a newborn's gestational age is imperative for effective postnatal management. Determination of gestational age by the nurse assists in planning appropriate care for the newborn and provides important information regarding potential problems that need interventions. (See Chapter 18 for more information on assessing gestational age.)

Postterm Newborn

A pregnancy that extends beyond 42 weeks' gestation produces a **postterm newborn**. Other terms used to describe these late births include postmature, prolonged pregnancy, or postdates pregnancy. Postterm newborns may be LGA, SGA, or dysmature (newborn weighs less than established normal parameters for estimated gestational age [IUGR]), depending on placental function.

The reason why some pregnancies last longer than others is not completely understood. What is known is that women who experience one postterm pregnancy are at increased risk in subsequent pregnancies. The incidence of prolonged pregnancy is approximately 10% (Gilbert & Harmon, 2003).

The ability of the placenta to provide adequate oxygen and nutrients to the fetus after 42 weeks' gestation is thought to be compromised, leading to perinatal mortality and morbidity. As the placenta loses its ability to nourish the fetus, the fetus uses stored nutrients to stay alive, and wasting occurs. This wasted appearance at birth is secondary to the loss of muscle mass and subcutaneous fat.

Characteristics of a Postterm Newborn

Postterm newborns typically exhibit the following characteristics:

- Dry, cracked, wrinkled skin
- Long, thin extremities

Consider THIS!

I had been waiting for this baby my whole married life and now I was told to wait even longer. I was into my third week past my due date and was just told that if I didn't go into labor on my own, the doctor would induce me on Monday. As I waddled out of his office into the hot summer sun, I thought about all the comments that would await me at the office: "You're not still pregnant, are you?" "Weren't you due last month?" "You look as big as a house." "Are you sure you aren't expecting triplets?" I started to get into my car when I felt warm fluid slide down my legs. Although I was embarrassed at my wetness, I was thrilled I wouldn't have to go back to the office and drove myself to the hospital. Within hours my wait was finally over with the birth of my son, a postterm infant with peeling skin and a thick head of hair. He was certainly worth the wait!

Thoughts: Although most due dates are within plus or minus 2 weeks, we can't "go to the bank with it" because so many factors influence the start of labor. This woman was anxious about her overdue status, but nature prevailed. The old adage "when the fruit is ripe, it will fall" doesn't always bring a good outcome: many women need a little push to bring a healthy newborn forth. What happens when the fetus stays inside the uterus too long? What other features are typical of postterm infants?

- Creases that cover the entire soles of the feet
- Wide-eyed, alert expression
- Abundant hair on scalp
- Thin umbilical cord
- Limited vernix and lanugo
- Meconium-stained skin
- Long nails (Green & Wilkinson, 2004)

Complications in Postterm Newborns

The postterm newborn is at risk for perinatal asphyxia, hypoglycemia, hypothermia, polycythemia, and meconium aspiration.

Perinatal Asphyxia

Perinatal asphyxia can be attributed to placental deprivation or oligohydramnios that leads to cord compression, thereby reducing perfusion to the fetus. Fetal distress will manifest as decelerations, bradycardia, or both on the fetal monitor during labor. Anticipating the need for newborn resuscitation is a priority. The newborn resuscitation team needs to be available in the birthing suite for immediate backup. The newborn may need to be transported to the neonatal intensive care unit (NICU) for continuous assessment, monitoring, and treatment, depending on the status after resuscitation.

Hypoglycemia

Hypoglycemia in the postterm infant is associated with hypoxia secondary to depleted glycogen reserves. In addition, placental insufficiency secondary to placental aging contributes to chronic fetal nutritional deficiency, further depleting glycogen stores. Since glucose is essential for cerebral metabolism, neurologic impairment, including intellectual and motor deficits, may result from hypoglycemia (Armentrout, 2004).

Care focuses on monitoring and maintaining blood glucose levels once stabilized. Intravenous dextrose 10% and/or early initiation of feedings will help stabilize the blood glucose levels to prevent CNS sequelae.

Hypothermia

Hypothermia results from loss of subcutaneous fat secondary to placental insufficiency. As the placenta loses its ability to nourish the growing fetus (placental insufficiency), the postterm fetus uses stored nutrients for nutrition, and wasting of subcutaneous fat, muscle, or both occurs (Putman, 2004). This loss of subcutaneous fat strips the infant of the natural insulation that would assist in temperature regulation.

Signs of hypothermia include bradycardia (<25 bpm), tachypnea (>60 bpm), tremors, irritability, wheezing, crackles, retractions, restlessness, lethargy, hypotonia, weak or high-pitched cry, hypothermia, temperature instability, seizures, poor feeding, and grunting (Green & Wilkinson, 2004).

Care focuses on assessing skin temperature, respiration characteristics, results of blood studies, such as arterial

blood gases (ABGs), blood glucose levels, and serum bilirubin, and neurologic status. Measures to prevent or reduce the incidence of hypothermia involve eliminating sources of heat loss by thoroughly drying the newborn at birth, wrapping him or her in a warmed blanket, and placing a stockinet cap on the newborn's head. Providing environmental warmth via a radiant heat source will help stabilize the newborn's temperature.

Polycythemia

Polycythemia develops secondary to intrauterine hypoxia, which triggers increased red blood cell production to compensate for lower oxygen levels. Polycythemia leads to sluggish organ perfusion and hyperbilirubinemia from the red blood cell breakdown. The true incidence of this condition is not known, since the majority of infants are asymptomatic. Diagnosis is typically based on hematocrit values. Manifestations may be subtle and include respiratory distress, lethargy, seizures, hypoglycemia, tachypnea, plethora, tremors, hypotonia, irritability, feeding difficulties, vomiting, hepatomegaly, and jaundice (Lessaris, 2005).

Closely assess all postterm infants for polycythemia. Review the maternal history to aid in identifying the newborn at risk for this problem. Providing adequate hydration will help reduce the viscosity of the newborn's blood to prevent thrombosis. Be alert to the early, often subtle signs to promote early identification and prompt treatment to prevent any neurodevelopmental delays.

Meconium Aspiration

Meconium aspiration is a possible complication in postterm infants who have experienced chronic intrauterine hypoxia. Meconium-stained amniotic fluid is present in 25% to 30% of all postterm births (Clark & Clark, 2004). The presence of meconium in the amniotic fluid increases the risk for aspiration, and it may be associated with adverse fetal and newborn outcomes, including acute respiratory complications, and long-term pulmonary and neurologic abnormalities. Astute observation of the amniotic fluid color when membranes rupture as well as a meconium-stained umbilical cord and fingernails is essential to alert the healthcare professional in charge of the birth to the possibility of meconium aspiration. Careful suctioning at the time of birth and afterwards, if the condition dictates it, reduces the incidence of meconium aspiration.

Preterm Newborn

A **preterm newborn** is one who is born before the completion of 37 weeks of gestation. Although the national birth rate has been declining since the 1990s, the preterm birth rate has been climbing rapidly. Approximately one in eight babies, or 12%, are born before the 37th week of ges-

tation (Nelson, 2004). Prematurity is now the leading cause of death within the first month of life and the second leading cause of all infant deaths. While certain risk factors have been identified (e.g., a previous preterm delivery, low socioeconomic status, preeclampsia, hypertension, poor maternal nutrition, smoking, multiple gestation, infection, advanced maternal age, and substance abuse), the etiology of half of all preterm births is unknown (Damus, 2005).

Preterm births take an enormous financial toll, estimated to be in the billions of dollars. They also take an emotional toll on those involved.

Changes in perinatal care practices, including regional care, have reduced newborn mortality rates. Transporting high-risk pregnant women to a tertiary center for birth rather than transferring the neonate after birth is associated with a reduction in neonatal mortality and morbidity (Bakewell-Sachs & Blackburn, 2003). Despite increasing rates of survival, preterm infants continue to be at high risk for neurodevelopmental disorders such as cerebral palsy or mental retardation, intraventricular hemorrhage, congenital anomalies, neurosensory impairment, and chronic lung disease (Bakewell-Sachs & Blackburn, 2003). Prevention of preterm births is best accomplished by making sure all pregnant women receive quality prenatal care throughout their gestation.

Characteristics of a Preterm Newborn

Although there isn't a typical preterm newborn appearance, some common physical findings include:

- Birthweight of less than 5.5 lb
- Scrawny appearance
- Head disproportionately larger than chest circumference
- Poor muscle tone
- Minimal subcutaneous fat
- Undescended testes
- Plentiful lanugo (a soft downy hair), especially over the face and back
- Poorly formed ear pinna with soft, pliable cartilage
- Fused eyelids
- Soft and spongy skull bones, especially along suture lines
- Matted scalp hair, wooly in appearance
- Absent to a few creases in the soles and palms
- Minimal scrotal rugae in male infants; prominent labia and clitoris in female infants
- Thin, transparent skin with visible veins
- Breast and nipples not clearly delineated
- Abundant vernix caseosa (Engstrom, 2004) (Fig. 23-2)

Effects of Prematurity on Body Systems

Since the preterm neonate did not remain in utero long enough, every body system may be immature, affecting the newborn's transition from intrauterine to extrauterine life and placing him or her at risk for complications. Without full development, organ systems are not capable



● **Figure 23-2** Characteristics of a preterm newborn. **(A)** Few plantar creases. **(B)** Soft, pliable ear cartilage, matted hair, and fused eyelids. **(C)** Lax posture with poor muscle development. **(D)** Breast and nipple area barely noticeable. **(E)** Male genitalia. Note the minimal rugae on the scrotum. **(F)** Female genitalia. Note the prominent labia and clitoris.

of functioning at the level needed to maintain extra-uterine homeostasis (Mattson & Smith, 2004).

Respiratory System

Because the respiratory system is one of the last to mature, the preterm newborn is a great risk for respiratory compli-

cations. A few of the problems that affect the preterm baby's breathing ability and adjustment to extrauterine life include:

- Surfactant deficiency, leading to the development of respiratory distress syndrome
- Unstable chest wall, leading to atelectasis

- Immature respiratory control centers, leading to apnea
- Smaller respiratory passages, leading to obstruction
- Inability to clear fluid from passages, leading to transient tachypnea

Cardiovascular System

The preterm newborn has great difficulty in making the transition from intrauterine to extrauterine life in terms of changing from a fetal to a neonatal circulation pattern. Making that transition is prompted by higher oxygen levels in the circulation once air breathing begins. If the oxygen levels remain low secondary to perinatal asphyxia, the fetal pattern of circulation may persist, causing blood flow to bypass the lungs. Another problem affecting the cardiovascular system is the increased incidence of congenital anomalies associated with continued fetal circulation—patent ductus arteriosus and an open foramen ovale. In addition, impaired regulation of blood pressure in preterm newborns may cause fluctuations throughout the circulatory system. One of special note is cerebral blood flow, which may predispose the fragile blood vessels in the brain to rupture, causing intracranial hemorrhage (Mattson & Smith, 2004).

Gastrointestinal System

Preterm newborns usually lack the neuromuscular coordination to maintain the suck, swallow, and breathing regimen necessary for sufficient calorie and fluid intake to support growth. Perinatal hypoxia causes shunting of blood from the gut to more important organs such as the heart and brain. Subsequently, ischemia and damage to the intestinal wall can occur. This combination of shunting, ischemia, damage to the intestinal wall, and poor sucking ability places the preterm infant at risk for malnutrition and weight loss.

In addition, preterm infants have a small stomach capacity, weak abdominal muscles, compromised metabolic function, limited ability to digest proteins and absorb nutrients, and weak or absent suck and gag reflexes. All of these limitations place the preterm infant at risk for nutritional deficiency and subsequent growth and development delays (Gregory, 2005).

Currently, minimal enteral feeding is used to prepare the preterm newborn's gut to overcome the many feeding difficulties associated with gastrointestinal immaturity. It involves the introduction of small amounts, usually 0.5 to 1 mL/kg/h, of enteral feeding to induce surges in gut hormones that enhance maturation of the intestine. This minute amount of breast milk or formula given via gavage feeding prepares the gut to absorb future introduction of nutrients. It builds mucosal bulk, stimulates development of enzymes, enhances pancreatic function, stimulates maturation of gastrointestinal hormones, reduces gastrointestinal distention and malabsorption, and enhances transition to oral feedings (Blackburn, 2003).

Renal System

The renal system of the preterm newborn is immature, reducing the baby's ability to concentrate urine and slowing the glomerular filtration rate. As a result, the risk for fluid retention, with subsequent fluid and electrolyte disturbances, is increased. In addition, these newborns have limited ability to clear drugs from their systems, thereby increasing the risk of drug toxicity. Close monitoring of the preterm newborn's acid–base and electrolyte balance is critical to identify metabolic inconsistencies. Prescribed medications require strict evaluation to prevent overwhelming the preterm baby's immature renal system.

Immune System

The preterm newborn's immune system is very immature, increasing his or her susceptibility to infections. A deficiency of IgG may occur because transplacental transfer does not occur until after 34 weeks' gestation. This protection is lacking if the baby was born before this time. In addition, preterm newborns have an impaired ability to manufacture antibodies to fight infection if they were exposed to pathogens during the birth process. The preterm newborn's thin skin and fragile blood vessels provide a limited protective barrier, adding to the increased risk for infection. Thus, the focus of care is on anticipating and preventing infections, which has a better outcome than treating them.

Central Nervous System

The preterm baby is susceptible to injury and insult to the CNS, increasing the potential for long-term disability into adulthood. Like all newborns, preterm babies have difficulty in temperature regulation and maintaining stability. However, their risk for heat loss is compounded by inadequate amounts of insulating subcutaneous fat; lack of muscle tone and flexion to conserve heat; inadequate brown fat to generate heat; limited muscle mass activity, reducing the possibility of producing their own heat; inability to shiver to generate heat; and an immature temperature-regulating center in the brain (Lowdermilk & Perry, 2004). The major focus of care is preventing cold stress, which increases metabolic and oxygen needs. The goal is to create a neutral thermal environment in which oxygen consumption is minimal but body temperature is maintained (Kenner, 2003).

Nursing Management of the Newborn With Gestational Age Variations

The newborn with a gestational age variation often presents with multiple problems. Although preterm and postterm newborns may appear to be at opposite ends of the gestational age spectrum and are so different in appearance and size, both are at high risk and need special care. Postterm newborns are just as vulnerable as preterm ones.

When preterm labor develops and cannot be stopped by medical intervention, plans for appropriate management of the mother and the preterm newborn need to be made, such as transporting them to a regional center with facilities to care for preterm newborns or notifying the facility's NICU. Depending on the degree of prematurity, the preterm infant may be kept in the NICU for months.

The postterm infant poses the same high-risk situation as the preterm infant and needs special intensive monitoring and care to survive.

Assessment

A thorough assessment of the preterm or postterm newborn upon admission to the nursery provides a baseline from which to identify changes in clinical status. Nurses need to be aware of the common physical characteristics and must be able to identify any deviation from the expected. In addition, knowing the typical complications each is at risk for will assist in initiating early interventions.

Common assessments for preterm and postterm newborns might include:

- Review the maternal history to identify risk factors for pre- or postterm birth.
- Review antepartum and intrapartum records for maternal infections to anticipate treatment.
- Assess gestational age and assess for IUGR, if appropriate.
- Complete a physical examination to identify any abnormalities.
- Monitor skin condition to treat complications early.
- Screen for hypoglycemia upon admission and then every 1 to 2 hours, and observe for nonspecific signs of hypoglycemia such as lethargy, poor feeding, and seizures.
- Assess for complications such as respiratory distress syndrome in the preterm infant.
- Assess the baby's skin for color and perfusion (capillary refill).
- Assess respirations, including observations for periods of apnea lasting more than 20 seconds.
- Monitor vital signs, including temperature via skin probe to identify hypothermia or fever, and heart rate for tachycardia or bradycardia.
- Assess heart sounds for possible murmur, indicating presence of patent ductus arteriosus in a preterm newborn.
- Monitor oxygen saturation levels by pulse oximetry to validate perfusion status.
- Assess neurologic status through behavior (restlessness, hypotonia, weak cry or suck).
- Monitor laboratory studies such as hemoglobin and hematocrit for signs of polycythemia and bilirubin concentrations.
- Identify family strengths and coping mechanisms to establish a basis for intervention.

Nursing Interventions

The birth of a preterm or postterm infant creates a crisis for the mother and her family, as most have not anticipated having a newborn requiring special care. Preterm newborns present with immaturity of all organ systems, abundant physiologic challenges, and significant morbidity and mortality (Jotzo & Poets, 2005). Postterm infants are susceptible to several birth challenges secondary to placental dysfunction that place them at risk for asphyxia, hypoglycemia, and respiratory distress. The nurse must be vigilant for complications when managing both preterm and postterm infants (Nursing Care Plan 23-1).

Promoting Oxygenation

Newborns normally start to breathe without assistance and often cry after birth, stimulated by a change in pressure gradients and environmental temperature. The work of taking that first breath is primarily due to overcoming the surface tension of the walls of the terminal lung units at the gas-tissue interface. Subsequent breaths require less inspiratory pressure since there is an increase in functional capacity and air retained. By 1 minute of age, most newborns are breathing well. A newborn who fails to establish adequate, sustained respiration after birth is said to have **asphyxia**. On a physiologic level, it can be defined as impairment in gas exchange resulting in a decrease in oxygen in the blood (hypoxemia) and an excess of carbon dioxide or hypercapnia that leads to acidosis. Asphyxia is the most common clinical insult in the perinatal period that results in brain injury, which may lead to mental retardation, cerebral palsy, or seizures (Hernandez et al., 2005).

The preterm infant lacks surfactant, which lowers surface tension in the alveolus and stabilizes the alveoli to prevent their collapse. Even if they can initiate respirations, preterm infants have a limited ability to retain air due to insufficient surfactant. Therefore, preterm newborns develop atelectasis quickly without alveoli stabilization. Postterm infants experience respiratory distress secondary to placental insufficiency and intrauterine hypoxia. In either case, their inability to initiate and establish respirations leads to hypoxia (decreased oxygen), acidosis (decreased pH), and hypercarbia (increased carbon dioxide). This change in the newborn's biochemical environment may inhibit the transition to extrauterine circulation, and fetal circulation patterns may persist.

Failure to initiate extrauterine breathing or failure to breathe well after birth leads to hypoxia (too little oxygen in the cells of the body). As a result, the heart rate falls, cyanosis develops, and the newborn becomes hypotonic and unresponsive. Although this can happen with any newborn, the risk is increased in preterm and postterm newborns.

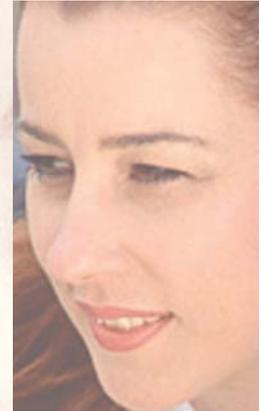
Prevention and early identification of newborns at risk are key. Be aware of the prenatal risk factors that can

(text continues on page 650)

Nursing Care Plan 23-1

Overview of the Care of a Preterm Newborn

Although Alice, an 18-year-old, felt she had done everything right during her first pregnancy, she didn't anticipate giving birth to a preterm infant at 32 weeks' gestation. When Mary Kaye was born, she had respiratory distress and hypoglycemia and couldn't stabilize her temperature. Assessment revealed the following: newborn described as scrawny in appearance; skin thin and transparent with prominent veins over abdomen; hypotonia with lax, extended positioning; weak sucking reflex when nipple offered; respiratory distress with tachypnea (70 breaths per minute), nasal flaring, and sternal retractions; low blood glucose level suggested by lethargy, tachycardia, jitteriness; temperature of 36°C (96.8°F) axillary despite warmed blanket; weight 2146 g (4.73 lb); length 45 cm (17.72 inches).



Nursing Diagnosis: Risk for imbalanced nutrition: less than body requirements related to poor sucking and lack of glycogen stores necessary to meet the newborn's increased metabolic demands

Outcome identification and evaluation

Newborn will demonstrate adequate nutritional intake, remaining free of signs and symptoms of hypoglycemia *as evidenced by blood glucose levels being maintained above 45 mg/dL, enhanced sucking ability, and appropriate weight gain.*

Interventions with rationales

Identify newborn at risk based on behavioral characteristics, body measurements, and gestational age *to establish a baseline and allow for early detection.*

Assess blood glucose levels as ordered *to determine status and establish a baseline for interventions.*

Obtain blood glucose measurements upon admission to nursery and every 1 to 2 hours as indicated *to evaluate for changes.*

Observe behavior for clues of low blood glucose *to allow for early identification.*

Initiate early oral feedings or gavage feedings *to maintain blood glucose levels.*

If oral or gavage feedings aren't tolerated, initiate an IV glucose infusion *to aid in stabilizing blood glucose levels.*

Assess skin for pallor and sweating *to identify signs of hypoglycemia.*

Assess neurologic status for tremors, seizures, jitteriness, and lethargy *to identify further drops in blood glucose levels.*

Monitor weights daily for changes *to determine effectiveness of feedings.*

Maintain temperature using warmed blankets, radiant warmer, or warmed isolette *to prevent heat loss and possible cold stress.*

Monitor temperature *to prevent cold stress resulting in decreased blood glucose levels.*

Offer opportunities for nonnutritive sucking on premature-size pacifier *to satisfy sucking needs.*

Monitor for tolerance of oral feedings, including intake and output, *to determine effectiveness.*

Administer IV dextrose if newborn is symptomatic *to raise blood glucose levels quickly.*

Overview of the Care of a Preterm Newborn (continued)

Outcome identification and evaluation

Interventions with *rationales*

Decrease energy requirements, including clustering care activities and providing for rest periods, to *conserve glucose and glycogen stores*.
 Inform parents about procedures and treatments, including rationale for frequent blood glucose levels, to *help reduce anxiety level*.

Nursing Diagnosis: Ineffective breathing pattern related to immature respiratory system and respiratory distress

Newborn's respiratory status returns to adequate level of functioning *as evidenced by rate remaining within 30 to 60 breaths per minute, maintenance of acceptable oxygen saturation levels, and minimal to absent signs of respiratory distress*.

Assess gestational age and risk factors for respiratory distress to *allow early detection*.
 Anticipate need for bag and mask setup and wall suction to *allow for prompt intervention should respiratory status continue to worsen*.
 Assess the respiratory effort (rate, character, effort) to *identify changes*.
 Assess heart rate for tachycardia and auscultate heart sounds to *determine worsening of condition*.
 Observe for cues (grunting, shallow respirations, tachypnea, apnea, tachycardia, central cyanosis, hypotonia, increased effort) to *identify newborn's need for additional oxygen*.
 Maintain slight head elevation to *prevent upper airway obstruction*.
 Assess skin color to *evaluate tissue perfusion*.
 Monitor oxygen saturation level via pulse oximetry to *provide objective indication of perfusion status*.
 Provide supplemental oxygen as indicated and ordered to *ensure adequate tissue oxygenation*.
 Assist with any ordered diagnostic tests, such as chest x-ray and arterial blood gases, to *determine effectiveness of treatments*.
 Cluster nursing activities to *reduce oxygen consumption*.
 Maintain a neutral thermal environment to *reduce oxygen consumption*.
 Monitor hydration status to *prevent fluid volume deficit or overload*.
 Explain all events and procedures to the parents to *help alleviate anxiety and promote understanding of the newborn's condition*.

Nursing Diagnosis: Ineffective thermoregulation related to lack of fat stores and hypotonia resulting in extended positioning

Newborn will demonstrate ability to regulate temperature *as evidenced by a temperature remaining in normal range (36.4° to 37.1°C), and absent signs of cold stress*

Assess the axillary temperature every hour or use a thermistor probe to *monitor for changes*.
 Review maternal history to *identify risk factors contributing to problem*.

(continued)

Overview of the Care of a Preterm Newborn (continued)

Outcome identification and evaluation

Interventions with rationales

Monitor vital signs, including heart rate and respiratory rate, *to identify deviations.*

Check radiant heat source or isolette *to ensure maintenance of appropriate temperature of the environment.*

Assess environment for possible sources of heat loss or gain through evaporation, conduction, convection, or radiation *to minimize risk of heat loss.*

Avoid bathing infant *to prevent cold stress.*

Prewarm all blankets and equipment that come in contact with newborn; place warmed cap on the newborn's head and keep it on *to minimize heat loss.*

Encourage kangaroo care (mother holds preterm infant underneath her clothing skin-to-skin and upright between her breasts) *to provide warmth.*

Educate parents on how to maintain a neutral thermal environment, including importance of keeping the newborn warm with a cap and double-wrapping with blankets and changing them frequently to keep dry *to promote newborn's adjustment.*

help identify the newborn who may need resuscitation at birth secondary to asphyxia:

- History of substance abuse
- Gestational hypertension
- Fetal distress due to hypoxia before birth
- Chronic maternal diseases such as diabetes or a heart or renal condition
- Maternal or perinatal infection
- Placental problems (previa or abruptio)
- Umbilical cord problems (nuchal or prolapsed)
- Difficult or traumatic birth
- Multiple births
- Congenital heart disease
- Maternal anesthesia or recent analgesia
- Preterm or postterm birth (Woods, 2004)

Note the newborn's Apgar score at 1 and 5 minutes. If the score is below 7 at either time, resuscitation efforts are needed. Several diagnostic studies may be done to identify possible underlying etiologies. For example, a chest x-ray helps to identify any structural abnormalities that might interfere with respirations. Blood studies may be done, such as cultures to rule out an infectious process, a toxicology screen to detect any maternal drugs in the newborn, and a metabolic screen to identify any metabolic conditions (Green & Wilkinson, 2004). In addition, monitor

vital signs continuously, check blood glucose levels for hypoglycemia secondary to stress, and maintain a neutral environmental temperature to promote energy conservation and minimize oxygen consumption.

Resuscitation Measures

Resuscitation involves a series of actions taken to establish normal breathing in the preterm or postterm infant. These actions aim to improve heart rate, color, tone, and activity. Resuscitation is necessary for all newborns that do not breathe well after birth or have a low 1-minute Apgar score.

The newborn with asphyxia requires immediate resuscitation. Dry the newborn thoroughly with a warm towel and then place him or her under a radiant heater to prevent rapid heat loss through evaporation. At times, handling and rubbing the newborn with a dry towel may be all that is needed to stimulate respirations. However, if the newborn fails to respond to stimulation, then active resuscitation is needed.

Any newborn can be born with asphyxia without warning. It is essential, therefore, to be prepared to resuscitate any newborn and to have all basic equipment immediately available and in working order. The equipment should be evaluated daily, and its condition and any needed repairs should be documented. Equipment needed for basic newborn resuscitation includes:

- A wall vacuum suction apparatus
- A wall source or tank source of 100% oxygen with a flow meter
- A neonatal self-inflating ventilation bag with correct-sized face masks
- A selection of endotracheal tubes (2.5, 3.0, or 3.5 mm) with introducers
- A laryngoscope with a small, straight blade and spare batteries and bulbs
- Ampules of naloxone (Narcan) with syringes and needles
- A wall clock to document timing of activities and events
- A supply of disposable gloves in a variety of sizes for staff to use

The procedure for newborn resuscitation is easily remembered by “ABCD”—airway, breathing, circulation, and drugs. The steps are highlighted in Box 23-2.

Resuscitation measures are continued until the newborn has a pulse above 100 bpm, a good cry, or good breathing efforts and a pink tongue. This last sign indicates a good oxygen supply to the brain (Woods, 2004).

Throughout the resuscitation period, keep the parents informed of what is happening to their newborn and what is being done and why. Provide support through this initial crisis. Once the newborn is stabilized, encour-

age bonding with the newborn by stroking, touching, and when appropriate holding the newborn (Fig. 23-3).

Oxygen Administration

Oxygen administration is a common therapy in newborn nurseries. Despite its use in newborns for over 75 years, there is no universal agreement on the most appropriate range at which oxygen levels should be maintained for hypoxic newborns, nor is there a standard timeframe for oxygen to be administered (Cunningham et al., 2005). While this uncertainty continues, nurses will experience a wide variation in practice in terms of modes of administration, monitoring, blood levels, and target ranges for both short- and long-term oxygen therapy.

A guiding principle, though, is that oxygen therapy should be targeted to levels appropriate to the condition, gestational age, and postnatal age of the newborn. Oxygen therapy must be used judiciously to prevent **retinopathy of prematurity (ROP)**, a major cause of blindness in preterm newborns in the past. ROP is a potentially blinding eye disorder that occurs when abnormal blood vessels grow and spread through the retina, eventually leading to retinal detachment. The incidence of ROP is inversely proportional to the preterm baby’s birthweight. Approximately 500 to 700 children become blind because of ROP in the United States annually (Gerontis, 2004). Although the role of oxygen in the pathogenesis of ROP is unclear, current evidence suggests that it is linked to the duration of oxygen use rather than the concentration. Thus, the use of 100% oxygen to resuscitate a newborn should not pose a problem (National Eye Institute, 2004). However, an ophthalmology consult for follow-up after discharge is essential for preterm infants whom have received extensive oxygen therapy.

Respiratory distress in preterm or postterm newborns is commonly caused by a deficiency of surfactant, retained fluid in the lungs (wet lung syndrome), meconium aspiration, pneumonia, hypothermia, or anemia. The principles

BOX 23-2

ABCDs OF NEWBORN RESUSCITATION

- **Airway**
 - Open the airway by placing the newborn’s head in neutral position.
 - Clear the throat via gentle suctioning with a bulb syringe or soft 10F catheter.
- **Breathing**
 - Hold mask ventilation (blow-by oxygen) over the newborn’s nose and mouth.
 - If no improvement is noted in the newborn’s respirations, then intubate.
 - Intubate with endotracheal (ET) tube and ventilate with positive-pressure ventilation bag.
- **Circulation**
 - Apply chest compressions at about 80 times a minute.
 - Place hand around infant’s chest using thumb on lower sternum.
 - Compress the chest two times, then follow with one ventilation.
- **Drugs**
 - If depression is due to narcotics, expect to administer naloxone (Narcan).
 - If metabolic acidosis is present, expect to administer sodium bicarbonate.
 - To improve heart rate, expect to administer epinephrine via ET tube or IV rapidly.



● Figure 23-3 Mother interacting with her preterm newborn in the isolette.

of care are the same regardless of the cause of respiratory distress. First, keep the newborn warm, preferably in a warmed isolette or with an overhead radiant warmer, to conserve the baby's energy and prevent cold stress. Handle the newborn as little as possible, because stimulation often increases the oxygen requirement. Provide energy through calories via intravenous dextrose or gavage or continuous tube feedings to prevent hypoglycemia. Treat cyanosis with an oxygen hood or blow-by oxygen placed near the newborn's face if respiratory distress is mild and short-term therapy is needed. Record the following important observations every hour, and document any deterioration or changes in respiratory status:

- Respiratory rate, quality of respirations, and respiratory effort
- Airway patency, including removal of secretions per hospital protocol
- Skin color, including any changes to duskiness, blueness, or pallor
- Lung sounds on auscultation to differentiate breath sounds in upper and lower fields
- Equipment required for oxygen delivery, such as:
 - Blow-by oxygen delivered via mask or tube for short-term therapy
 - Oxygen hood (oxygen is delivered via a plastic hood placed over the newborn's head)
 - Nasal cannula (oxygen is delivered directly through the nares) (Fig. 23-4A)
 - Continuous positive airway pressure (CPAP), which prevents collapse of unstable alveoli and delivers high inspired oxygen into the lungs
 - Mechanical ventilation, which delivers consistent assisted ventilation and oxygen therapy, reducing the work of breathing for the fatigued infant (see Fig. 23-4B)
- Correct placement of endotracheal tube (if present)

- Heart rate, including any changes
- Oxygen saturation levels via pulse oximetry to evaluate need for therapy modifications based on hemoglobin
- Maintenance of oxygen saturation level from 87% to 95% (Askin & Diehl-Jones, 2004)
- Nutritional intake, including calories provided, to prevent hypoglycemia and method of feeding, such as gavage, intravenous, or continuous enteral feedings
- Hydration status, including any signs and symptoms of fluid overload
- Laboratory tests, including ABGs, to determine effectiveness of oxygen therapy
- Administration of medication, such as exogenous surfactant

If the newborn shows worsening cyanosis or if oxygen saturation levels fall below 86%, prepare to give additional oxygen as ordered. Throughout care, strict asepsis, including handwashing, is vital to reduce the risks of infection.

Maintaining Thermal Regulation

Immediately after birth, dry the newborn with a warmed towel and then place him or her in a second warm, dry towel before performing the assessment. This drying prevents rapid heat loss secondary to evaporation. Newborns who are active, breathing well, and crying are stable and can be placed on their mother's chest ("kangaroo care") to promote warmth and prevent hypothermia. Preterm or postterm infants may not be stable enough to stay with their mother and thus need to be placed under a radiant warmer or in a warmed isolette after they are dried with a warmed towel.

Typically newborns use nonshivering thermogenesis for heat production by metabolizing their own brown adipose tissue. Neither the preterm nor the postterm newborn has an adequate supply of brown fat. The preterm newborn left the uterus before it was available; the postterm



● Figure 23-4 (A) A preterm newborn receiving oxygen therapy via a nasal cannula. Note that the newborn also has an enteral feeding tube inserted for nutrition. (B) Preterm newborn receiving mechanical ventilation.

newborn used his or her supply for survival in a hypoxic environment. The preterm newborn has decreased muscle tone and thus cannot assume the flexed fetal position, which reduces the amount of skin exposed to a cooler environment. In addition, both preterm and postterm newborns have large body surface areas compared to their weight. This allows an increased transfer of heat from their bodies to the environment.

Typically, a preterm or postterm newborn who is having problems with thermal regulation will be cool to cold to the touch. The hands, feet, and tongue may appear cyanotic. Respirations will be shallow or slow, or the newborn will exhibit signs of respiratory distress. Lethargy, hypotonia, poor feeding, and feeble cry also may be noted. Blood glucose levels most likely will be low, leading to hypoglycemia, due to the energy expended to keep warm.

When providing care for the preterm or postterm newborn to promote thermal regulation:

- Be knowledgeable about the four heat transfer mechanisms and how to prevent loss:
 - Convection: heat loss through air currents (avoid drafts near the newborn)
 - Conduction: heat loss through direct contact (warm everything the newborn comes in contact with, such as blankets, mattress, stethoscope)
 - Radiation: heat loss without direct contact (keep isolettes away from cold sources and provide insulation to prevent heat transfer)
 - Evaporation: heat loss by conversion of liquid into vapor (keep the newborn dry and delay the first bath until the baby's temperature is stable)
- Frequently assess the temperature of the isolette or radiant warmer, adjusting the temperature as necessary to prevent hypo- or hyperthermia.
- Assess the newborn's temperature every hour until stable.
- Observe for clinical signs of cold stress, such as respiratory distress, central cyanosis, hypoglycemia, lethargy, weak cry, abdominal distention, apnea, bradycardia, and acidosis.
- Be aware of the complications of hypothermia and frequently assess the newborn for signs and symptoms:
 - Metabolic acidosis secondary to anaerobic metabolism used for heat production, which results in the production of lactic acid
 - Hypoglycemia due to depleted glycogen stores
 - Pulmonary hypertension secondary to pulmonary vasoconstriction
- Monitor the newborn for signs of hyperthermia such as tachycardia, tachypnea, apnea, warm to touch, flushed skin, lethargy, weak or absent cry, and CNS depression; adjust the environmental temperature appropriately.
- Explain to the parents the need to maintain the newborn's temperature, including the measures used; demonstrate ways to safeguard warmth and prevent heat loss.

Promoting Nutrition and Fluid Balance

Providing nutrition is challenging for preterm and postterm newborns because their needs are great but their ability to take in optimal energy/calories is reduced due to their compromised health status. Individual nutritional needs are highly variable. Typically, adequate caloric intake for the preterm infant is 120 kcal/kg/day (Gregory, 2005).

Depending on their gestational age, preterm and postterm newborns receive nutrition orally, enterally, or parenterally, via an infusion. Several different methods can be used to provide nutrition for the preterm or postterm infant: parenteral feedings administered through a percutaneous central venous catheter for long-term venous access with delivery of total parenteral nutrition (TPN), or enteral feedings, which can include oral feedings (sucking on a nipple), continuous nasogastric tube feedings, or intermittent orogastric (gavage) tube feedings. Gavage feedings are commonly used for compromised newborns to allow them to rest during the feeding process. Many have a weak suck and become fatigued and thus cannot consume enough calories to meet their needs.

Most newborns born after 34 weeks' gestation without significant complications can feed orally. Those born before 34 weeks' gestation typically start with parenteral nutrition within the first 24 hours of life. Then, enteral nutrition is introduced and advanced based on the degree of maturity and clinical condition. Ultimately, enteral nutrition methods replace parenteral nutrition. Parenteral requirements are about 20% less than enteral requirements, or about 80 to 90 kcal/kg/day.

To promote nutrition and fluid balance in the preterm or postterm newborn:

- Measure daily weight and plot it on a growth curve.
- Monitor intake; calculate fluid and caloric intake daily.
- Assess fluid status by monitoring weight; urinary output; urine specific gravity; laboratory test results such as serum electrolyte levels, blood urea nitrogen, creatinine, and hematocrit; skin turgor; and fontanels (they will be sunken if the baby is dehydrated) (Kenner & Lott, 2004).
- Continually assess for enteral feeding intolerance; measure abdominal girth, auscultate bowel sounds, and measure gastric residuals before the next tube feeding.
- Assess for signs of dehydration, including a decrease in urinary output, sunken fontanels, temperature elevation, lethargy, and tachypnea.

Preventing Infection

Prevention of infection is critical when caring for preterm or postterm newborns. Infections are the most common cause of morbidity and mortality in the NICU population (Kenner & Lott, 2004). Nursing assessment and the ability to identify problems early are imperative for better newborn outcomes.

Preterm newborns are at risk for infection because their early birth deprived them of maternal antibodies needed for passive protection. Both preterm and post-

term infants are susceptible to infection because of their limited ability to produce antibodies, asphyxia at birth, and thin, friable skin that is easily traumatized, leaving an entry for microorganisms.

Early detection is crucial. Be aware of the clinical manifestations, which can be nonspecific and subtle: apnea, diminished activity, poor feeding, temperature instability, respiratory distress, seizures, tachycardia, hypotonia, irritability, pallor, jaundice, and hypoglycemia. Report any of these to the primary care provider immediately so that treatment can be instituted.

Include the following interventions when caring for a preterm or postterm newborn to prevent infection:

- Assess for risk factors in maternal history that place the newborn at increased risk.
- Monitor for changes in vital signs such as temperature instability, tachycardia, or tachypnea.
- Assess oxygen saturation levels and initiate oxygen therapy as ordered if oxygen saturation levels fall below acceptable parameters.
- Assess feeding tolerance, typically an early sign of infection.
- Monitor laboratory test results for changes.
- Remove all jewelry on your hands prior to washing hands; wash hands upon entering the nursery and in between caring for newborns.
- Adhere to standard precautions; use clean gloves to handle dirty diapers and dispose of them properly.
- Avoid using tape on the newborn's skin to prevent tearing.
- Use sterile gloves when assisting with any invasive procedure; attempt to minimize the use of invasive procedures.
- Use equipment that can be thrown away after use.
- Avoid coming to work when ill, and screen all visitors for contagious infections.

Preventing Complications

Preterm or postterm newborns face a myriad of possible complications as a result of their fragile health status or the procedures and treatments used. Some of the more common complications in preterm newborns are respiratory distress syndrome, periventricular-intraventricular hemorrhage, bronchopulmonary dysplasia, ROP, hyperbilirubinemia, anemia, necrotizing enterocolitis, hypoglycemia, infection or septicemia, delayed growth and development, and mental or motor delays (March of Dimes, 2005). Several of these complications are described in Chapter 24.

Providing Appropriate Stimulation

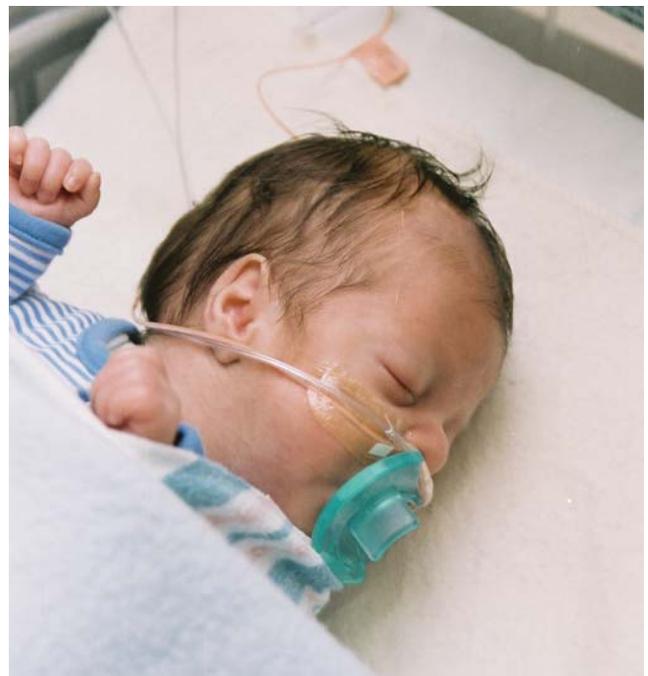
Newborn stimulation involves a series of activities to encourage normal development in preterm and postterm infants. Research on developmental interventions has found that when preterm infants, in particular, receive sensorimotor interventions such as rocking, massaging, hold-

ing, or sleeping on waterbeds, they gain weight faster, progress in feeding abilities more quickly, and show improved interactive behavior compared to preterm newborns who were not stimulated (Dodd, 2005). Conversely, overstimulation may have negative effects by reducing oxygenation and causing stress in preterm infants. A newborn reacts to stress by flailing the hands or bringing an arm up to cover the face. When overstimulated, such as by noise, lights, excessive handling, alarms, and procedures, and stressed, heart and respiratory rates decrease and periods of apnea or bradycardia may follow (Bremmer et al., 2003).

Appropriate developmental stimulation that would not overtax the compromised newborn might include kangaroo (skin-to-skin) holding, rocking, singing softly, cuddling, soft music, stroking the infant's skin gently, colorful mobiles, gentle massage, waterbed mattresses, and nonnutritive sucking opportunities (Fig. 23-5) or using sucrose if tolerated.

The NICU environment can be altered to provide periods of calm and rest for the newborn by dimming the lights, lowering the volume and tone of conversations, closing doors gently, setting the telephone ringer at the lowest volume possible, clustering nursing activities, and covering the isolette with a blanket to act as a light shield to promote rest at night.

Encourage parents to hold and interact with their newborn. Doing so helps to acquaint the parents with their newborn, promotes self-confidence, and fosters parent-newborn attachment (Fig. 23-6).



● **Figure 23-5** A preterm newborn receiving non-nutritive sucking.



● Figure 23-6 A mother bonds with her preterm newborn.

Managing Pain

Pain is an unpleasant sensory and emotional experience felt by all humans. Newborns in the NICU are subjected to repeated procedures that cause them pain. Newborns, whether preterm, full term, or postterm, do experience pain, but the pain is difficult to validate with consistent behaviors. Considering that ill newborns undergo multiple noxious stimuli from invasive procedures, such as lumbar punctures, heel sticks, venipuncture, line insertions, chest tube placement, specimen collections, endotracheal intubation and suctioning, and mechanical ventilation, common sense would suggest that newborns experience pain from these many activities and interventions. However, pain management in infants was not addressed formally until various professional and accrediting organizations issued position statements and clinical recommendations in an effort to promote effective pain management (Verklan & Walden, 2004). An international consortium established principles of newborn pain prevention and management that all nurses should be familiar with and apply (Box 23-3).

Nurses play a key role in assessing a newborn's pain level. Assess the newborn frequently. Pain assessment is considered the "fifth vital sign" and should be done as frequently as the other four vital signs. Also, be able to differentiate pain from agitation by observing for changes in vital signs, behavior, facial expression, and body movement. Suspect pain if the newborn exhibits the following:

BOX 23-3

NEWBORN PAIN PREVENTION AND MANAGEMENT GUIDELINES

- Newborn pain frequently goes unrecognized and undertreated.
- Pain assessment is an essential activity prior to pain management.
- Newborns experience pain, and analgesics should be given.
- A procedure considered painful for an adult should also be considered painful for a newborn.
- Developmental maturity and health status must be considered when assessing for pain in newborns.
- Newborns may be more sensitive to pain than adults.
- Pain behavior is frequently mistaken for irritability and agitation.
- Newborns are more susceptible to the long-term effects of pain.
- Adequate pain management may reduce complications and mortality.
- Nonpharmacologic measures can prevent, reduce, or eliminate newborn pain.
- Sedation does not provide pain relief and may mask pain responses.
- A newborn's response to both pharmacologic and nonpharmacologic pain therapy should be assessed within 30 minutes of administration or intervention.
- Health care professionals are responsible for pain assessment and treatment.
- Written guidelines are needed on each newborn unit.

Anand, 2001; Spence et al., 2005; Walden, 2004; and Kenner & Lott, 2004.

- Sudden high-pitched cry
- Facial grimace with furrowing of brow and quivering chin
- Increased muscle tone
- Oxygen desaturation
- Body posturing, such as squirming, kicking, arching
- Limb withdrawal and thrashing movements
- Increase in heart rate, blood pressure, pulse, and respirations
- Fussiness and irritability (Littleton & Engebretson, 2005)

The goals of pain management are to minimize the amount, duration, and strength of pain and to assist the newborn in coping. Nonpharmacologic techniques to reduce pain may include:

- Gentle handling, rocking, caressing, cuddling, and massaging
- Rest periods before and after painful procedures
- Swaddling and positioning to establish physical boundaries
- Offering a pacifiers dipped in sucrose prior to procedure
- Use of minimal amount of tape, with gentle removal to avoid skin tears

- Use of warm blankets for wrapping to facilitate relaxation
- Reduction of environmental stimuli by removing or turning down noxious stimuli such as noise from alarms, beepers, loud conversations, and bright lights
- Use of distraction, such as colored objects or mobiles (Byers & Thornley, 2004)

Pain in the newborn is managed most effectively by preventing, limiting, or avoiding noxious stimuli and by administering pharmacologic agents when appropriate. The number of analgesic drugs available for preterm and postterm newborns is limited. Morphine and fentanyl, usually administered intravenously, are the most commonly used opioids to relieve moderate to severe pain. Mild pain relief is achieved with acetaminophen. Benzodiazepines are used as sedatives during painful procedures and can be combined with opioids for more effectiveness (AAP, 2000). Local or topical anesthetics (e.g., EMLA cream) also may be used before procedures (Walden & Franck, 2003).

Be vigilant for the potential adverse effects (respiratory depression or hypotension) when administering pharmacologic agents for pain management, especially in preterm newborns with neurologic impairment. These negative effects are usually dose- and route-related, so be knowledgeable about the pharmacokinetics and therapeutic dosing of any drug administered.

Promoting Growth and Development

In the late 1970s, researchers evaluated the NICU environment in terms of light and sound levels, caregiving activities, and handling of newborns. As a result of this research, many environmental modifications were made to reduce the stress and overstimulation of the NICU, and developmentally supportive care was introduced. Developmentally supportive care is defined as care of a newborn or infant to support positive growth and development. Developmental care focuses on what newborns or infants can do at that stage of development; it uses therapeutic interventions only to the point that they are beneficial; and it provides for the development of the newborn–family unit (Kenner & McGrath, 2004).

Developmental care is a philosophy of care that requires rethinking the relationships between newborns, families, and health care providers. It includes a variety of activities designed to manage the environment and individualize the care of the preterm or high-risk ill newborn based on behavioral observations. The goal is to promote a stable, well-organized newborn who can conserve energy for growth and development (Byers, 2003).

Developmental care includes these strategies:

- Clustering care to promote rest and conserve the infant's energy
- Flexed positioning to simulate the in utero positioning
- Environmental management to reduce noise and visual stimulation
- Kangaroo care to promote skin-to-skin sensation
- Placing twins in the same isolette or open crib to reduce stress
- Activities that promote self-regulation and state regulation:
 - Surrounding the newborn with nesting rolls/devices
 - Swaddling with a blanket to maintain the flexed position
 - Providing sheepskin or a waterbed to simulate the uterine environment
 - Providing nonnutritive sucking (calms the infant)
 - Providing objects to grasp (comforts the newborn)
- Promoting parent–infant bonding by making parents feel welcome in the NICU
- Providing open, honest communication with parents and staff
- Collaborating with the parents in planning the infant's care (Robison, 2003)

Developmental care can be fostered by clustering the lights in one area so that no lights are shining directly on newborns, installing visual alarm systems and limiting overhead pages to minimize noise, and monitoring continuous and peak noise levels. Nurses can play an active role by serving as members on committees that address these issues. In addition, nurses can provide direct developmentally supportive care. Doing so involves careful planning of nursing activities to provide the ideal environment for the newborn's development. For example, dim the lights and cover isolettes at night to simulate nighttime; support early extubation from mechanical ventilation; encourage early and consistent feedings with breast milk; administer prescribed antibiotics judiciously; position the newborn as if he or she was still in utero (a nesting fetal position); promote kangaroo care by encouraging parents to hold the newborn against the chest for extended periods each day; and coordinate care to respect sleep and awake states.

Throughout the newborn's stay, work with the parents, developing a collaborative partnership so they feel comfortable caring for their newborn. Be prepared to make referrals to community support groups to enhance coping (Carrier, 2004).

Promoting Parental Coping

Generally, pregnancy and the birth of a newborn are exciting times, with plans being made for the future. When the newborn has serious, perhaps life-threatening problems, the exciting experience suddenly changes to one of anxiety, fear, guilt, loss, and grief.

Anxiety Reduction

Parents who are typically unprepared for the birth of a preterm or postterm infant. They commonly experience an array of emotions, including disappointment, fear for the survival of the newborn, and anxiety due to the separation from their newborn immediately after birth (Jotzo & Poets, 2005). Early interruptions in the bonding process and concern about the newborn's survival can create extreme anxiety and interfere with attachment (Roller, 2005).

Nursing interventions aimed at reducing parental anxiety include:

- Review with them the events that have occurred since birth.
- Provide simple relaxation and calming techniques (visual imagery, breathing).
- Explore their perception of the newborn's condition, and offer explanations.
- Validate their anxiety and behaviors as normal reactions to stress and trauma.
- Provide a physical presence and support during emotional outbursts.
- Explore the coping strategies they used successfully in the past.
- Address their reactions to the NICU environment and explain all equipment used.
- Encourage frequent visits to the NICU.
- Identify family and community resources available to them.

Perinatal Loss

Nurses working in a NICU face a difficult situation when caring for newborns who may not survive. Newborn death is incomprehensible to most parents; this makes the grieving process more difficult because what is happening “can’t be real.” Deciding whether to see, touch, or hold the dying newborn is extremely difficult for many parents. Nurses play a major role in assisting parents to make their dying newborn “real” to them by providing them with as many memories as possible and encouraging them to see, hold, touch, dress, and take care of the infant and take photographs. These interventions help to validate the parents’ sense of loss, to relive the experience, and to attach significance to the meaning of loss. A lock of hair, name card, and identification bracelet may serve as important mementoes that can ease the grieving process. The memories created by these interventions can be useful allies in the grieving process and in facilitating grief resolution (Cartwright & Read, 2004).

Parent–newborn interaction is vital to the normal processes of attachment and bonding. Equally important for parents is the detachment process involved in a newborn’s death. Nurses can aid in this process by helping parents to see their newborn through the maze of equipment, explaining the various procedures and equipment, encouraging them to express their feelings about their fragile newborn’s status, and providing time for them to be with their dying newborn (Lundquist et al., 2002).

A common reaction by many people when learning that a newborn is not going to survive is one of avoidance. Nurses are no exception. It is difficult to initiate a conversation about such a sensitive issue without knowing how the parents are going to react and cope with the impending loss. One way to begin a conversation with the parents is to convey concern and acknowledge their loss. Active listening can provide parents a safe place to begin the heal-

ing process. The relationship that the nurse establishes with the parents is a unique one, providing an opportunity for both the nurse and the parents to share their feelings.

Be aware of personal feelings about loss and how these feelings are part of one’s own life and personal belief system. Actively listen to the parents when they are talking about their experiences. Communicate empathy (understanding and feeling what another person is feeling), and respect their feelings and respond to them in helpful and supportive ways (Stevens, 2005).

When caring for the family experiencing a perinatal loss, include the following interventions:

- Help the family to accept the reality of death by using the word “died.”
- Acknowledge their grief and the fact that their newborn has died.
- Help the family to work through their grief by validating and listening.
- Provide the family with realistic information about the causes of death.
- Offer condolences to the family in a sincere manner.
- Initiate spiritual comfort by calling the hospital clergy if needed.
- Acknowledge variations in spiritual needs and readiness.
- Encourage the parents to have a funeral or memorial service to bring closure.
- Encourage the parents to take photographs, make memory boxes, and record their thoughts in a journal.
- Suggest that the parents plant a tree or flowers to remember the infant.
- Explore with family members how they dealt with previous losses.
- Discuss meditation and relaxation techniques to reduce stress.
- Provide opportunities for the family to hold the newborn if they choose to do so.
- Assess the family’s support network.
- Address attachment issues concerning subsequent pregnancies.
- Reassure the family that their feelings and grieving responses are normal.
- Provide information about local support groups.
- Provide anticipatory guidance regarding the grieving process.
- Recommend that family members maintain a healthy diet and get adequate rest and exercise to preserve their health.
- Present information about any impact on future child-bearing, and refer the parents to appropriate specialists or genetic resources.
- Provide suggestions as to how friends can be helpful to the family.
- Offer to pray with the family if appropriate (Shuzman, 2004).

In a time of crisis or loss, individuals are often more sensitive to other people’s reactions. For example, the

parents may be extremely aware of the nurse's facial expressions, choice of words, and tone of voice. Talking quickly, in a businesslike fashion, or ignoring the loss may inhibit parents from discussing their pain or how they are coping with it. Parents may need to vent their frustrations and anger, and the nurse may become the target. Validate their feelings and attempt to reframe or refocus the anger toward the real issue of loss. An example would be to say, "I understand your frustration and anger about this situation. You have experienced a tremendous loss and it must be difficult not to have an explanation for it at this time." Doing so helps to defuse the anger while allowing them to vent.

When assisting bereaved parents, start where the parents are in the grief process to avoid imposing your own agenda on them. You may feel uncomfortable at not being able to change the situation or take the pain away. The nurse's role is to provide immediate emotional support and help facilitate the grieving process (Wallerstedt et al., 2003).

Preparing for Discharge

Discharge planning typically begins with evidence that recovery of the newborn is certain. However, the exact date of discharge may not be predictable. The goal of the discharge plan is to make a successful transition to home care. Essential elements for discharge are a physiologically stable infant, a family who can provide the necessary care with appropriate support services in place in the community, and a primary care physician available for ongoing care.

The care of each high-risk newborn after discharge requires careful coordination to provide ongoing multidisciplinary support for the family. The discharge planning team should include the parents, primary care physician, neonatologists, neonatal nurses, and a social worker. Other professionals, such as surgical specialists and pediatric subspecialists; occupational, physical, speech, and respiratory therapists; nutritionists; home health care nurses; and a case manager may be included as needed. Critical components of discharge planning are summarized in Box 23-4.

Nurses involved in the discharge process are instrumental in bridging the gap between the hospital and home. Interventions include:

- Assess the physical status of the mother and the newborn.
- Discuss the early signs of complications and what to do if they occur.
- Reinforce instructions for infant care and safety.
- Provide instructions for medication administration.
- Reinforce instructions for equipment operation, maintenance, and trouble-shooting.
- Teach infant cardiopulmonary resuscitation and emergency care.
- Demonstrate techniques for special care procedures such as dressings, ostomy care, artificial airway maintenance, chest physiotherapy, suctioning, and infant stimulation.

BOX 23-4

CRITICAL COMPONENTS OF DISCHARGE PLANNING

- Parental education—involvement and support in newborn care during NICU stay will ensure their readiness to care for the infant at home
- Evaluation of unresolved medical problems—review of the active problem list and determination of what home care and follow-up is needed
- Implementation of primary care—completion of newborn screening tests, immunizations, examinations such as funduscopic exam for ROP, and hematologic status evaluation
- Development of home care plan, including assessment of:
 - Equipment and supplies needed for care
 - In-home caregiver's preparation and ability to care for infant
 - Adequacy of the physical facilities in the home
 - An emergency care and transport plan if needed
 - Financial resources for home care costs
 - Family needs and coping skills
 - Community resources, including how they can be accessed
- Provide breastfeeding support or instruction on gavage feedings.
- Assist with defining roles in the adjustment period at home.
- Assess the parents' emotional stability and coping status.
- Provide support and reassurance to the family.
- Report abnormal findings to the health care team for intervention.
- Follow up with parents to assure them that they have a "lifeline."

KEY CONCEPTS

- Variations in birthweight and gestational age can place a newborn at risk for problems that require special care.
- Variations in birthweight include the following categories: small for gestational age, appropriate for gestational age, and large for gestational age. Newborns who are small or large for gestational age have special needs.
- The small-for-gestational-age newborn faces problems related to a decrease in placental function in utero; these problems may include perinatal asphyxia, hypothermia, hypoglycemia, polycythemia, and meconium aspiration.
- Risk factors for the birth of a large-for-gestational-age infant include maternal diabetes mellitus or glucose intolerance, multiparity, prior history of a macrosomic infant, postdates gestation, maternal obesity, male fetus, and genetics. Large-for-

gestational-age newborns face problems such as birth trauma due to cephalopelvic disproportion, hypoglycemia, polycythemia, and jaundice secondary to hyperbilirubinemia.

- Variations in gestational age include postterm and preterm newborns. Postterm newborns may be large or small for gestational age or dysmature, depending on placental function.
- The postterm newborn may develop several complications after birth, including fetal hypoxia, hypoglycemia, hypothermia, polycythemia, and meconium aspiration.
- Preterm birth is the leading cause of death within the first month of life and the second leading cause of all infant deaths.
- The preterm newborn is at risk for complications because his or her organ systems are immature, thereby impeding the transition from intrauterine life to extrauterine life.
- Newborns can experience pain, but their pain is difficult to validate with consistent behaviors.
- Newborns with gestational age variations, primarily preterm newborns, benefit from developmental care, which includes a variety of activities designed to manage the environment and individualize the care based on behavioral observations.
- Nurses play a key role in assisting the parents and family of a newborn with special needs to cope with this crisis situation, including dealing with the possibility that newborn may not survive. Nurses working with parents experiencing a perinatal loss can help by actively listening and understanding the parents' experiences and communicating empathy.
- The goal of discharge planning is to make a successful transition to home care.

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Web Resources

- March of Dimes: www.marchofdimes.com
- National Association of Neonatal Nurses: www.nann.org
- Neonatal Network: www.neonatalnetwork.com
- Parental Guide for Developmentally Supportive Care: www.comeunity.com/premature/baby/supportive-care.html
- Physical and Developmental Environment of the High-Risk Infant: www.med.usf.edu/tsinger
- Premature Infant: www.premature-infant.com

Chapter WORKSHEET

● MULTIPLE CHOICE QUESTIONS

- The nurse would classify a newborn as postterm if he was born after:
 - 38 weeks' gestation
 - 40 weeks' gestation
 - 42 weeks' gestation
 - 44 weeks' gestation
- SGA and LGA newborns have an excessive number of red blood cells because of:
 - Hypoxia
 - Hypoglycemia
 - Hypocalcemia
 - Hypothermia
- Because subcutaneous and brown fat stores were used for survival in utero, the nurse would be alert for which possible complication after birth in an SGA newborn?
 - Hyperbilirubinemia
 - Hypothermia
 - Polycythemia
 - Hypoglycemia
- In dealing with parents experiencing a perinatal loss, which of the following nursing interventions would be most appropriate?
 - Shelter them from the bad news.
 - Make all the decisions regarding care.
 - Encourage them to participate in care.
 - Leave them alone to grieve.
- In assessing a preterm newborn, which of the following findings would be of greatest concern?
 - Milia over the bridge of the nose
 - Thin transparent skin
 - Poor muscle tone
 - Heart murmur

● CRITICAL THINKING EXERCISES

- After fetal distress was noted on the monitor, a post-term newborn was delivered via a difficult vacuum extraction. The newborn had low Apgar scores and had to be resuscitated before being transferred to the nursery. Once admitted, the nurse observed the following behavior: jitters, tremors, hypotonia, lethargy, and rapid respirations.
 - What might these behaviors indicate?
 - What other conditions is this neonate at high risk for?
 - What intervention is needed to address this condition?
- A preterm newborn was born at 35 weeks following an abruptio placentae due to a car accident. He was transported to the NICU at a nearby regional medical center. After being stabilized, he was placed in an isolette close to the door and placed on a heart monitor. A short time later, the nurse notices that he is cool to the touch and lethargic, has a weak cry, and has an axillary temperature of 36°C.
 - What might have contributed to this infant's hypothermic condition?
 - What transfer mechanism may have been a factor?
 - What intervention would be appropriate for the nurse to initiate?
- A term SGA newborn weighing 4 lb was brought to the nursery for admission a short time after birth. The labor and birth nurse reports the mother was a heavy smoker and a cocaine addict and experienced physical abuse throughout her pregnancy. After stabilizing the newborn and correcting the hypoglycemia with oral feedings, the nurse observes the following: acrocyanosis, ruddy color, poor circulation to the extremities, tachypnea, and irritability.
 - What complication common to SGA infants might be manifested in this newborn?
 - What factors may have contributed to this complication?
 - What is the appropriate intervention to manage this condition?

● STUDY ACTIVITIES

1. At a community maternity center, secure permission to present a program about the effects of smoking during pregnancy and how it can be harmful to the infant. Start the session by asking about the women's perception of how smoking affects babies, and then after the session ask if any of their views have changed. Encourage them to take steps to quit smoking.
2. Visit the March of Dimes website and review this group's national campaign to reduce the incidence of prematurity. Are their strategies workable or not? Explain your reasoning.
3. A common metabolic disorder present in both SGA and LGA infants after birth is _____.
4. A 10-lb LGA newborn is brought to the nursery after a difficult vaginal birth. The nursery nurse should focus on detecting birth injuries such as _____.
5. Nursing care that is organized to require minimal infant energy expenditure will promote growth and development of newborns with variations in gestational age or birthweight. Nursing measures to facilitate energy conservation include:
(Select all that apply)
 - a. Minimal handling of the infant
 - b. Maintaining a neutral thermal environment
 - c. Decreasing environmental stimuli
 - d. Initiating early oral feedings
 - e. Using thermal warmers in all cribs